COASTAL OBSERVATION PROGRAMME - ENGINEERING (COPE)

BARGARA - WOONGARRA SHIRE

FOR THE YEARS 1976 TO 1984

REPORT NO. C16.1

Beach Protection Authority

October 1985

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ABSTRACT:-

This report provides a summary of primary analyses of COPE data on wind, wave and beach processes observed at Bargara Beach in Woongarra Shire, on the central Queensland coast. The data were recorded by volunteer observer Mrs. V.M. Henkel during the period June 1976 to June 1984. The recordings were made daily during the eight year period and the information published is considered representative of the long term conditions.

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Coastal Observation Programme - Engineering (COPE), Yeppoon - Livingstone Shire, (Report C15.1).

REFERENCES:

1. ROBINSON, D.A. AND JONES, C.M.

Queensland Volunteer Coastal Observation Programme - Engineering (COPE). 3rd Australian Conference on Coastal and Ocean Engineering, Melbourne, April 1977.

2. PATTERSON, D.C. AND BLAIR, R.J.

Visually Determined Wave Parameters. 6th Australian Conference on Coastal and Ocean Engineering, Gold Coast, July 1983.

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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 observer at Bargara is supplied with a basic kit of recording instruments including:-

- 30 metre Tape
- Wind Meter
- Abney Level
- 1.4 metre Sighting Support
- Recording Forms
- 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 eight year period 1976 to 1984 in a useful statistical form. No attempt has been made to interpret the observed data.

If this eight year period is representative of the long term average meteorological conditions, then the statistics presented on wind, wave and beach movements can be regarded as typical. However, this eight year 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

The Bargara COPE station is on the central Queensland coast and is located within the Woongarra Shire. It is situated approximately 13 kilometres north-east of the town of Bundaberg and forms part of the coast between the Burnett River mouth in the north and the Elliott River mouth to the south. The town of Bargara lies immediately south of the station. The location of the Bargara COPE station is shown in Figure 1.

2.2 Observers

This station has been operated by volunteer observer Mrs. V. Henkel, during the period June 1976 to June 1984. Mrs. Henkel is a resident of Bargara.

2.3 Observed Parameters

The observer at this station usually recorded once daily at 6.30 a.m. during the entire period covered by this report.

This station has recorded:

- Wave Period
- Wave Height
- Wave Angle
- Wave Type
- Surf Zone Width
- Presence of Offshore Bar
- Wind Speed
- Wind Direction
- State of Tide
- Distance to Fixed Contour
- Distance to Vegetation Line
- Foreshore Slope
- Longshore Current Speed
- Longshore Current Direction.

In addition a sand sample was collected at the station each month and since September 1976 a profile of the beach has usually been recorded monthly.

2.4 Tidal Information

Tidal information for this station as presented below is essentially the same as that for Bundaberg. Datum is Low Water Datum.

M.H.W.S. 2.44 metres
M.H.W.N. 1.92 metres
M.S.L. 1.35 metres
M.L.W.N. 0.79 metres
M.L.W.S. 0.24 metres.

A.H.D. is 1.243 metres above Low Water Datum.

2.5 Description of the Beach

The beach at Bargara is a pocket beach which has had a short groyne constructed at either end. It has a well formed dunal system which supports a variety of vegetation. It exhibits the following characteristics:

- Typical beach slopes: foreshore slopes are in the range 1 in 19 to 1 in 6 (3^{o} to 9^{o}).

- Beach width: typically 15 to 35 metres from the seaward toe of the frontal dune to low water mark.

- D50 sand size: 0.35 mm averaged over eight years.

- Adjoining Landform: Low frontal dune backed by a slightly higher secondary dune system.

- Vegetation: The frontal dune and seaward slope of the secondary dune support herbland vegetation dominated by sand spinifex grass (Spinifex sericeus), goats foot convolvulus (Ipomoea pes-caprae) and beach bean (Vigna marina). Horsetail she-oak (Casuarina equisetifolia var. incana), screw pine (Pandanus pedunculatus) and coconut palms (Cocos nucifera) are present on the crest and landward sections of the secondary dune system.

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 and maintenance of the reference pole for this station has been carried out by the Woongarra Shire Council, and the Authority wishes to thank the Council for its assistance in all matters associated with the COPE project.

3.0 DATA

3.1 General

COPE data for this station for the eight year period June 1976 to June 1984 are presented on the attached figures. The data have 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. Wind direction is estimated to the nearest compass sector.

A summary of annual wind speed and direction percentage occurrences are shown as a wind rose in Figure 2. Where applicable, morning and afternoon readings as well as the overall average are shown.

3.3 Waves

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

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

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 beach. These sectors have been selected as:-

Sector 1 - 0^{o} to 60^{o}
Sector 2 - 61^{o} to 85^{o}
Sector 3 - 86^{o} to 95^{o}
Sector 4 - 96^{o} to 120^{o}
Sector 5 - 121^{o} to 180^{o}

Note: 0^{o} is the beach alignment to the left of the observer when facing seawards, and at the COPE station this direction is approximately 10^{o} east of 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 3).

(b) the percentage occurrence of various combinations of wave heights and periods and directions (Figure 4 and Figure 5).

(c) surf zone width with an indication of the existence or otherwise of an offshore bar in Figures 6 to 14.

(d) tabulation of the occurrence of various wave heights, periods, types and directions (Tables 1 to 9).

3.4 Longshore Currents

The observer measured the distance parallel to the shoreline that a dye patch 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 15 to Figure 23). Mean upcoast and downcoast components and the overall annual means are also presented.

3.5 Beach Profile Parameters

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

- Distance from the reference pole to the 1.0 metre, relative to A.H.D. fixed contour level.

- Distance from reference pole to the vegetation line.

- The foreshore slope.

Changes in these parameters with time indicate how the beach moves in response to varying wave attack. Plots of these parameters are shown in Figures 24 to 32.

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 Figures 33 to 41.

TABLE 1

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara YEAR 1976

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences – 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	8.8	0.35	77.8	-	-	22.2	-	-	15.8	78.9	5.3	-	-
JULY	7.7	0.41	76.9	-	-	11.6	11.5	-	19.2	42.3	11.5	15.5	11.5
AUGUST	6.6	0.20	100.0	-	-	-	-	-	30.0	70.0	-	-	-
SEPTEMBER	6.1	0.24	80.0	-	-	4.0	16.0	-	4.0	56.0	24.0	-	16.0
OCTOBER	4.8	0.20	92.3	-	-	7.7	-	-	38.5	26.9	34.6	-	-
NOVEMBER	4.5	0.28	100.0	-	-	-	-	-	42.3	46.2	11.5	-	-
DECEMBER	4.3	0.32	100.0	-	-	-	-	-	45.8	29.2	25.0	-	-
WHOLE YEAR	5.9	0.29	88.7	0.0	0.0	6.8	4.5	0.0	28.2	46.8	17.9	2.6	4.5

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

Bargara YEAR 1977

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.4	0.45	64.0	16.0	12.0	8.0	-	-	20.0	40.0	40.0	-	-
FEBRUARY	4.2	1.0	39.1	47.8	-	13.1	-	-	17.4	82.6	-	-	-
MARCH	4.6	0.80	46.2	42.3	3.8	7.7	-	-	3.8	92.4	3.8	-	-
APRIL	3.9	0.78	92.0	4.0	4.0	-	-	-		80.0	20.0	-	-
MAY	4.8	0.27	82.7	4.3	13.0	-	-	-	4.3	82.6	13.1	-	-
JUNE	4.6	0.24	85.7	-	4.8	9.5	-	-	5.0	55.0	40.0	-	-
JULY	4.6	0.30	78.3	4.3	13.0	4.4	-	-	-	47.8	52.2	-	-
AUGUST	4.1	0.45	96.0	4.0	-	-	-	-	-	68.0	32.0	-	-
SEPTEMBER	3.8	0.43	87.0	13.0	-	-	-	-	17.4	60.9	21.7	-	-
OCTOBER	3.4	0.47	68.0	32.0	-	-	-	-	16.0	72.0	12.0	-	-
NOVEMBER	3.6	0.44	73.1	26.9	-	-	-	-	38.5	23.0	38.5	-	-
DECEMBER	3.2	0.43	74.1	25.9	-	-	-	-	14.8	59.3	25.9	-	-
WHOLE YEAR	4.1	0.51	73.7	18.8	4.1	3.4	0.0	0.0	11.7	63.6	24.7	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

Bargara **YEAR 1978**

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.2	0.45	72.0	28.0	-	-	-	-	3.8	88.5	7.7	-	-
FEBRUARY	3.6	0.66	70.8	25.0	4.2	-	-	-	4.2	87.5	8.3	-	-
MARCH	3.6	0.66	82.6	17.4	-	-	-	-	20.8	62.5	16.7	-	-
APRIL	3.9	0.47	60.9	-	-	39.1	-	-	17.4	78.3	4.3	-	-
MAY	3.8	0.77	70.4	29.6	-	-	-	-	7.4	85.2	7.4	-	-
JUNE	4.3	0.23	100.0	-	-	-	-	-	15.4	73.1	11.5	-	-
JULY	4.7	0.60	81.0	9.4	4.8	4.8	-	-	4.8	81.0	14.2	-	-
AUGUST	4.2	0.30	95.8	-	4.2	-	-	-	-	91.7	8.3	-	-
SEPTEMBER	5.7	0.39	92.0	8.0	-	-	-	-	36.0	32.0	32.0	-	-
OCTOBER	5.9	1.09	53.8	46.2	-	-	-	-	42.4	3.8	53.8	-	-
NOVEMBER	5.7	0.79	52.4	33.3	-	14.3	-	-	38.1	14.3	47.6	-	-
DECEMBER	6.4	1.00	56.5	43.5	-	-	-	-	52.2	4.3	43.5	-	-
WHOLE YEAR	4.5	0.62	74.3	20.1	1.0	4.6	0.0	0.0	20.0	59.0	21.0	0.0	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

Bargara YEAR 1979

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	6.7	1.66	34.6	65.4	-	-	-	-	26.9	-	73.1	-	-
FEBRUARY	7.1	1.31	23.8	71.4	-	4.8	-	-	13.6	-	86.4	-	-
MARCH	8.3	0.35	83.3	4.2	12.5	-	-	-	12.5	8.3	79.2	-	-
APRIL	8.5	0.50	85.7	9.5	4.8	-	-	-	14.3	-	85.7	-	-
MAY	8.0	0.25	81.5	-	18.5	-	-	-	3.7	-	96.3	-	-
JUNE	7.1	0.28	95.2	4.8	-	-	-	-	14.3	-	85.7	-	-
JULY	6.5	0.41	87.5	8.3	4.2	-	-	-	4.2	-	95.8	-	-
AUGUST	5.2	0.36	100.0	-	-	-	-	-	31.8	-	68.2	-	-
SEPTEMBER	4.8	0.58	73.9	26.1	-	-	-	-	34.8	-	65.2	-	-
OCTOBER	4.6	0.56	47.6	52.4	-	-	-	-	42.9	-	57.1	-	-
NOVEMBER	4.5	0.54	73.1	26.9	-	-	-	-	57.7	-	42.3	-	-
DECEMBER	4.5	0.65	66.7	33.3	-	-	-	-	68.2	-	31.8	-	-
WHOLE YEAR	6.3	0.63	71.1	24.9	3.6	0.4	0.0	0.0	26.9	0.7	72.4	0.0	0.0

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

TABLE 5

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara YEAR 1980

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.6	0.67	39.1	60.9	-	-	-	-	60.9	-	39.1	-	-
FEBRUARY	5.1	0.94	47.0	41.2	5.9	5.9	-	-	17.6	-	82.4	-	-
MARCH	-	-	-	-	-	-	-	-	-	-	-	-	-
APRIL	-	-	-	-	-	-	-	-	-	-	-	-	-
MAY	4.8	0.44	94.7	-	-	5.3	-	-	5.0	-	95.0	-	-
JUNE	5.5	0.34	86.7	13.3	-	-	-	-	6.7	-	93.3	-	-
JULY	5.0	0.22	100.0	-	-	-	-	-	14.3	-	85.7	-	-
AUGUST	-	-	-	-	-	-	-	-	-	-	-	-	-
SEPTEMBER	-	-	-	-	-	-	-	-	-	-	-	-	-
OCTOBER	4.1	0.37	70.4	25.9	3.7	-	-	-	55.6	-	44.4	-	-
NOVEMBER	4.0	0.50	33.3	66.7	-	-	-	-	62.5	-	37.5	-	-
DECEMBER	4.3	0.87	10.5	89.5	-	-	-	-	57.9	-	42.1	-	-
WHOLE YEAR	4.6	0.53	59.1	38.4	1.2	1.3	0.0	0.0	38.0	0.0	62.0	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 WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara **YEAR 1981**

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.4	0.74	66.7	33.3	–	–	–	–	3.7	–	96.3	–	–
FEBRUARY	4.3	0.55	80.0	20.0	–	–	–	–	46.7	–	53.3	–	–
MARCH	4.7	0.73	45.5	54.5	–	–	–	–	–	–	100.0	–	–
APRIL	5.1	0.70	100.0	–	–	–	–	–	15.4	–	84.6	–	–
MAY	5.9	0.62	85.7	14.3	–	–	–	–	4.8	–	95.2	–	–
JUNE	5.9	0.36	100.0	–	–	–	–	–	29.4	–	70.6	–	–
JULY	7.1	0.40	72.0	12.0	–	16.0	–	–	16.0	8.0	72.0	4.0	–
AUGUST	5.8	0.42	95.2	4.8	–	–	–	–	28.6	–	71.4	–	–
SEPTEMBER	5.0	0.47	68.0	32.0	–	–	–	–	16.0	–	84.0	–	–
OCTOBER	4.7	0.44	77.3	22.7	–	–	–	–	25.0	20.0	55.0	–	–
NOVEMBER	4.5	0.42	73.3	26.7	–	–	–	–	71.4	14.3	14.3	–	–
DECEMBER	4.3	0.44	84.2	15.8	–	–	–	–	55.6	44.4	–	–	–
WHOLE YEAR	5.2	0.51	78.8	19.5	0.0	1.7	0.0	0.0	21.3	5.2	73.0	0.5	0.0

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

TABLE 7

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara **YEAR 1982**

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.5	0.49	100.0	-	-	-	-	-	33.4	33.3	33.3	-	-
FEBRUARY	4.7	0.49	83.3	16.7	-	-	-	-	33.3	66.7	-	-	-
MARCH	4.5	0.56	63.2	36.8	-	-	-	-	11.1	55.6	33.3	-	-
APRIL	5.0	0.55	71.4	28.6	-	-	-	-	-	37.5	62.5	-	-
MAY	6.1	0.47	84.6	15.4	-	-	-	-	-	100.0	-	-	-
JUNE	6.9	0.42	100.0	-	-	-	-	-	-	-	100.0	-	-
JULY	6.6	0.49	89.5	10.5	-	-	-	-	25.0	50.0	25.0	-	-
AUGUST	5.5	0.52	50.0	50.0	-	-	-	-	10.0	40.0	50.0	-	-
SEPTEMBER	5.2	0.50	80.0	20.0	-	-	-	-	53.3	13.4	33.3	-	-
OCTOBER	5.8	0.50	68.2	31.8	-	-	-	-	47.4	-	52.6	-	-
NOVEMBER	4.3	0.52	21.1	78.9	-	-	-	-	62.5	12.5	25.0	-	-
DECEMBER	4.2	0.51	61.1	38.9	-	-	-	-	69.2	7.7	23.1	-	-
WHOLE YEAR	5.3	0.50	72.6	27.4	0.0	0.0	0.0	0.0	38.4	25.9	35.7	0.0	0.0

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

TABLE 8

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara **YEAR 1983**

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type						Wave Direction				
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.2	0.50	50.0	50.0	-	-	-	-	30.0	-	70.0	-	-
FEBRUARY	4.6	0.51	80.0	20.0	-	-	-	-	-	40.0	60.0	-	-
MARCH	4.2	0.51	70.6	29.4	-	-	-	-	25.0	-	75.0	-	-
APRIL	5.3	0.51	73.3	26.7	-	-	-	-	14.3	-	85.7	-	-
MAY	5.2	0.56	41.7	58.3	-	-	-	-	42.9	-	57.1	-	-
JUNE	6.9	0.50	82.4	17.6	-	-	-	-	42.9	-	57.1	-	-
JULY	5.8	0.52	77.8	22.2	-	-	-	-	56.2	6.3	37.5	-	-
AUGUST	7.3	0.50	100.0	-	-	-	-	-	50.0	-	50.0	-	-
SEPTEMBER	5.3	0.53	52.2	47.8	-	-	-	-	78.9	5.3	15.8	-	-
OCTOBER	4.8	0.51	65.2	34.8	-	-	-	-	68.8	-	31.2	-	-
NOVEMBER	4.4	0.56	40.0	60.0	-	-	-	-	72.7	-	27.3	-	-
DECEMBER	4.5	0.55	43.8	56.2	-	-	-	-	50.0	-	50.0	-	-
WHOLE YEAR	5.2	0.52	64.1	35.9	0.0	0.0	0.0	0.0	51.6	3.3	45.1	0.0	0.0

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

TABLE 9

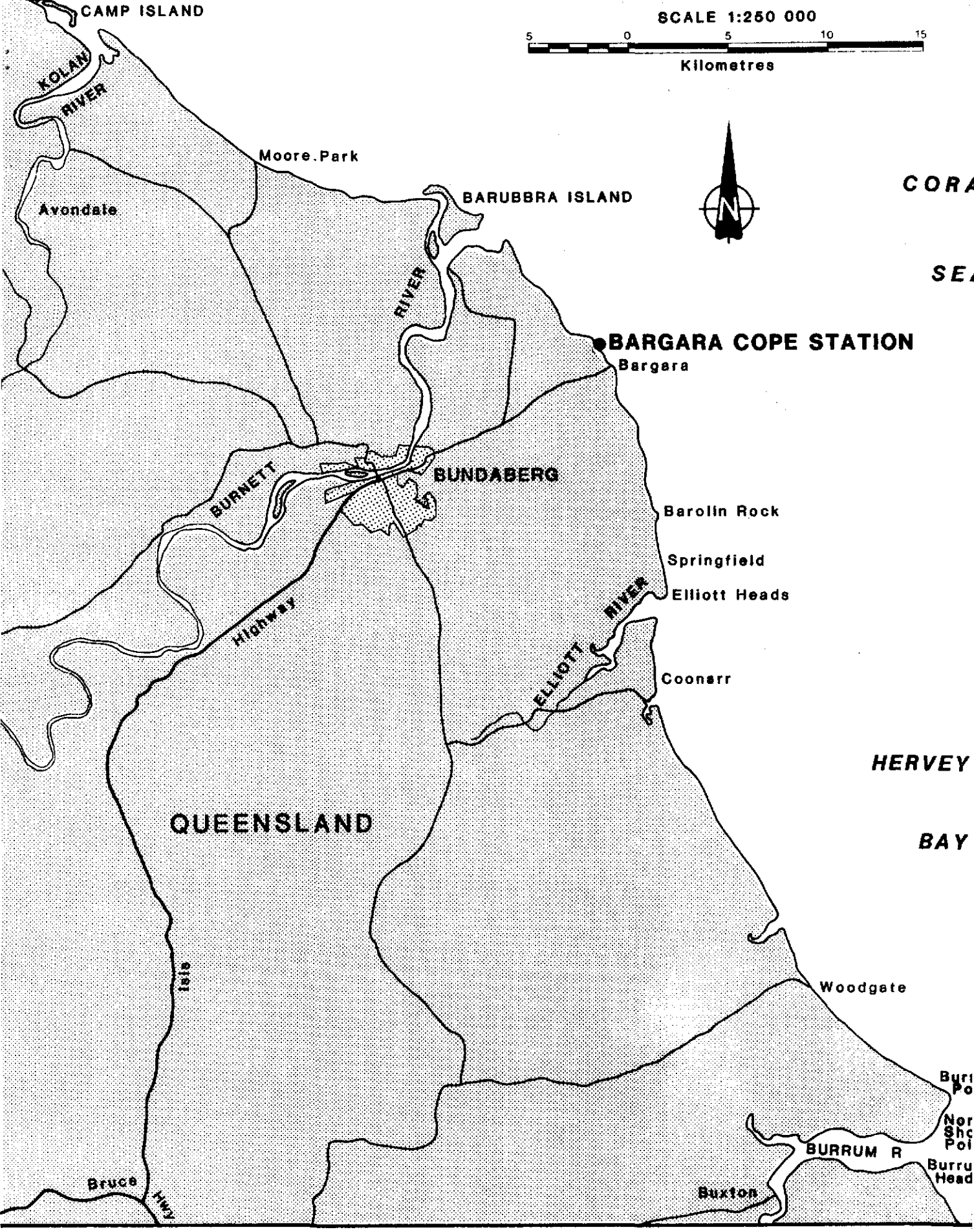
MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Bargara YEAR 1984

MONTH	MEAN WAVE PERIOD (Secs)	MEAN WAVE HEIGHT (Metres)	Percentage Occurrences - Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.8	0.53	68.4	21.1	10.5	-	-	-	73.3	-	26.7	-	-
FEBRUARY	5.1	0.53	64.7	35.3	-	-	-	-	64.3	-	35.7	-	-
MARCH	4.7	0.58	54.5	45.5	-	-	-	-	53.8	-	46.2	-	-
APRIL	6.8	0.85	31.3	68.7	-	-	-	-	40.0	-	60.0	-	-
MAY	6.0	0.71	63.2	36.8	-	-	-	-	16.7	-	83.3	-	-
JUNE	6.8	0.70	88.9	11.1	-	-	-	-	-	-	100.0	-	-
JULY													
AUGUST													
SEPTEMBER													
OCTOBER													
NOVEMBER													
DECEMBER													
WHOLE YEAR	5.5	0.64	59.8	38.2	2.0	0.0	0.0	0.0	51.6	0.0	48.4	0.0	0.0

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



Beach Protection Authority

LOCALITY PLAN

COPE
Bargara

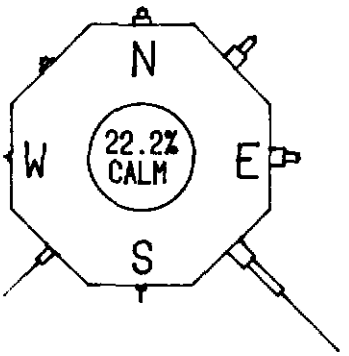
FIGURE 1

C 16.1

COPE - Coastal Observation Programme Engineering

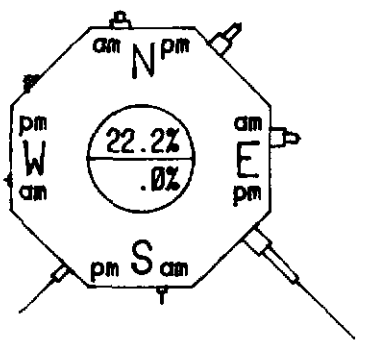
WOONGARRA SHIRE BARGARA 1201

ALL OBSERVATIONS



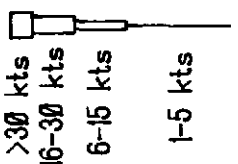
Total No. of Observations : 1943

MORNING - AFTERNOON OBSERVATIONS



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

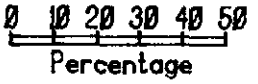
LEGEND



No. of Morning Observations : 1943
No. of Afternoon Observations :

Mean Time :- Morning Obs : 0630 hrs
Mean Time :- Afternoon Obs :

SCALE



WIND DATA - JUNE 1976 to JUNE 1984

Beach Protection Authority

WIND DATA

COPE
Bargara

Figure 2
C 16.1

Beach Protection Authority

WAVE HEIGHT % EXCEEDANCE

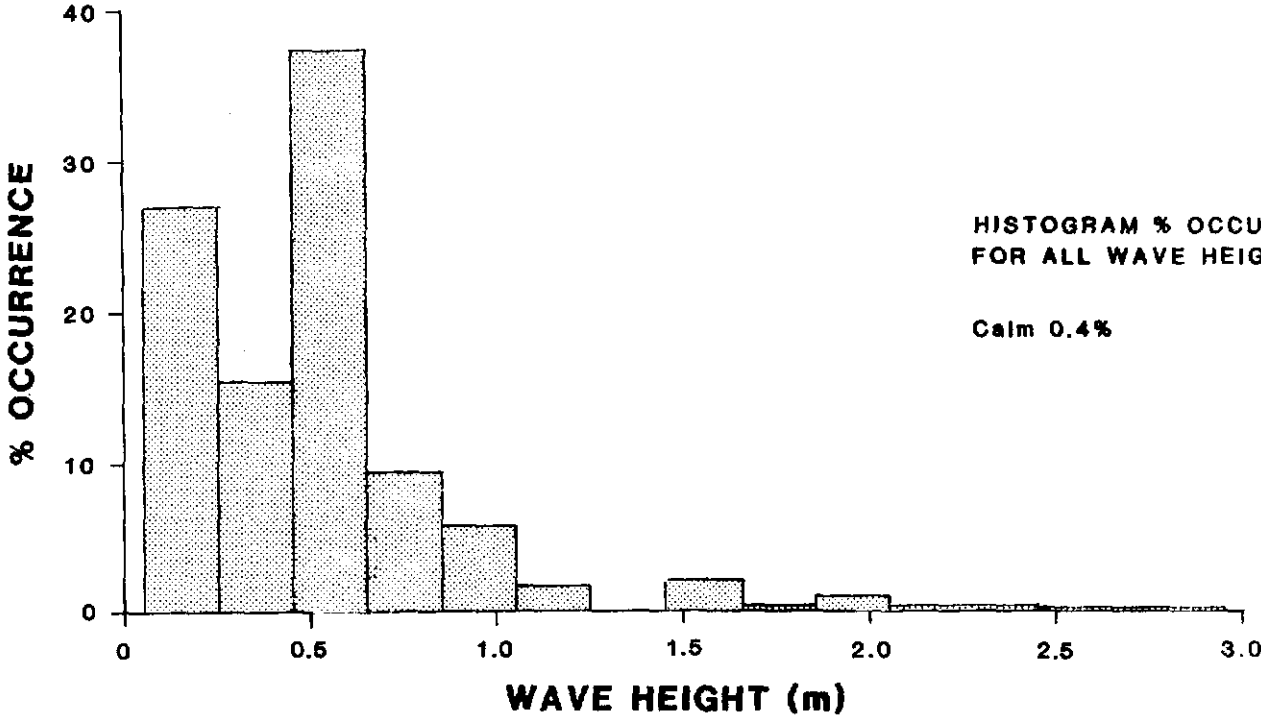
ALL DATA

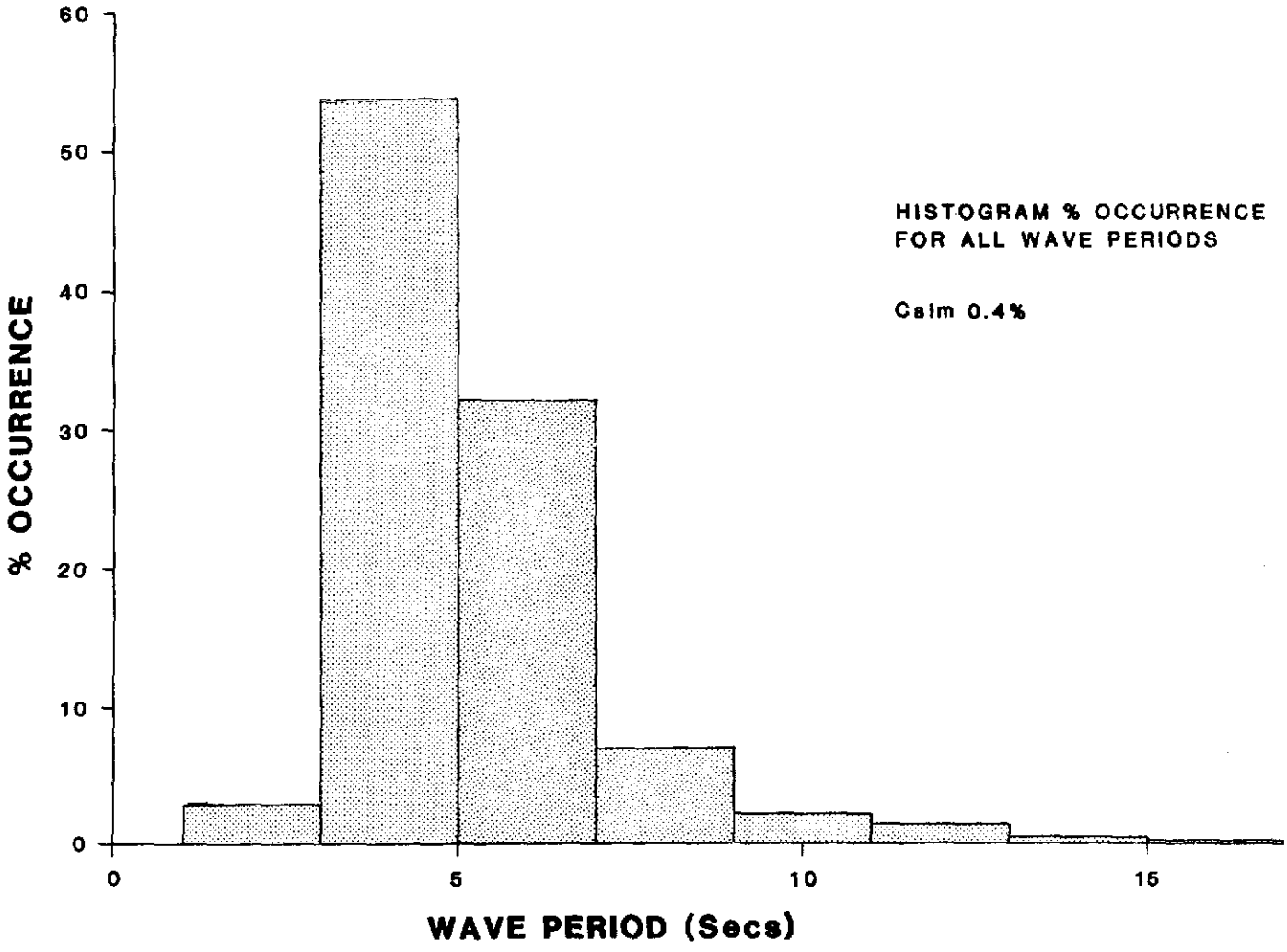
COPE

Bargara

FIGURE 3

C 16. 1





Beach Protection Authority

WAVE HEIGHT AND PERIOD % OCCURRENCE

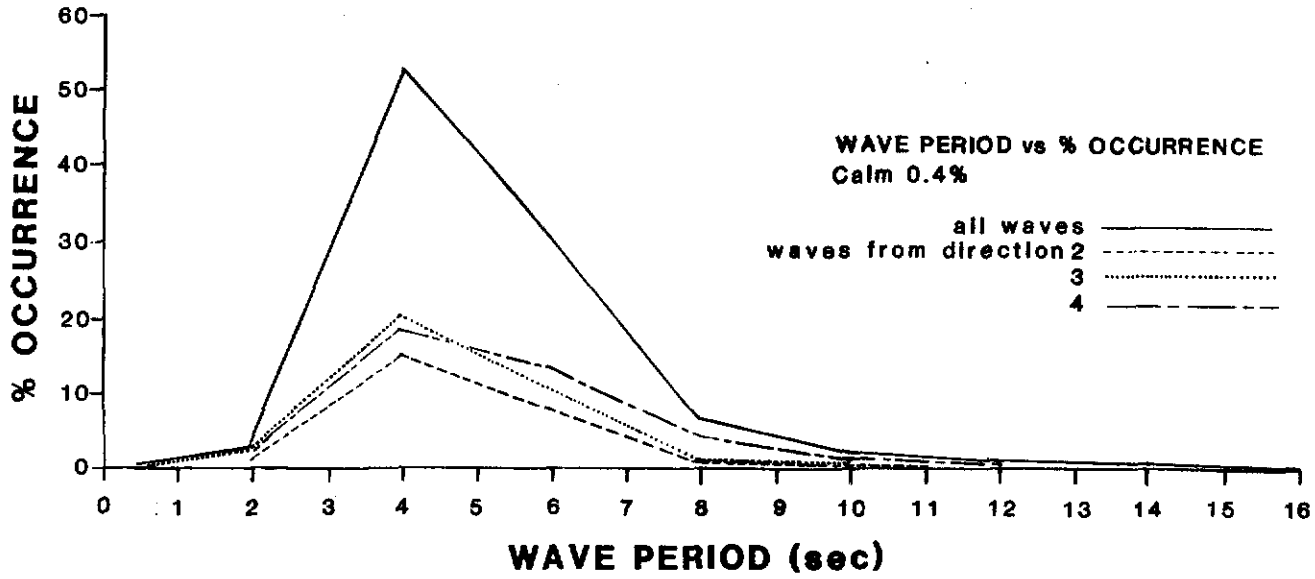
ALL DATA

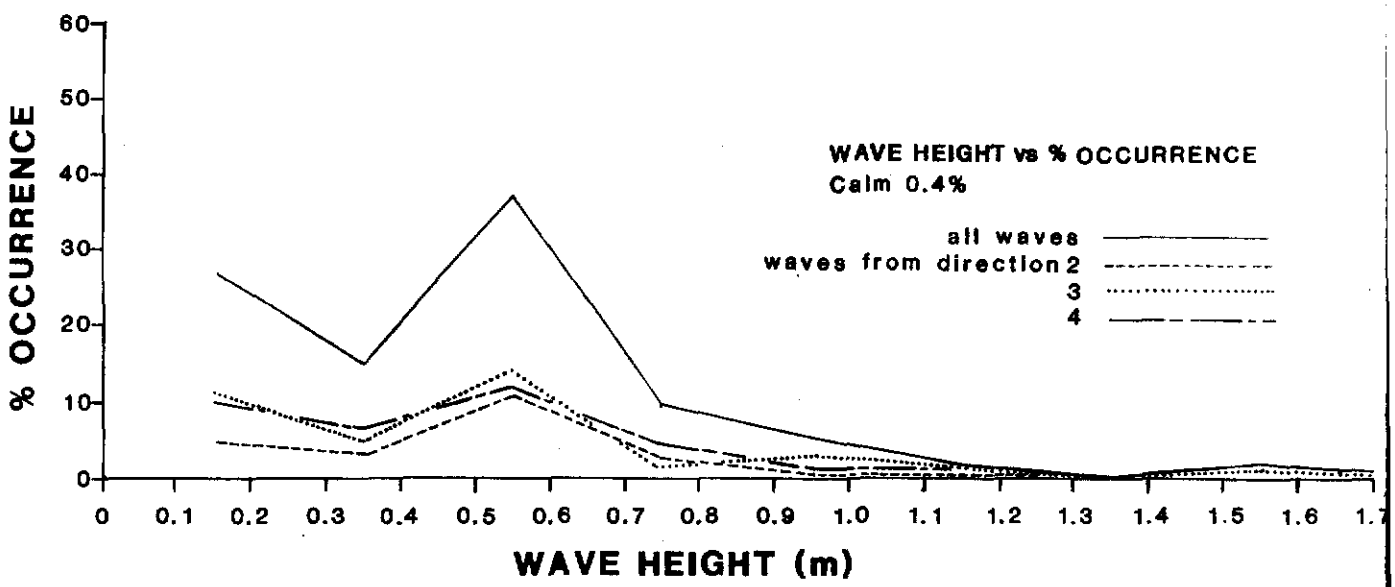
COPE

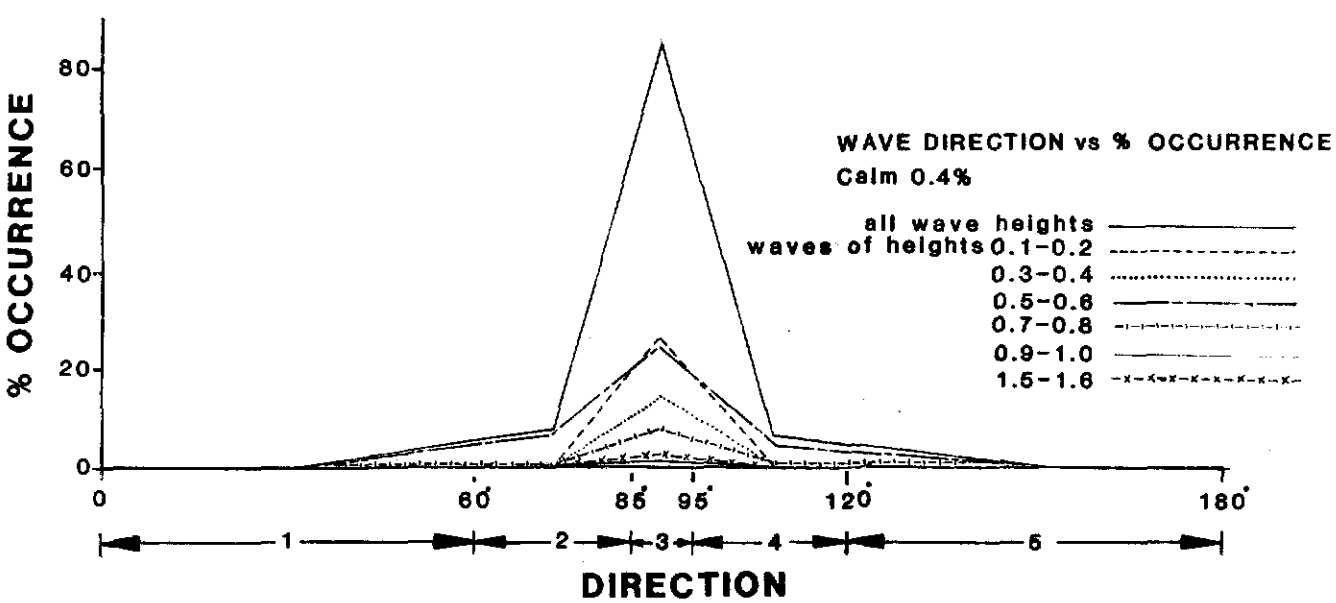
Bargara

FIGURE 4

C 16.1







Beach Protection Authority

WAVE DIRECTION ANALYSIS

ALL DATA

COPE

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FIGURE 5

Beach Protection Authority

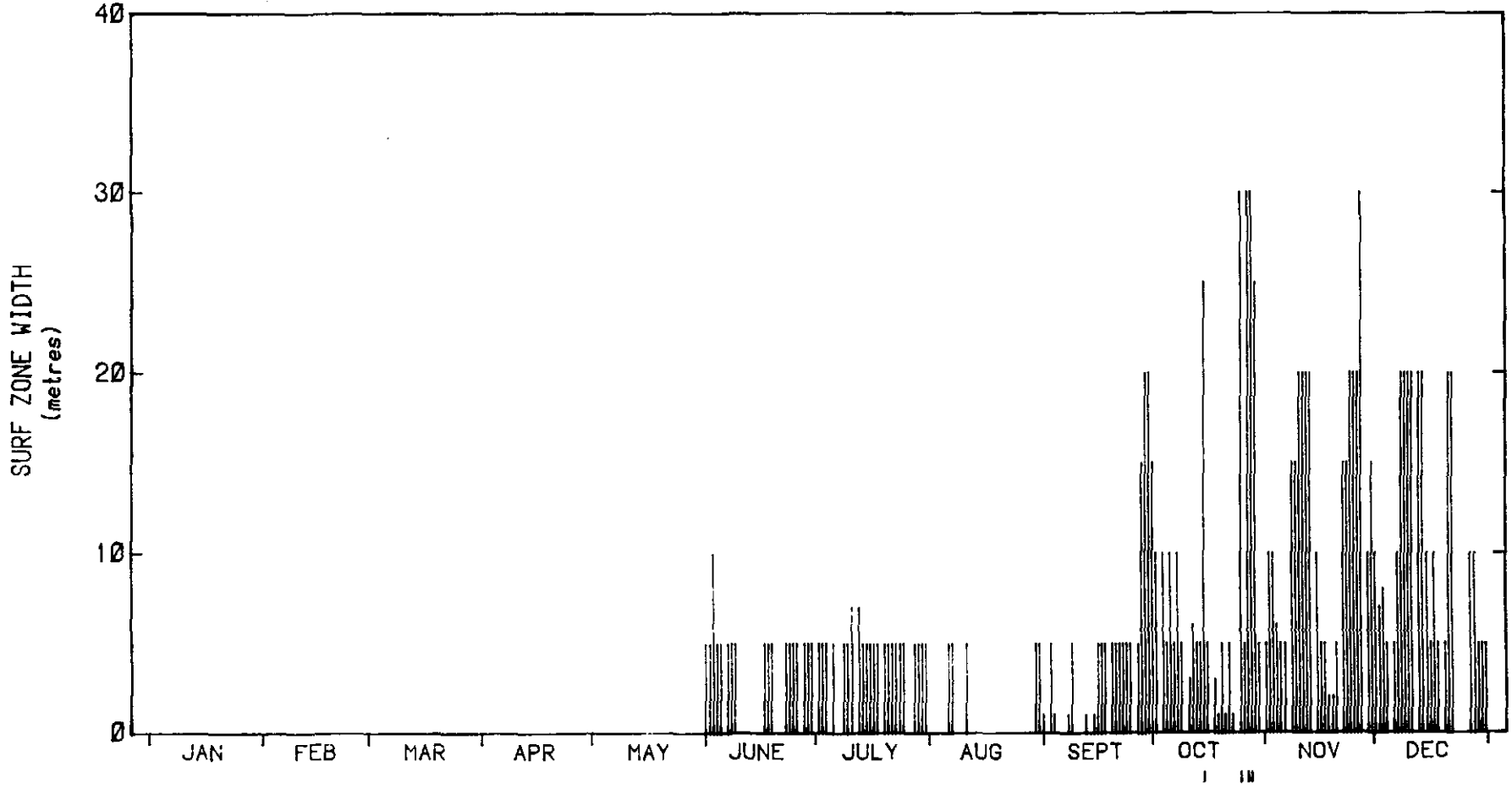
SURF ZONE WIDTH - MORNING 1976

COPE
Bargara

Figure 6
C 16.1

COPE - Coastal Observation Programme Engineering

BARGARA **WOONGARRA SHIRE** **1201**



SURF ZONE WIDTH SUMMARY - 1976

No. of Observations : 157 MORNING OBSERVATIONS Mean Surf Zone Width = 7.8 m

Indicates Offshore Bar Present

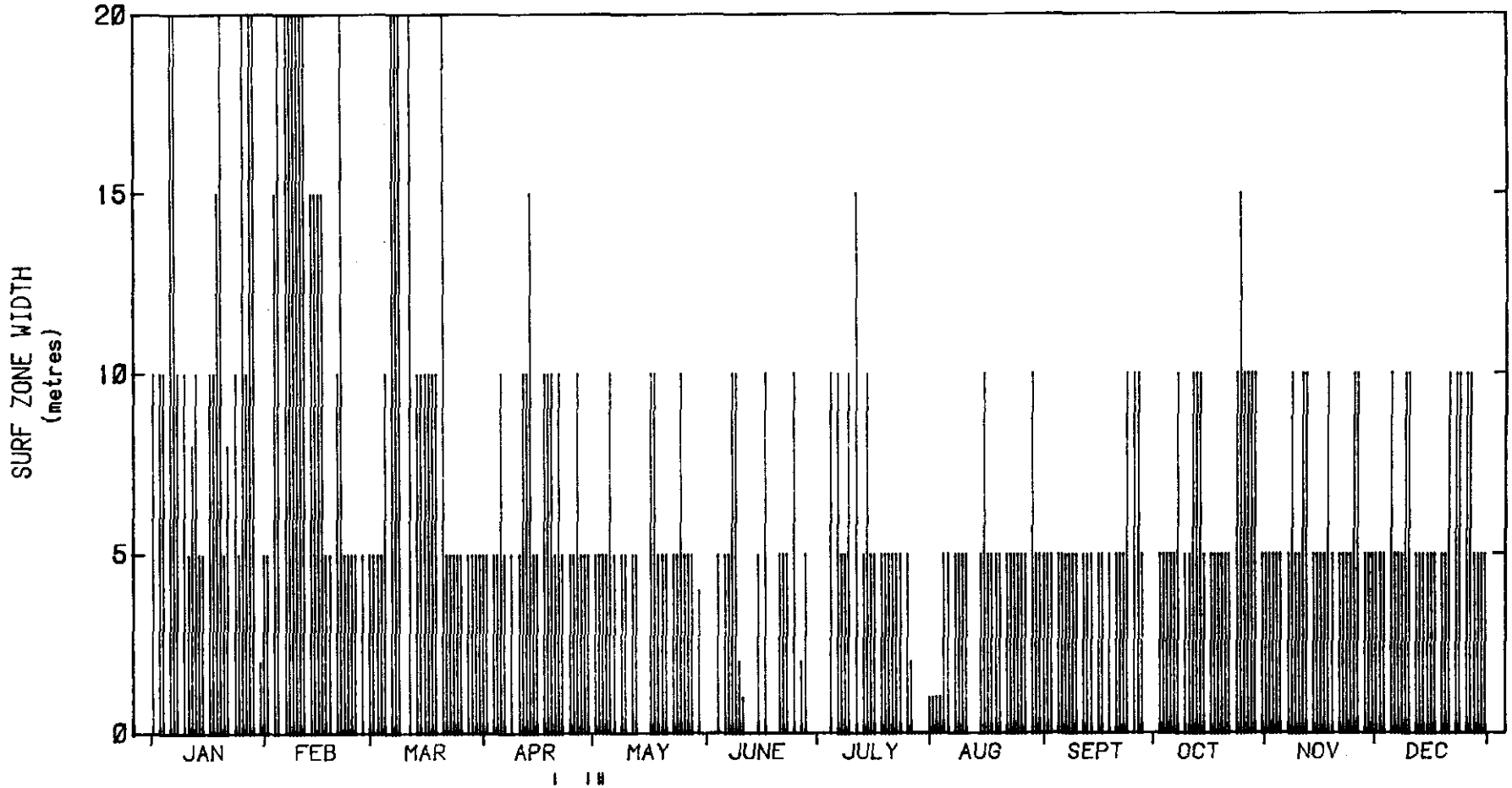
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA

WOONGARRA SHIRE

1201



SURF ZONE WIDTH - MORNING 1977

SURF ZONE WIDTH SUMMARY - 1977

No. of Observations : 295

MORNING OBSERVATIONS

Mean Surf Zone Width = 7.0 m

COPE Bargara

Figure 7
C 16.1

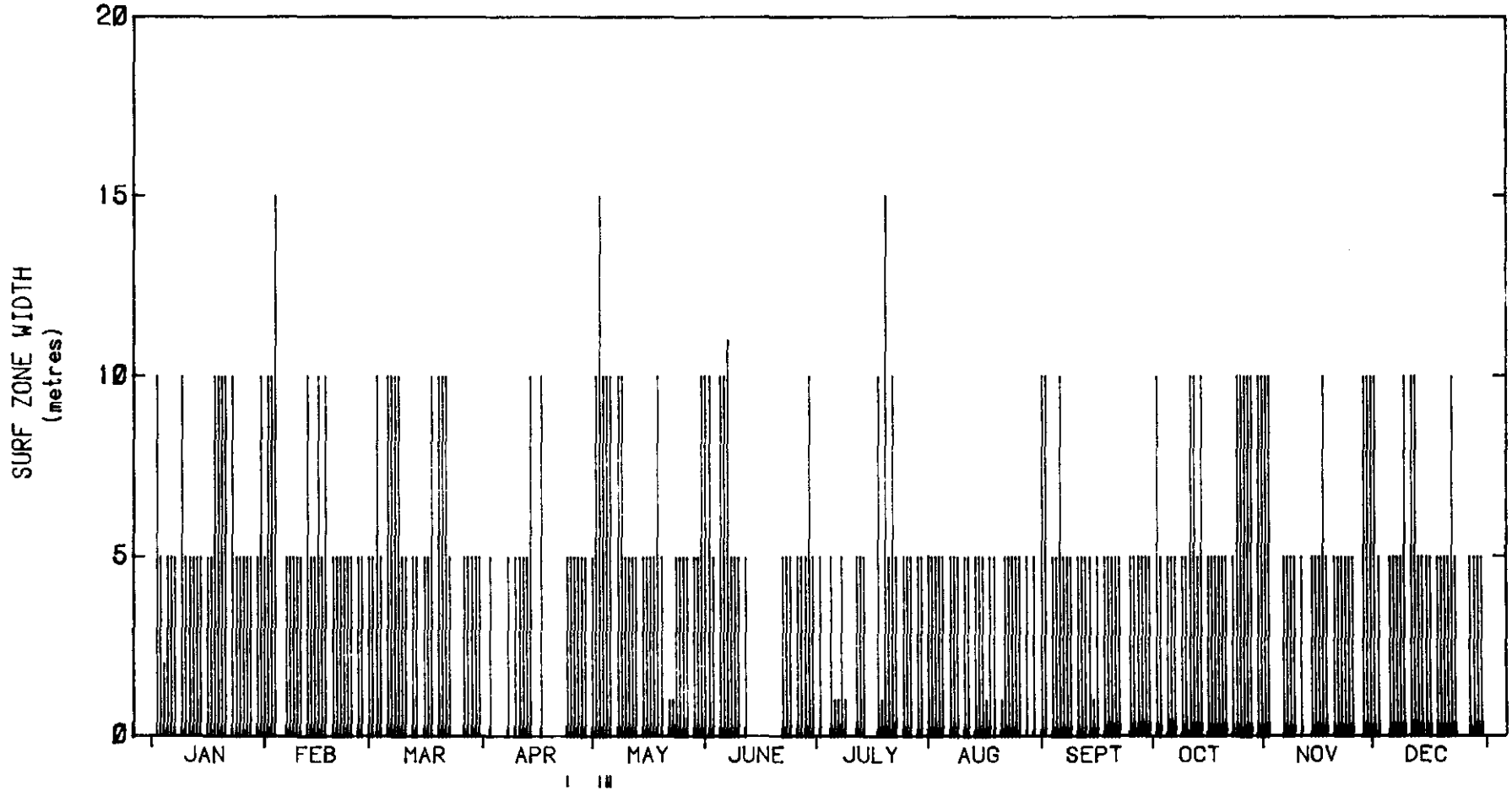
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA

WOONGARRA SHIRE

1201



SURF ZONE WIDTH SUMMARY - 1978

No. of Observations : 296

MORNING OBSERVATIONS

Mean Surf Zone Width = 5.6 m

SURF ZONE WIDTH - MORNING 1978

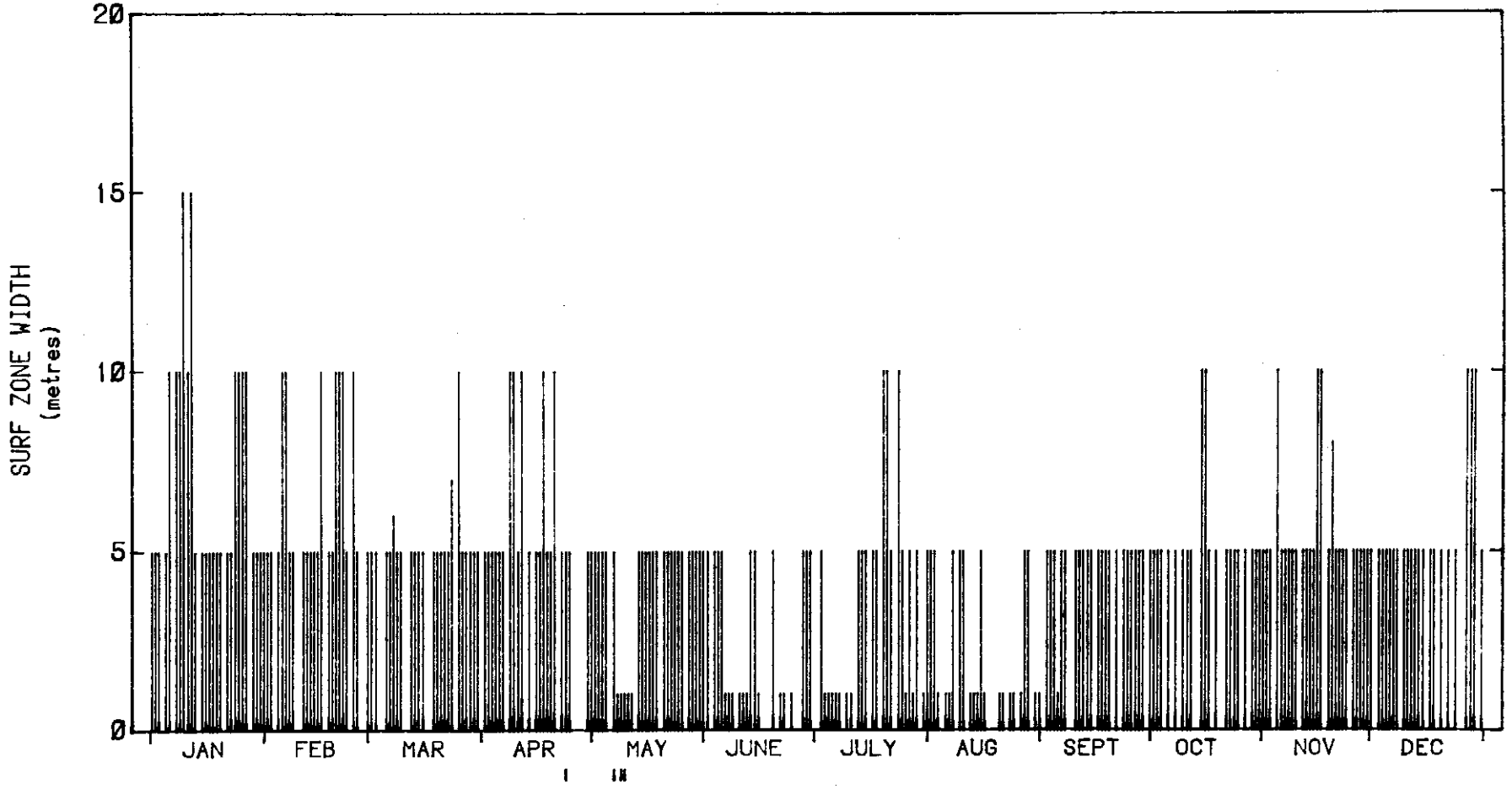
COPE Bargara

Figure 8
C 16.1

Beach Protection Authority

COPE - Coastal Observation
Programme Engineering

BARGARA **WOONGARRA SHIRE** **1201**



SURF ZONE WIDTH SUMMARY - 1979

No. of Observations : 281 MORNING OBSERVATIONS Mean Surf Zone Width = 5.0 m

SURF ZONE WIDTH - MORNING 1979

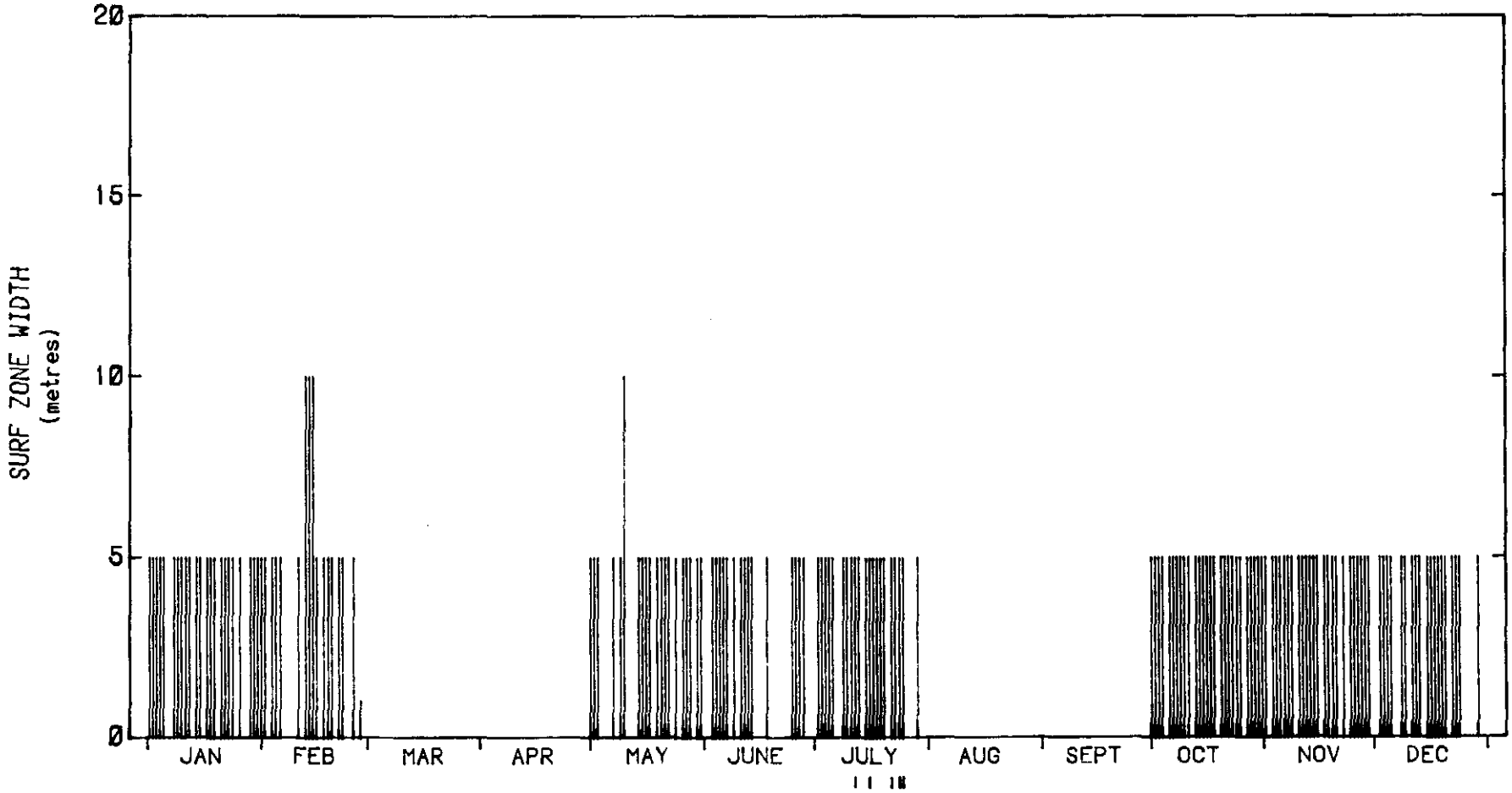
COPE
Bargara

Figure 9
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA **WOONGARRA SHIRE** **1201**



SURF ZONE WIDTH SUMMARY - 1980

No. of Observations : 180 MORNING OBSERVATIONS Mean Surf Zone Width = 4.7 m

■ Indicates Offshore Bar Present

SURF ZONE WIDTH - MORNING 1980

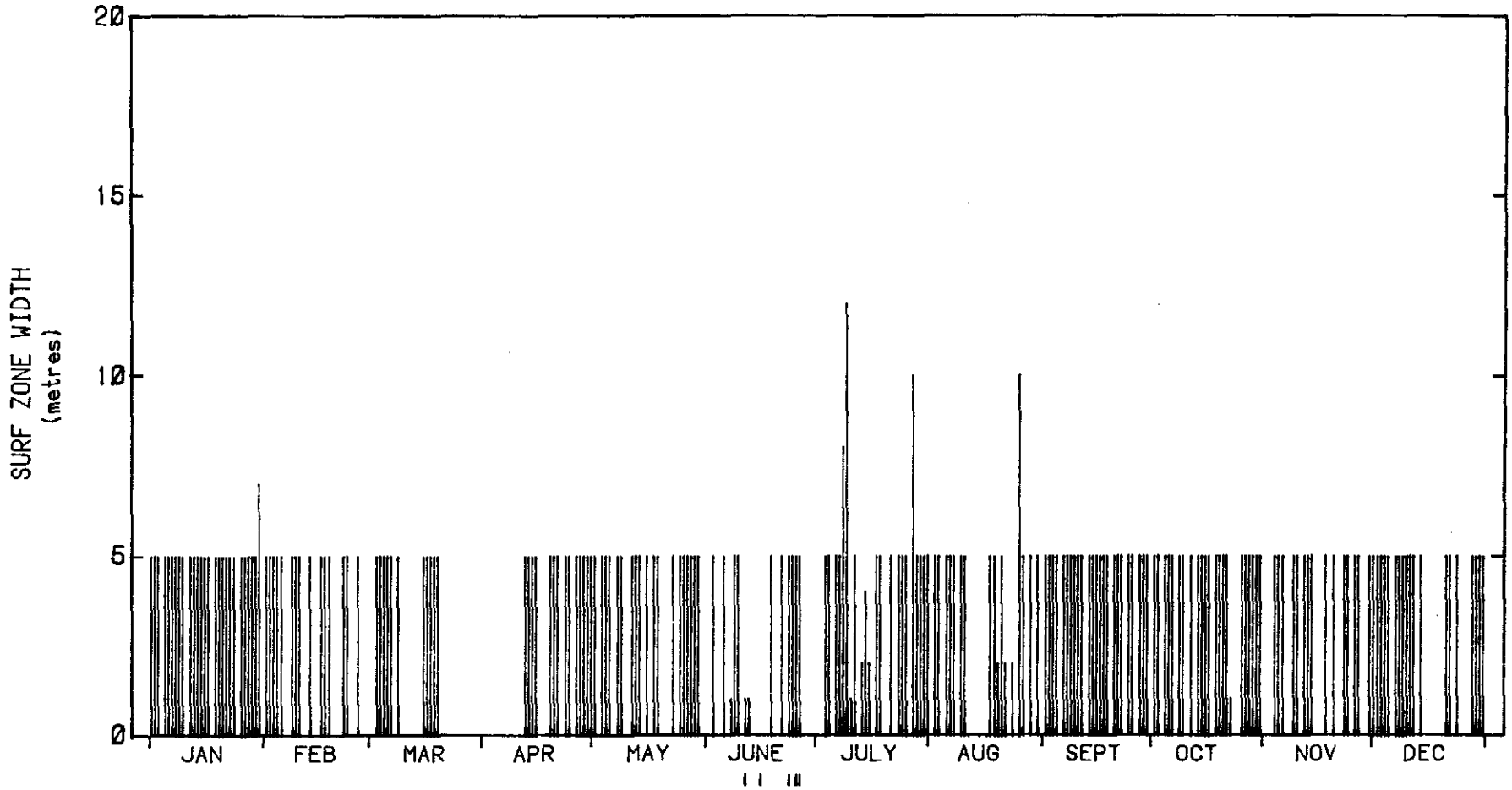
COPE Bargara

Figure 10
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA **WOONGARRA SHIRE** **1201**



SURF ZONE WIDTH SUMMARY - 1981

No. of Observations : 230 MORNING OBSERVATIONS Mean Surf Zone Width = 4.7 m

SURF ZONE WIDTH - MORNING 1981

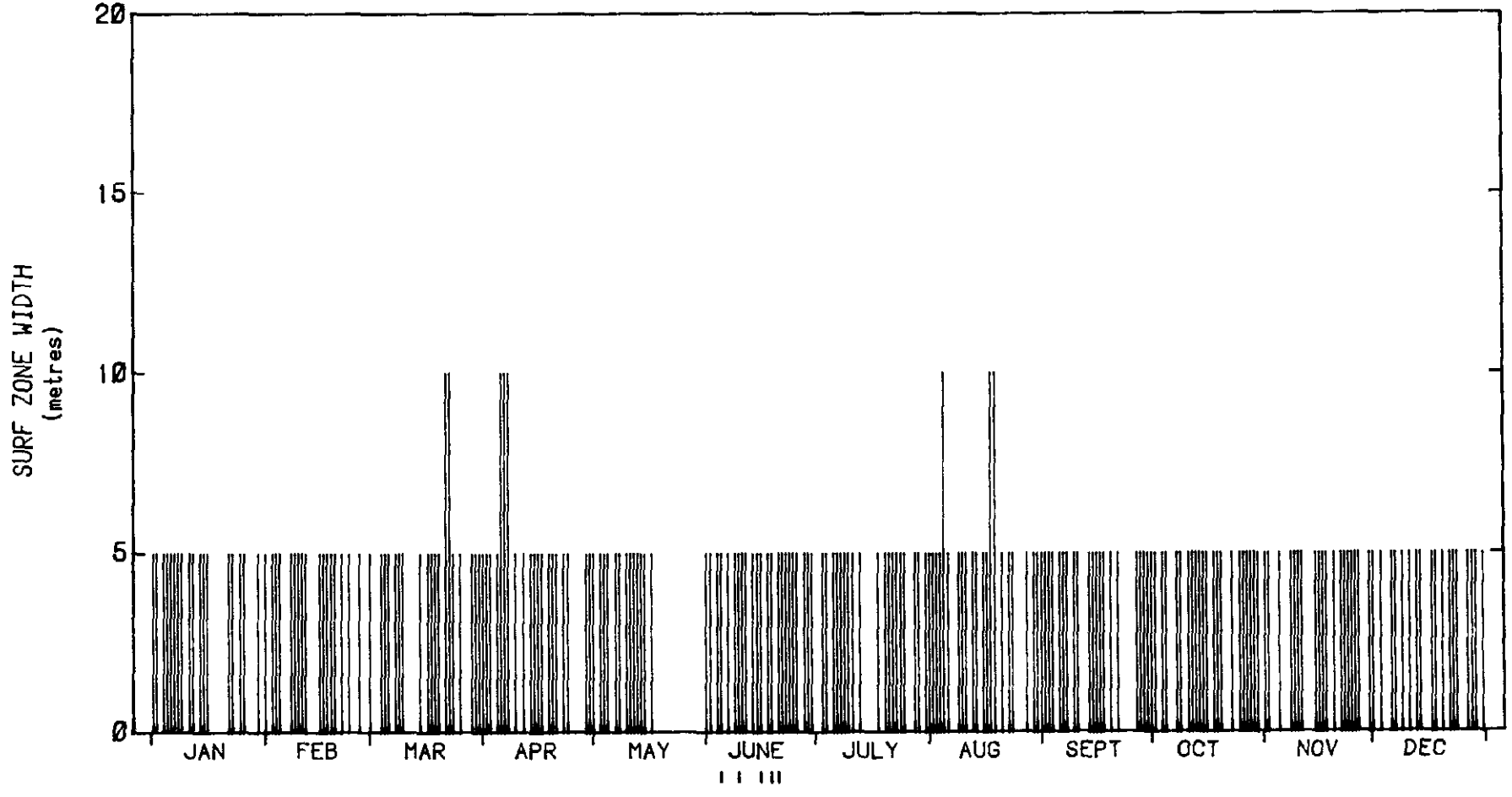
COPE Bargara

Figure 11
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA **WOONGARRA SHIRE** **1201**



SURF ZONE WIDTH SUMMARY - 1982

No. of Observations : 231 MORNING OBSERVATIONS Mean Surf Zone Width = 5.1 m

SURF ZONE WIDTH - MORNING 1982

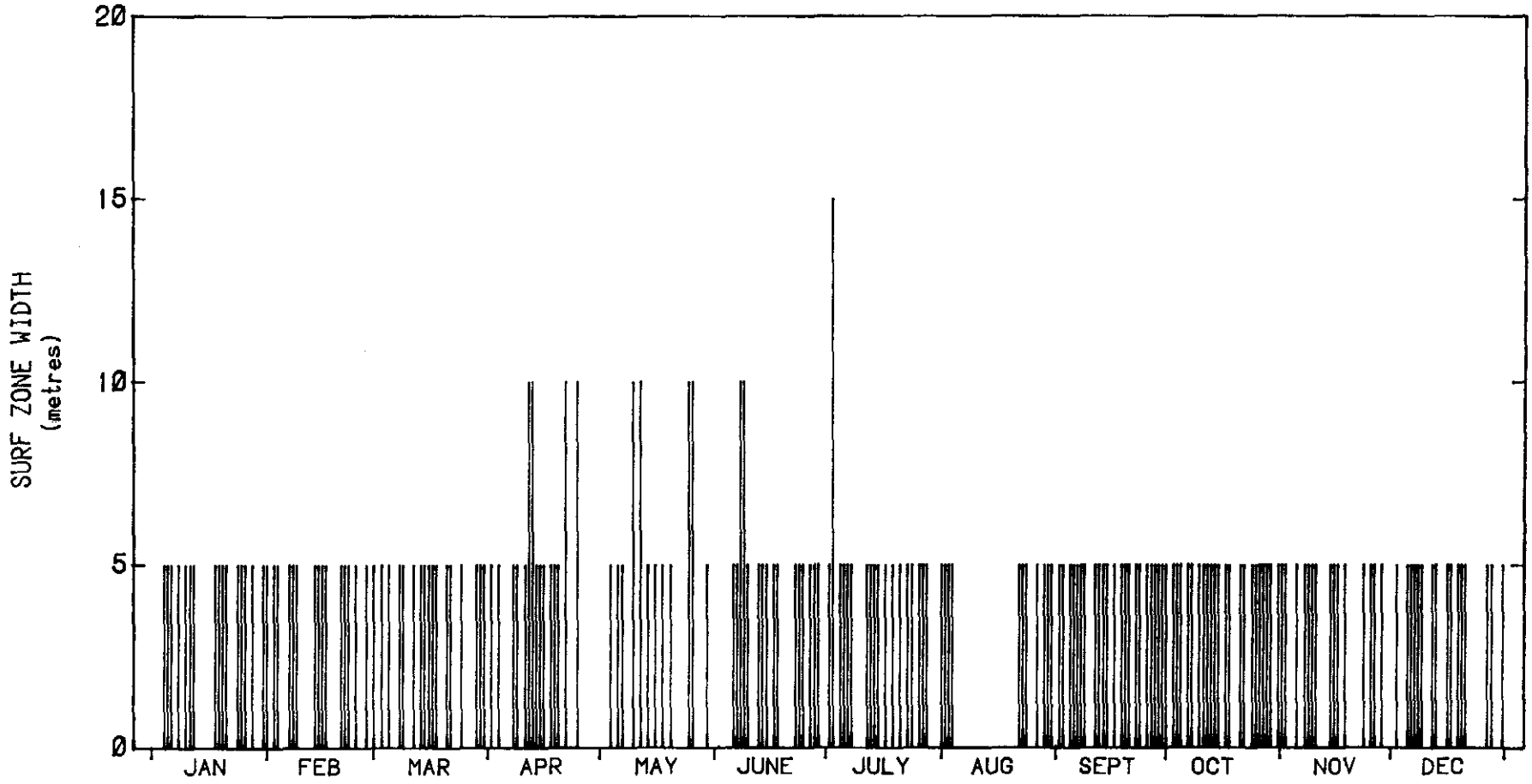
COPE Bargara

Figure 12
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA WOONGARRA SHIRE 1201



SURF ZONE WIDTH - MORNING 1983

SURF ZONE WIDTH SUMMARY - 1983

No. of Observations : 198 MORNING OBSERVATIONS Mean Surf Zone Width = 5.3 m

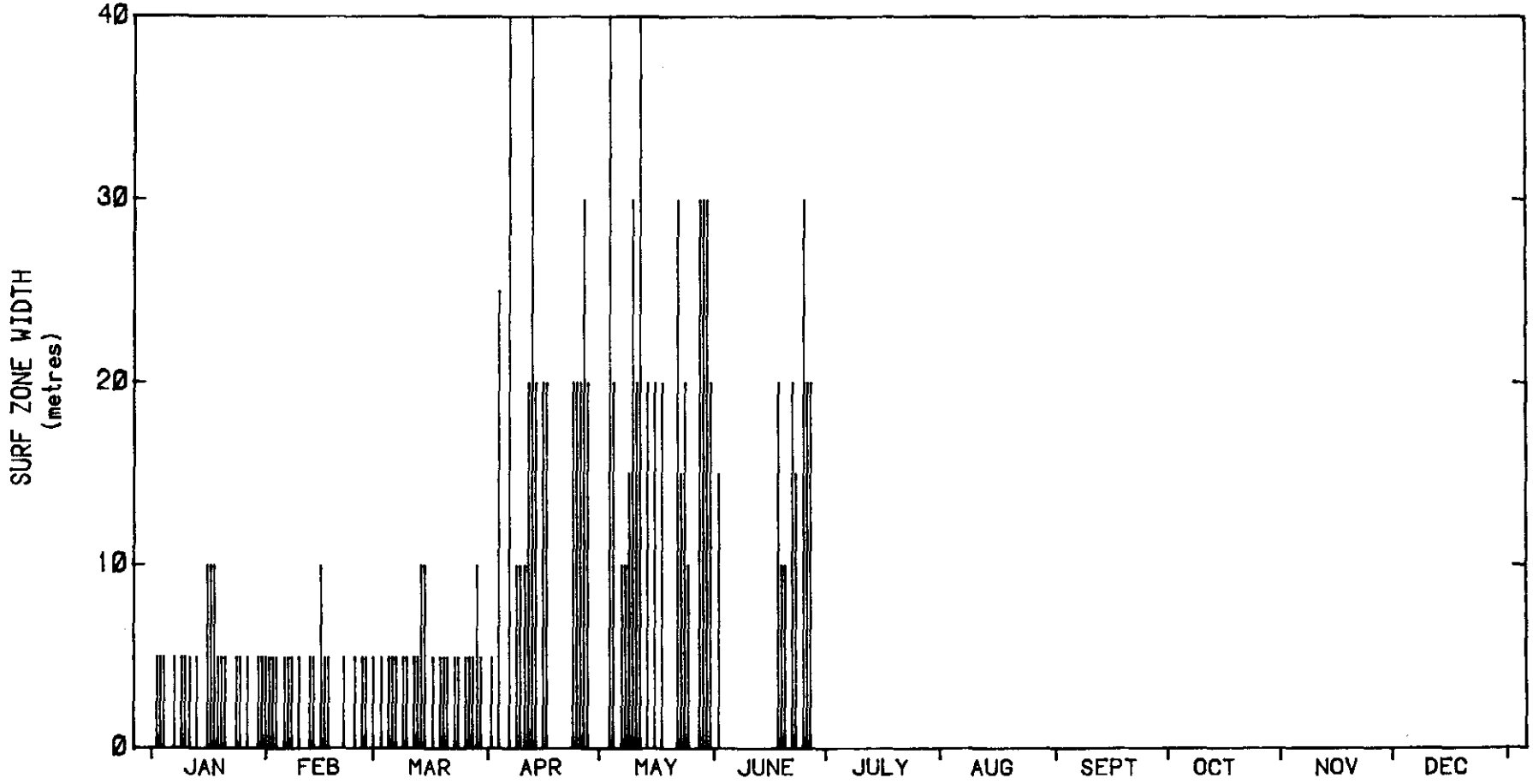
COPE
Bargara

Figure 13
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

BARGARA WOONGARRA SHIRE 1201



SURF ZONE WIDTH SUMMARY - 1984

No. of Observations : 116 MORNING OBSERVATIONS Mean Surf Zone Width = 11.8 m

SURF ZONE WIDTH - MORNING 1984

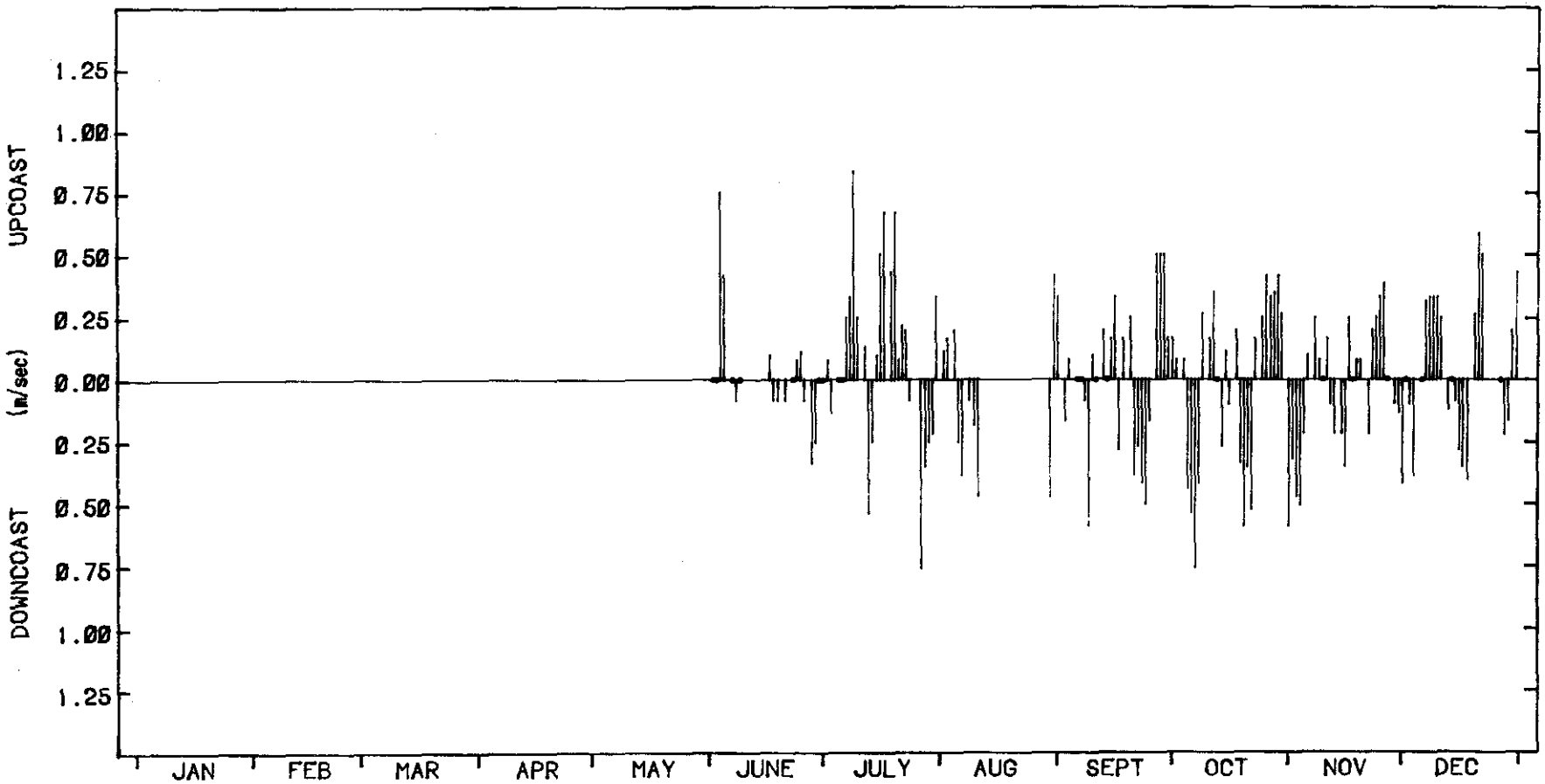
COPE
Bargara

Figure 14
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE BARGARA 1201



LITTORAL CURRENT SUMMARY - 1976

Mean Vel = 0.011 m/sec (up) Mean Upcoast Vel = 0.279 m/sec Mean Downcoast Vel = 0.298 m/sec

MORNING OBSERVATIONS - (155 recordings)

LITTORAL CURRENTS - MORNING 1976

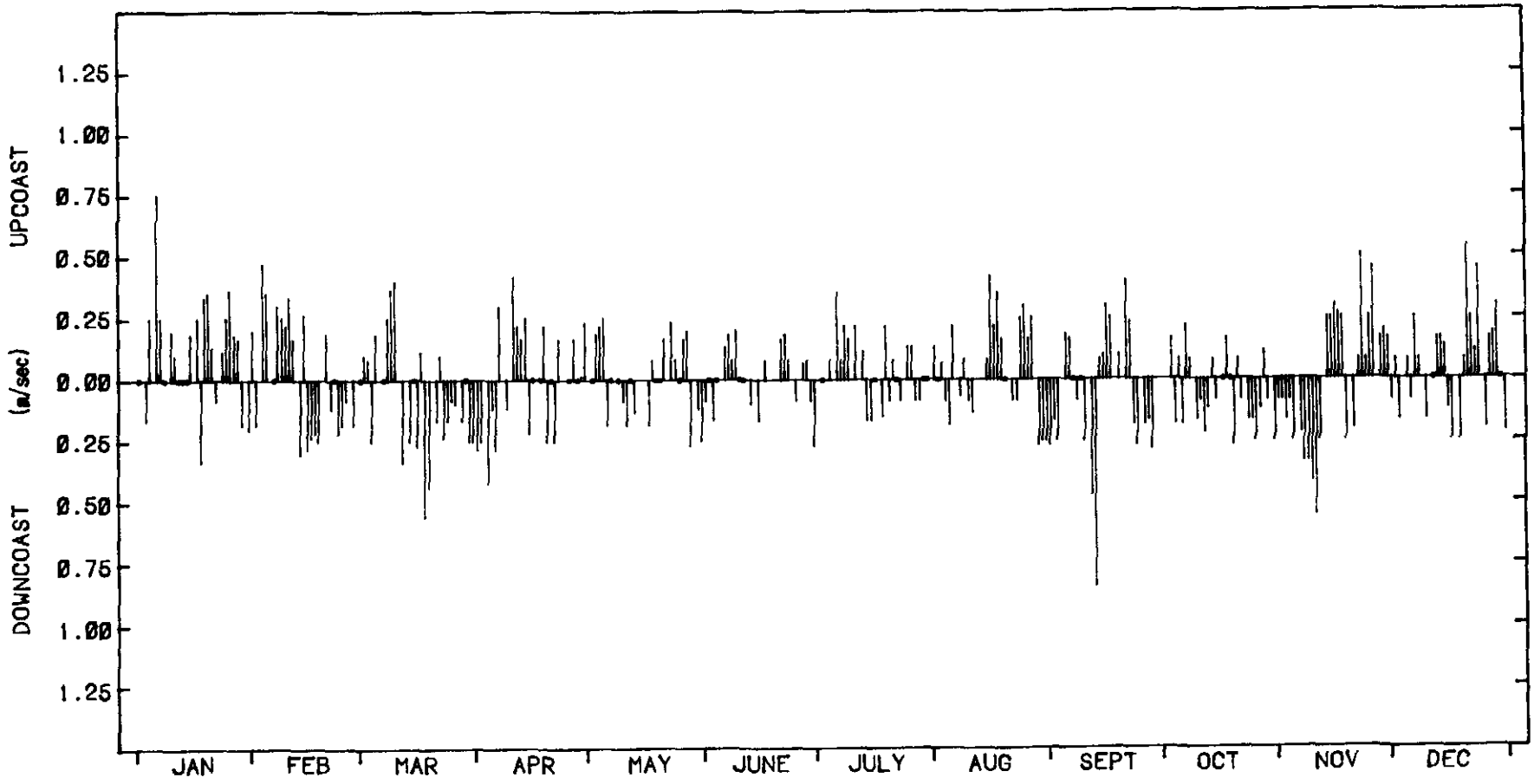
COPE Bargara

Figure 15
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE BARGARA 1201



LITTORAL CURRENT SUMMARY - 1977

Mean Vel = 0.009 m/sec (up) Mean Upcoast Vel = 0.205 m/sec Mean Downcoast Vel = 0.201 m/sec

MORNING OBSERVATIONS - (291 recordings)

LITTORAL CURRENTS - MORNING 1977

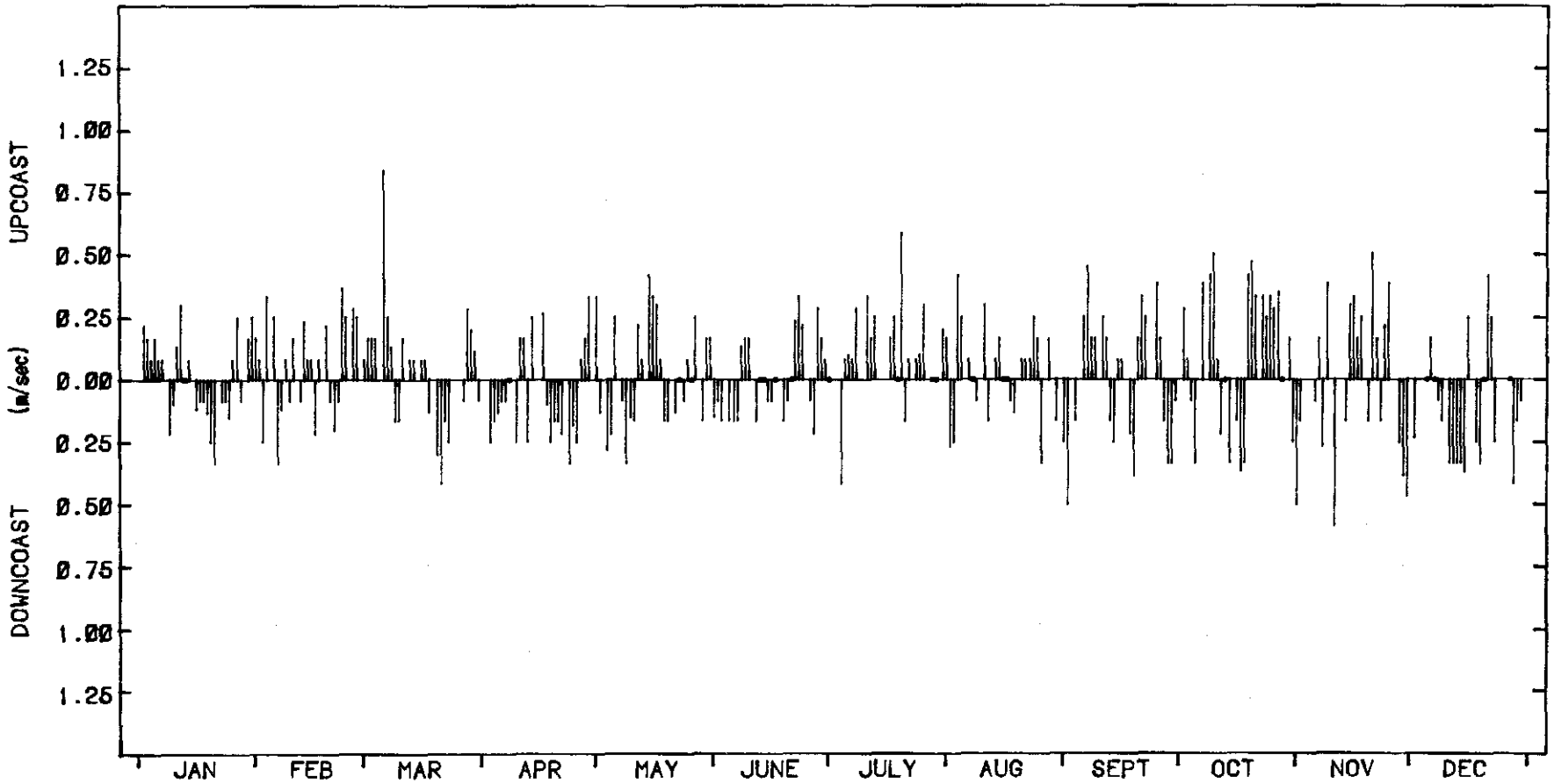
COPE Bargara

Figure 16
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE BARGARA 1201



LITTORAL CURRENT SUMMARY - 1978

Mean Vel = 0.018 m/sec (up) Mean Upcoast Vel = 0.218 m/sec Mean Downcoast Vel = 0.206 m/sec

MORNING OBSERVATIONS - (286 recordings)

LITTORAL CURRENTS - MORNING 1978

COPE Bargara

Figure 17
C 16.1

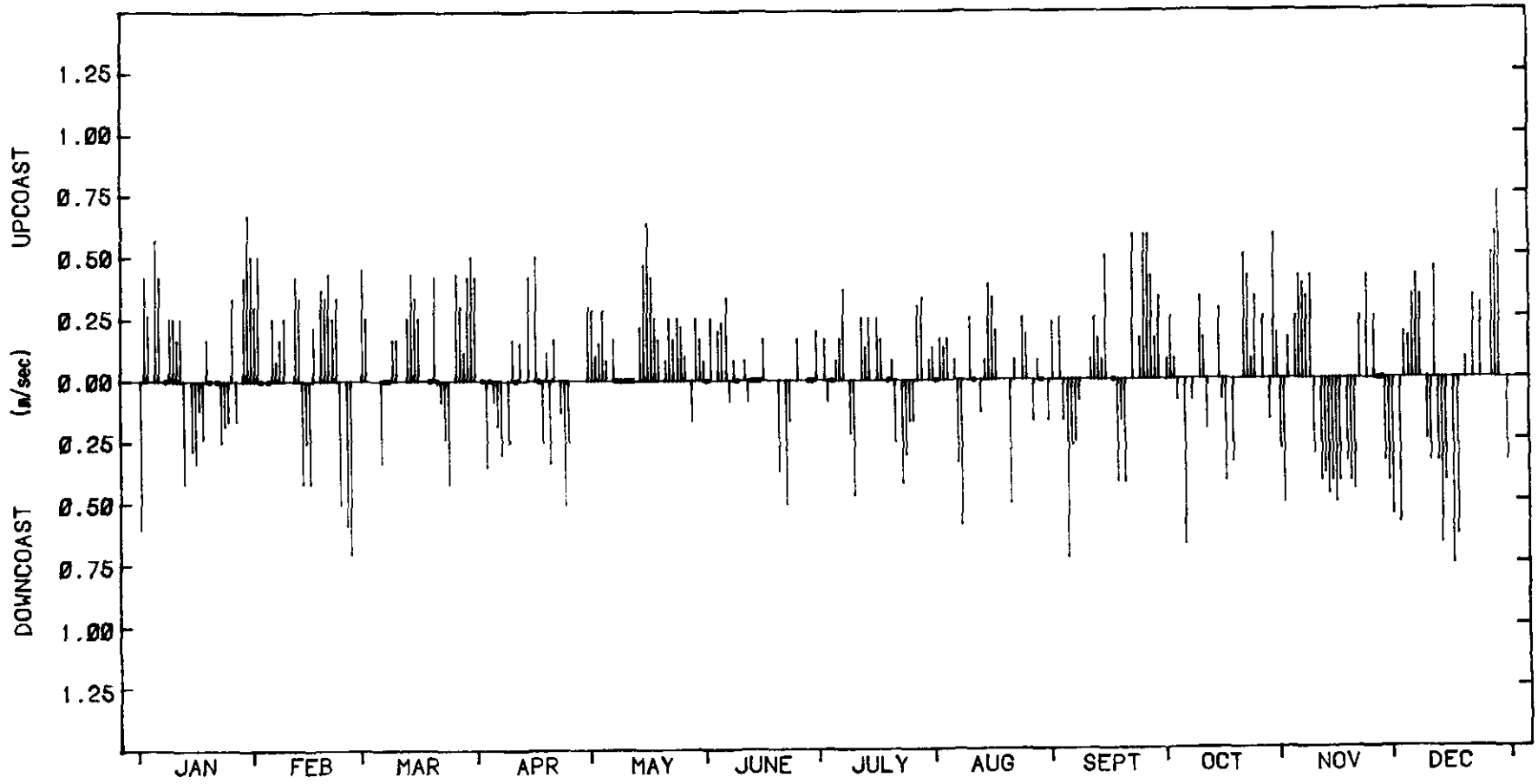
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

1201



LITTORAL CURRENT SUMMARY - 1979

Mean Vel = 0.047 m/sec (up) Mean Upcoast Vel = 0.276 m/sec Mean Downcoast Vel = 0.329 m/sec

MORNING OBSERVATIONS - (277 recordings)

LITTORAL CURRENTS - MORNING 1979

COPE
Bargara

Figure 18
C 16.1

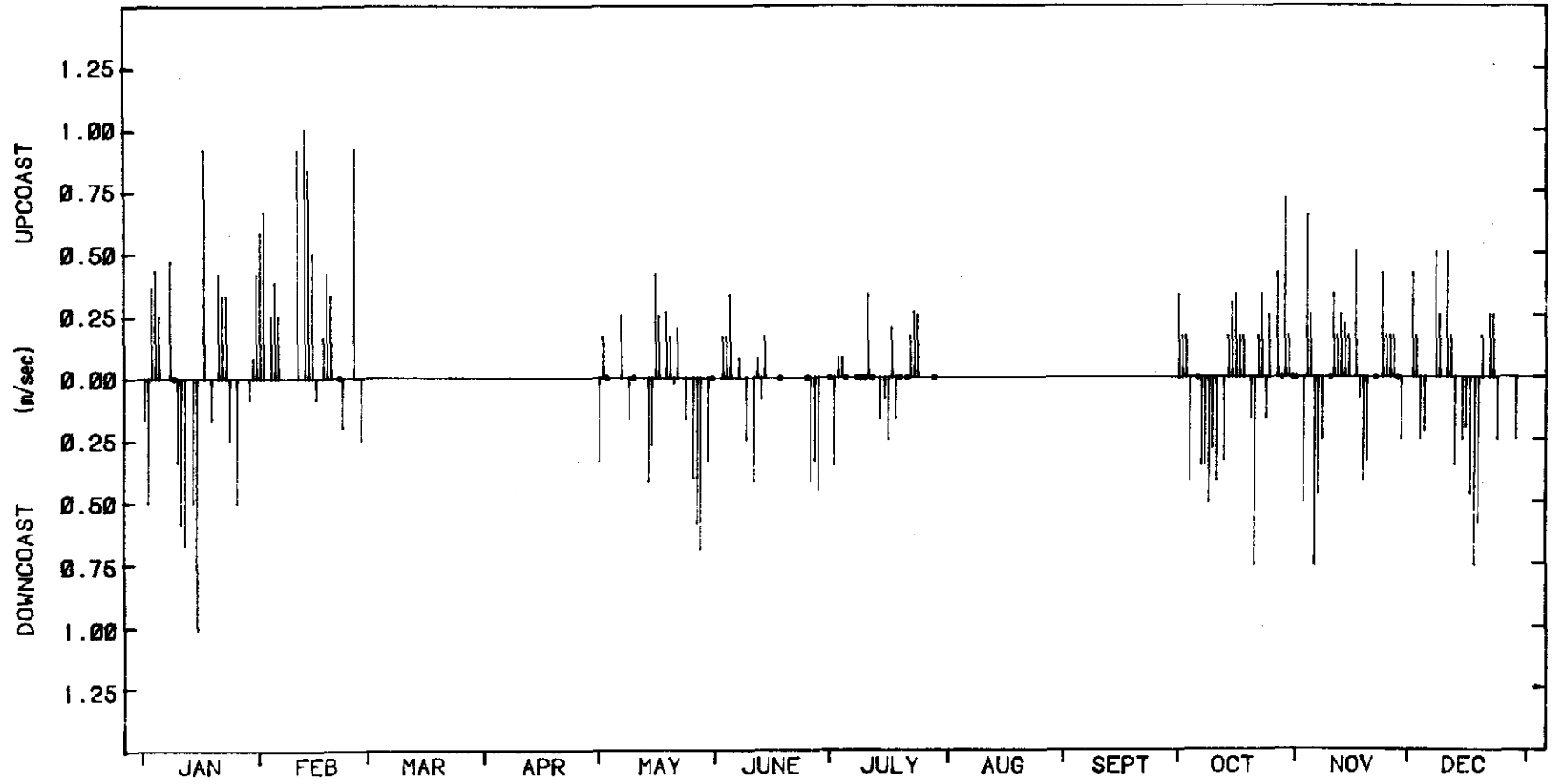
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

1201



LITTORAL CURRENT SUMMARY - 1980

Mean Vel = 0.020 m/sec (up)

Mean Upcoast Vel = 0.324 m/sec

Mean Downcoast Vel = 0.349 m/sec

MORNING OBSERVATIONS - (164 recordings)

LITTORAL CURRENTS - MORNING 1980

COPE
Bargara

Figure 19
C 16.1

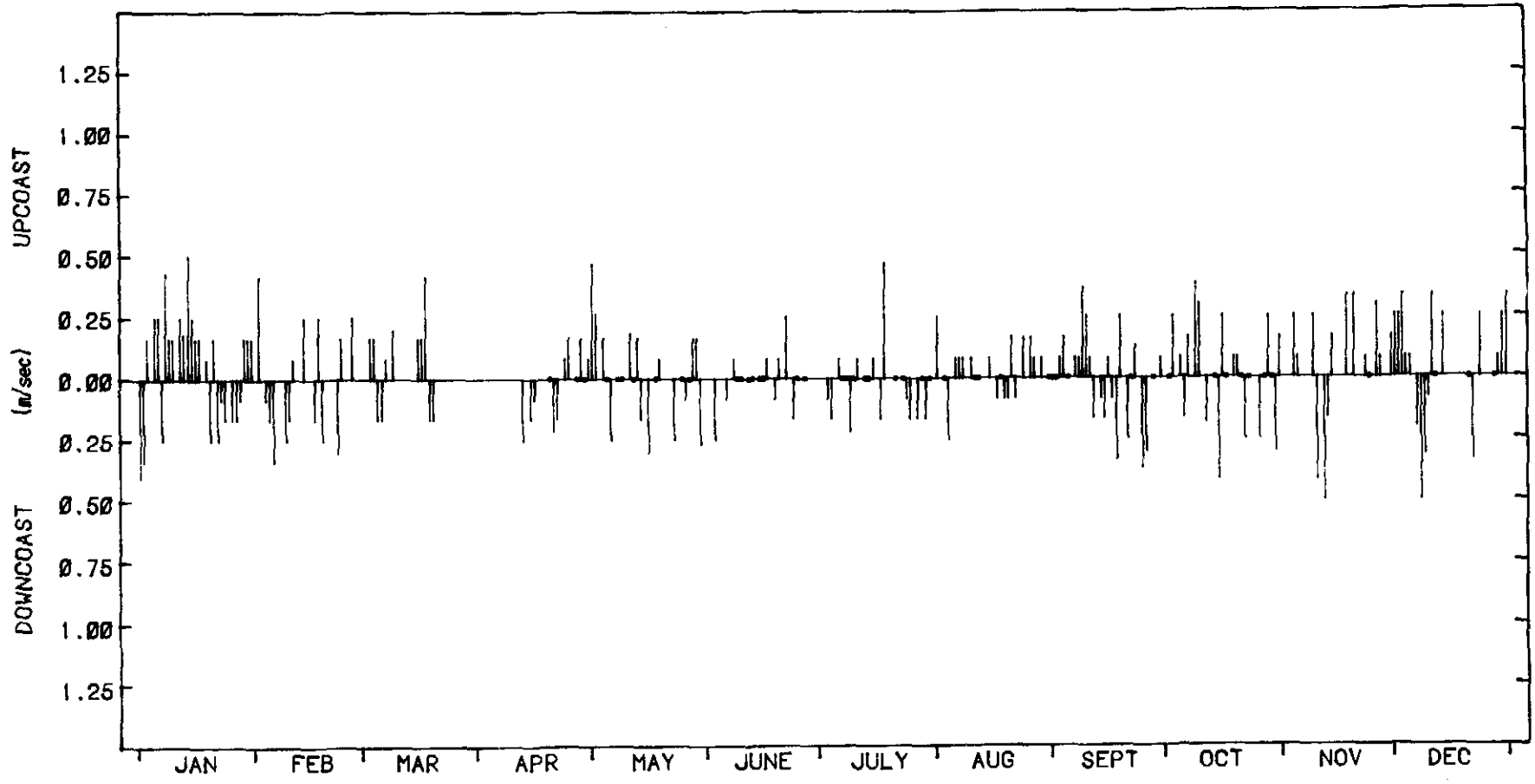
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

1201



LITTORAL CURRENTS - MORNING 1981

LITTORAL CURRENT SUMMARY - 1981

Mean Vel = 0.020 m/sec (up) Mean Upcoast Vel = 0.189 m/sec Mean Downcoast Vel = 0.208 m/sec

MORNING OBSERVATIONS - (225 recordings)

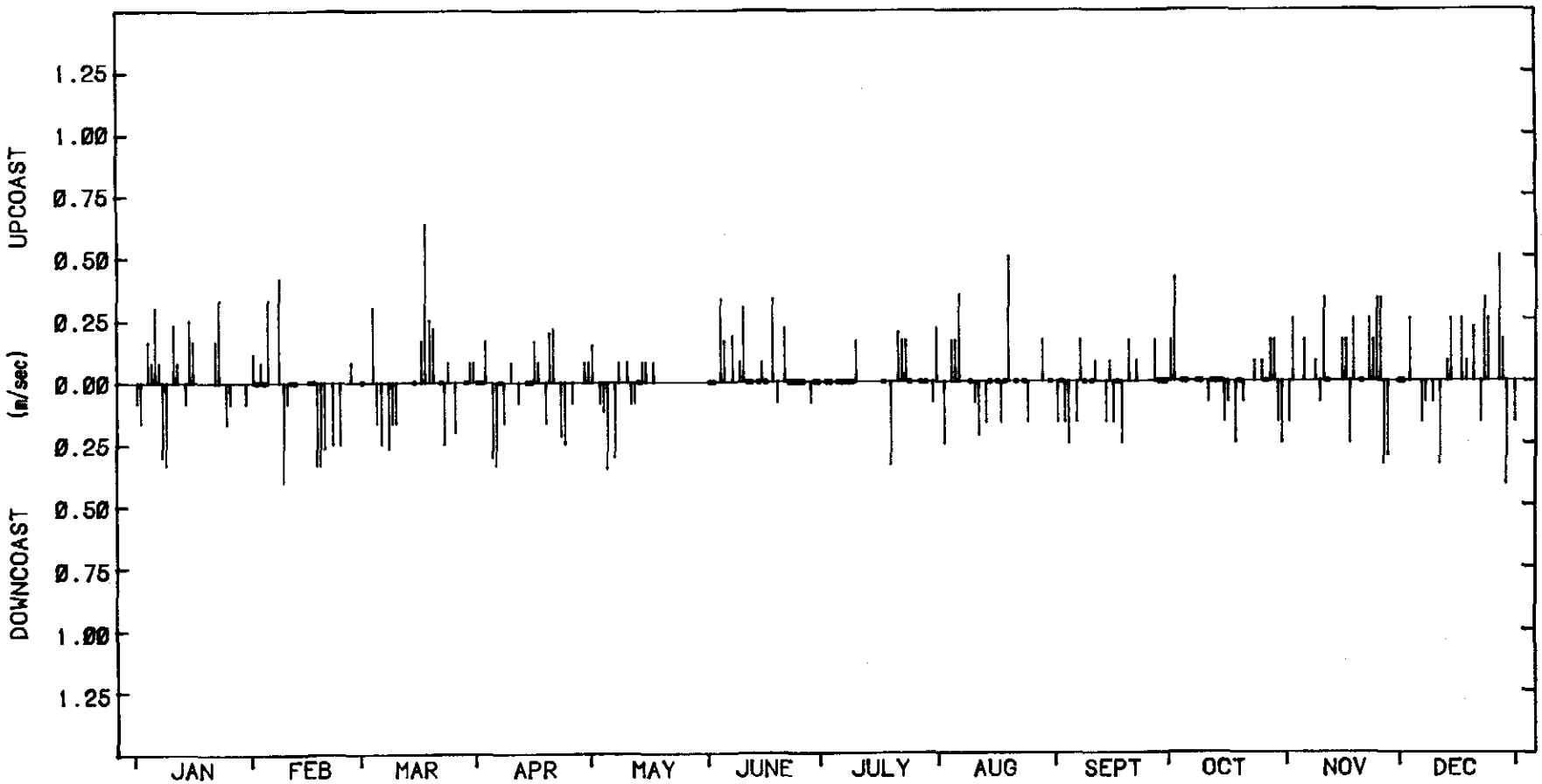
COPE Bargara

Figure 20
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE BARGARA 1201



LITTORAL CURRENT SUMMARY - 1982

Mean Vel = 0.014 m/sec (up) Mean Upcoast Vel = 0.194 m/sec Mean Downcoast Vel = 0.193 m/sec

MORNING OBSERVATIONS - (227 recordings)

LITTORAL CURRENTS - MORNING 1982

COPE Bargara

Figure 21
C 16.1

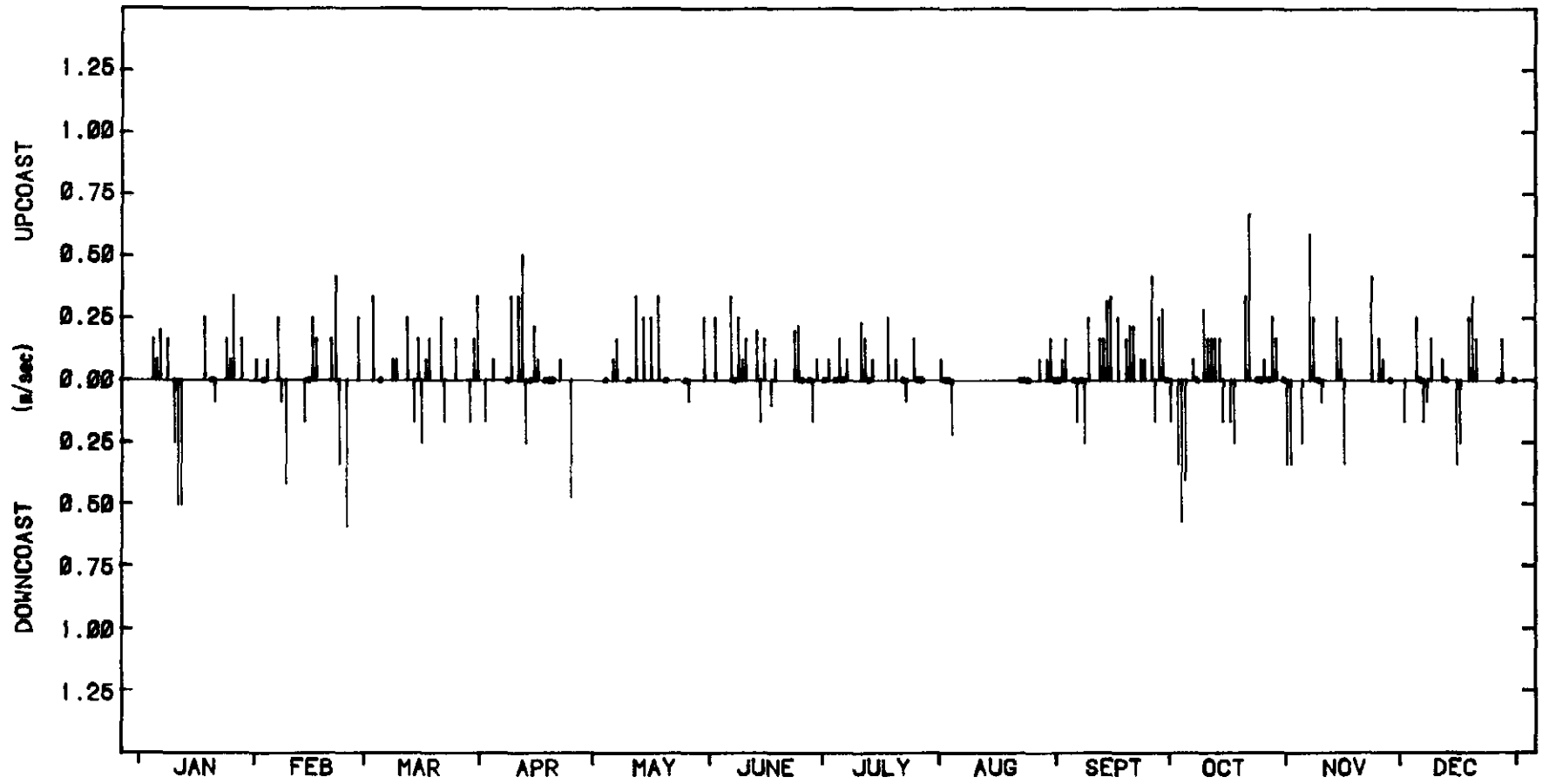
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

1201



LITTORAL CURRENT SUMMARY - 1983

Mean Vel = 0.059 m/sec (up) Mean Upcoast Vel = 0.203 m/sec Mean Downcoast Vel = 0.246 m/sec

MORNING OBSERVATIONS - (193 recordings)

LITTORAL CURRENTS - MORNING 1983

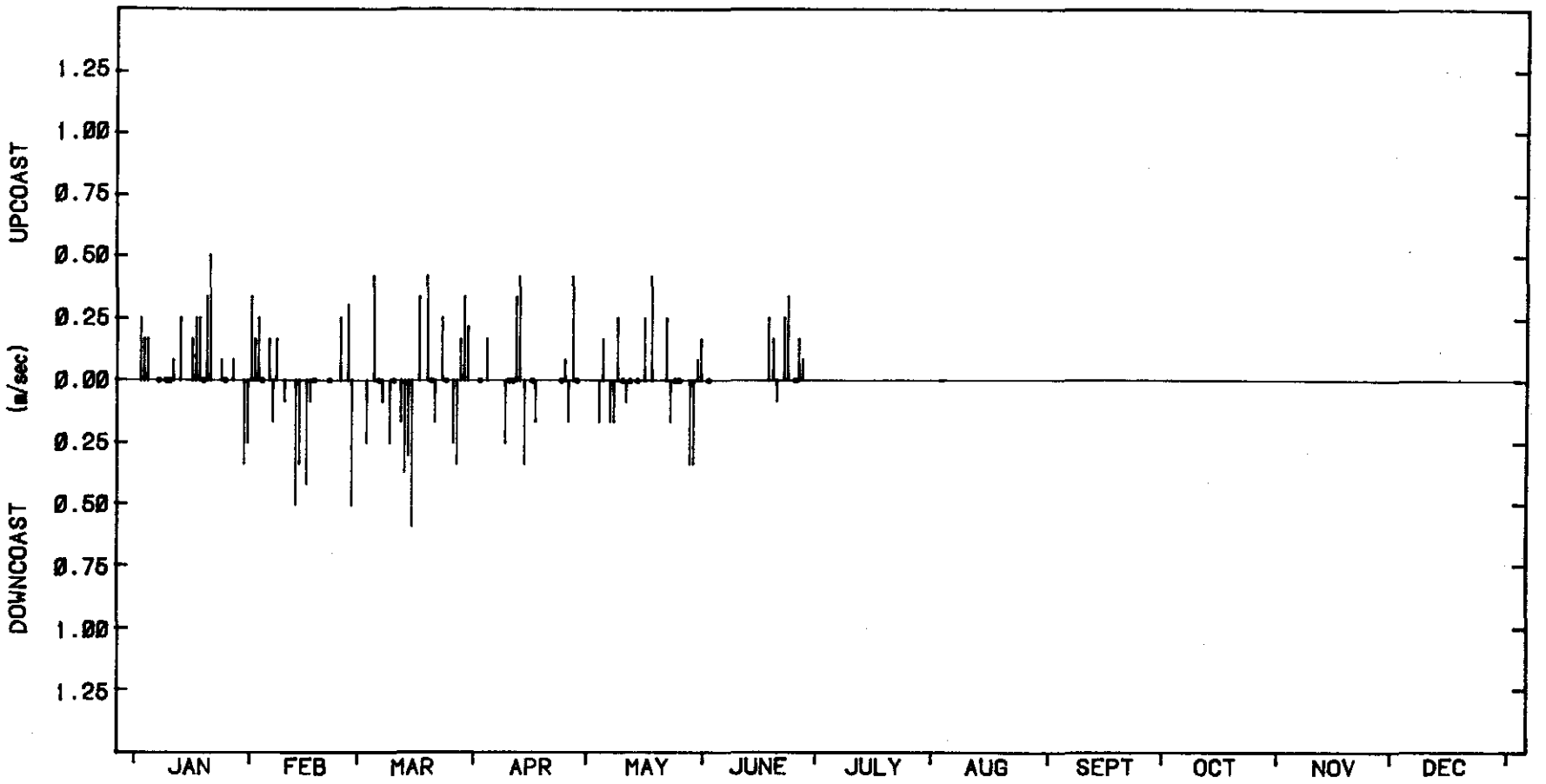
COPE
Bargara

Figure 22
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE BARGARA 1201



LITTORAL CURRENT SUMMARY - 1984

Mean Vel = 0.018 m/sec (up) Mean Upcoast Vel = 0.236 m/sec Mean Downcoast Vel = 0.245 m/sec

MORNING OBSERVATIONS - (100 recordings)

LITTORAL CURRENTS - MORNING 1984

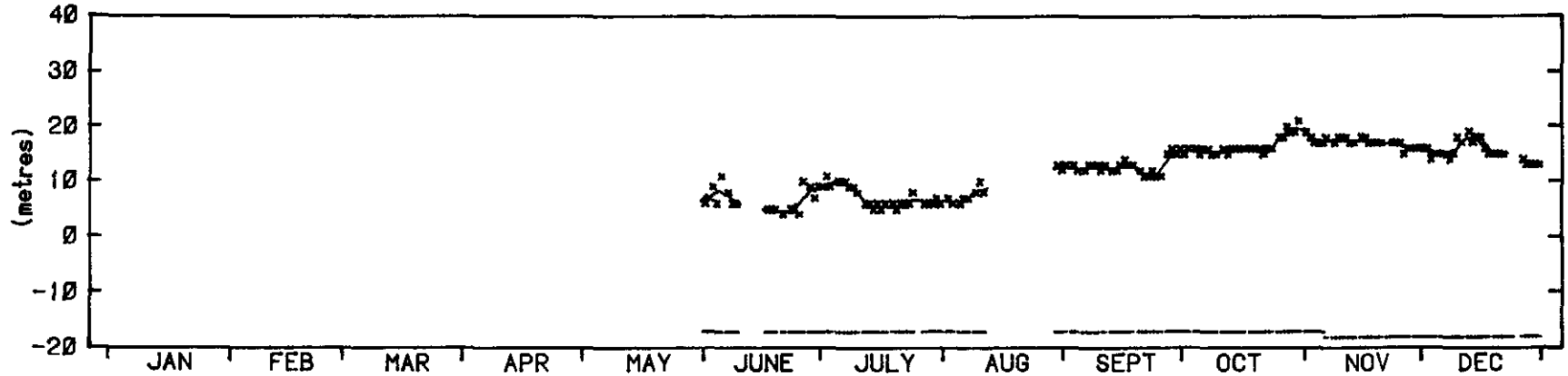
COPE
Bargara

Figure 23
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

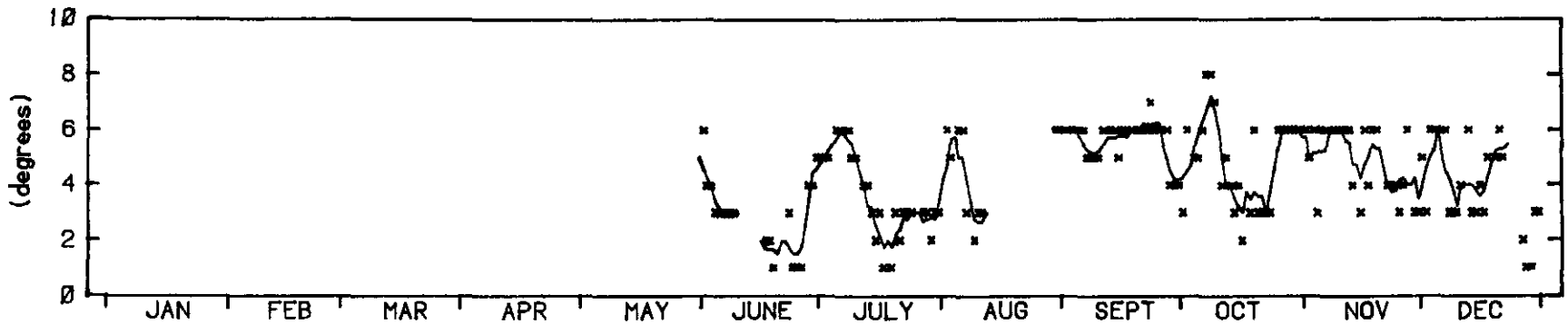
WOONGARRA SHIRE BARGARA 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1976

Indicates Distance to Fixed Contour : 155 Observations Fixed Contour Level isapprox 1.0 m above AHD

Indicates Distance to Vegetation Line : 158 Observations



FORESHORE SLOPE - 1976

Five Day Moving Average

No. of Observations : 154

BEACH PROFILE PARAMETERS - 1976

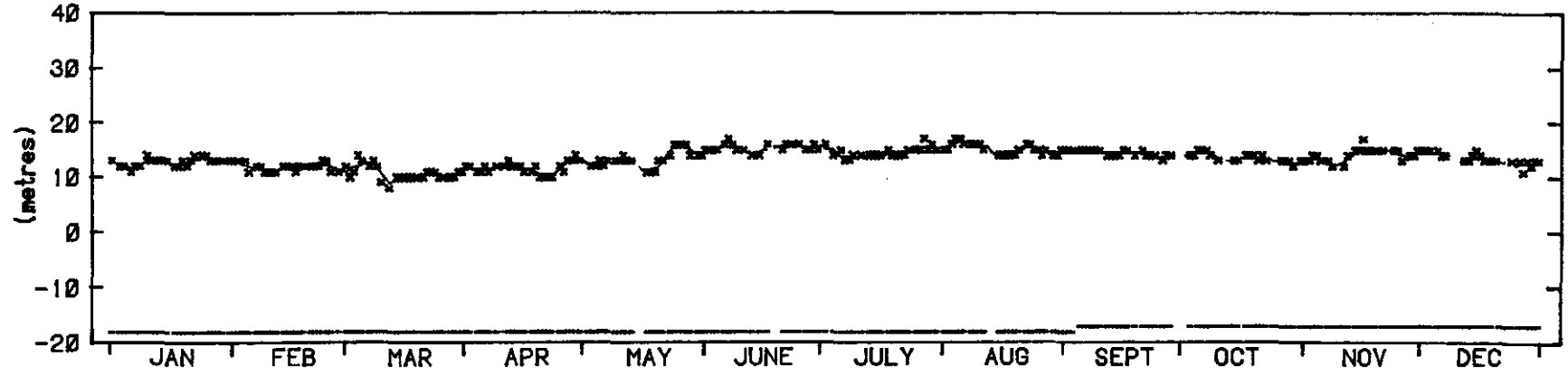
COPE
Bargara

Figure 24
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

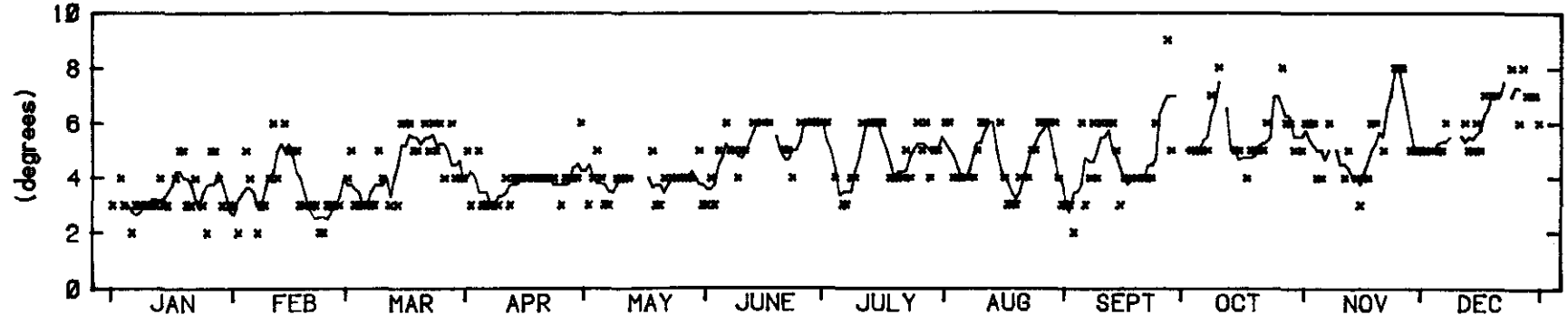
WOONGARRA SHIRE **BARGARA** **1201**



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1977

Indicates Distance to Fixed Contour : 276 Observations Fixed Contour Level is approx 1.0 m above AHD

Indicates Distance to Vegetation Line : 294 Observations



FORESHORE SLOPE - 1977

Five Day Moving Average

No. of Observations : 274

BEACH PROFILE PARAMETERS - 1977

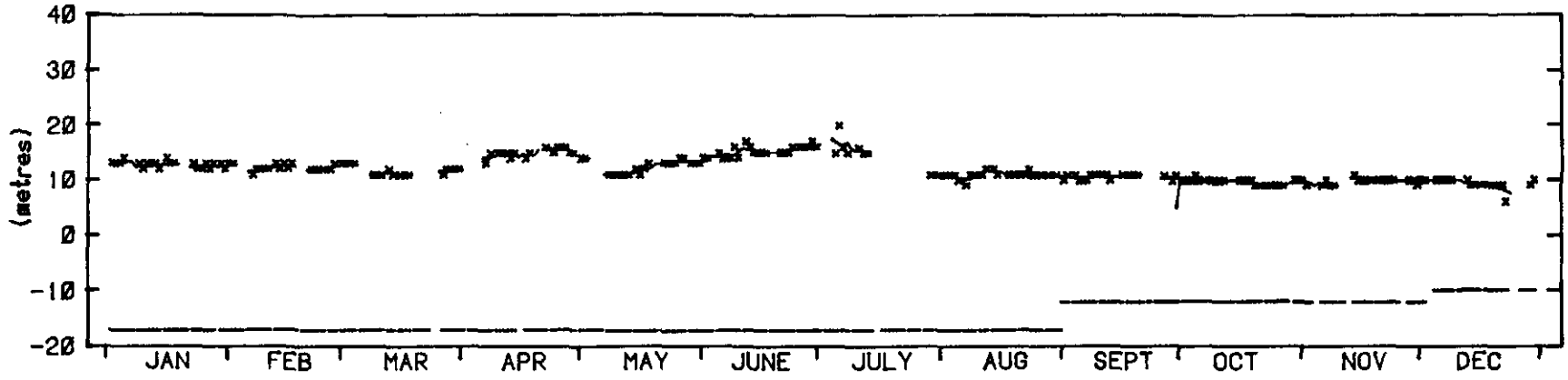
COPE
Bargara

Figure 25
C 16.1

Beach Protection Authority

COPE - Coastal Observation
Programme Engineering

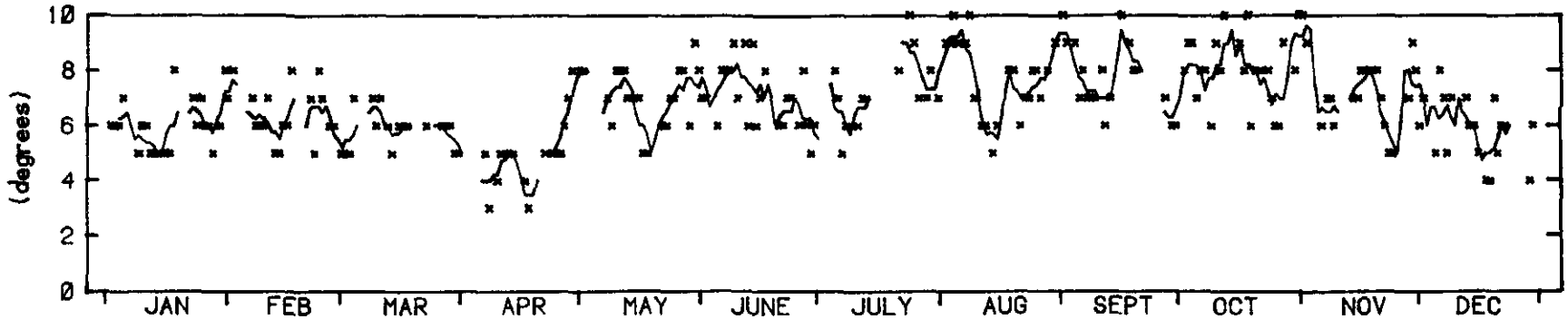
WOONGARRA SHIRE **BARGARA** 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1978

xxxxx Indicates Distance to Fixed Contour : 225 Observations Fixed Contour Level is approx 1.0 m above AHD

—— Indicates Distance to Vegetation Line : 297 Observations



FORESHORE SLOPE - 1978

Five Day Moving Average

No. of Observations : 231

BEACH PROFILE PARAMETERS - 1978

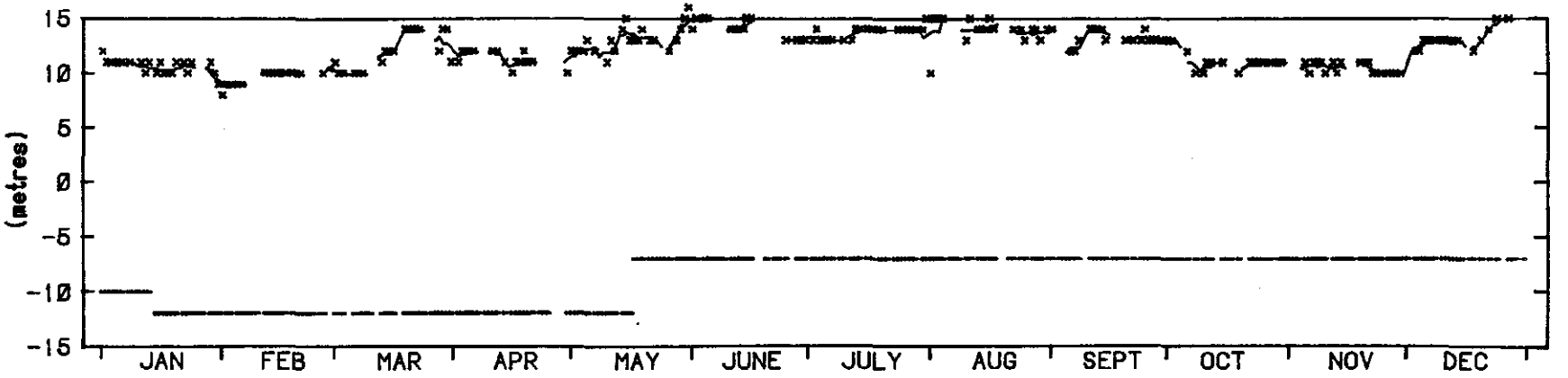
COPE
Bargara

Figure 26
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

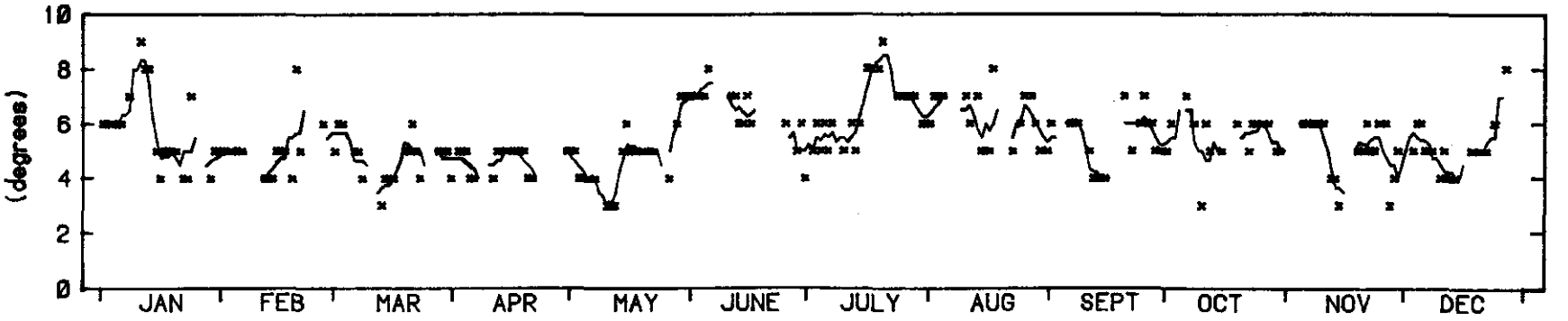
WOONGARRA SHIRE BARGARA 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1979

xxxxx Indicates Distance to Fixed Contour : 213 Observations Fixed Contour Level is approx 1.0 m above AHD

— Indicates Distance to Vegetation Line : 281 Observations



FORESHORE SLOPE - 1979

Five Day Moving Average

No. of Observations : 213

BEACH PROFILE PARAMETERS - 1979

COPE
Bargara

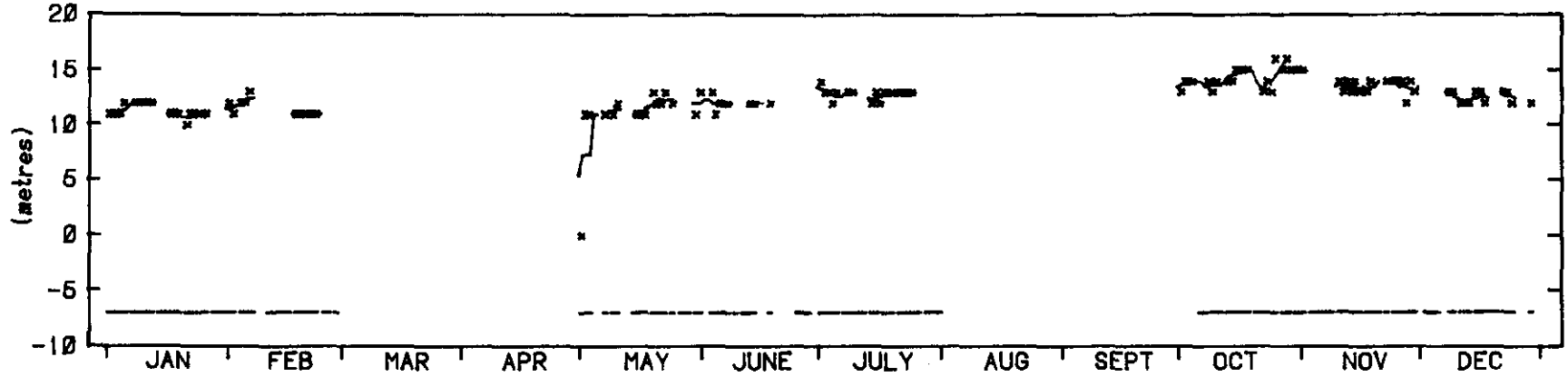
Figure 27
C 16.1

Beach Protection Authority

BEACH PROFILE PARAMETERS - 1980

COPE - Coastal Observation Programme Engineering

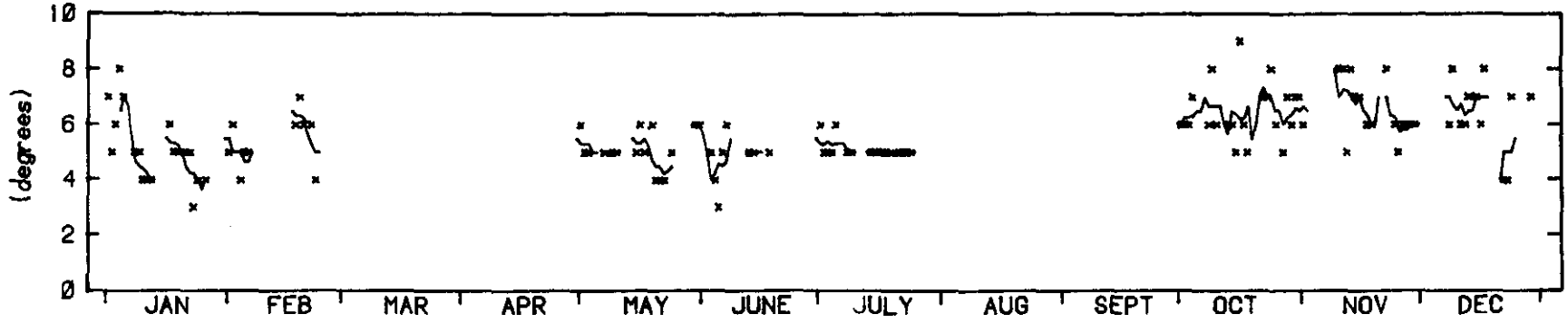
WOONGARRA SHIRE BARGARA 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1980

xxxxx Indicates Distance to Fixed Contour : 119 Observations Fixed Contour Level is approx 1.0 m above AHD

— Indicates Distance to Vegetation Line : 176 Observations



FORESHORE SLOPE - 1980

Five Day Moving Average

No. of Observations : 119

COPE
Bargara

Figure 28
C 16.1

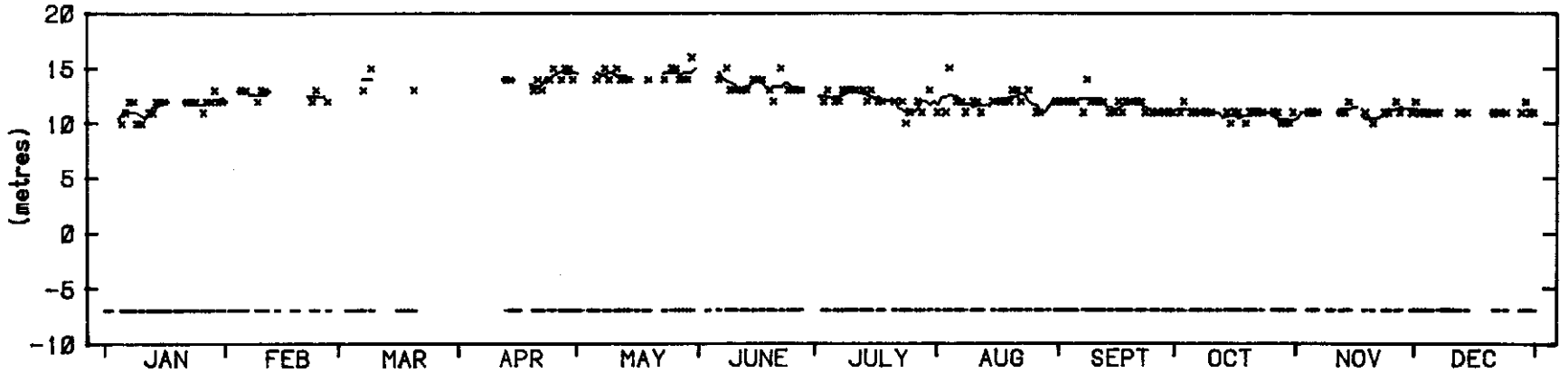
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

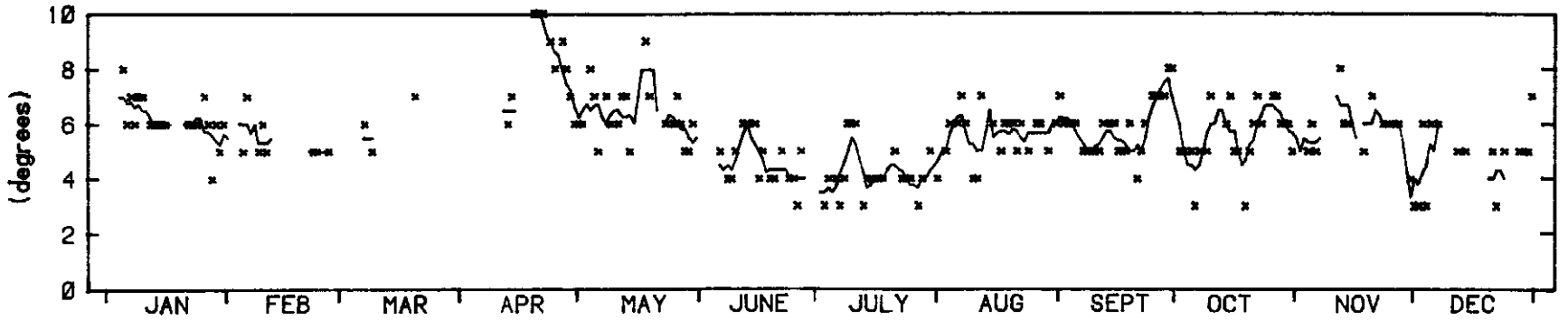
1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1981

xxxxx Indicates Distance to Fixed Contour : 188 Observations Fixed Contour Level is approx 1.0 m above AHD

— Indicates Distance to Vegetation Line : 225 Observations



FORESHORE SLOPE - 1981

Five Day Moving Average

No. of Observations : 194

BEACH PROFILE PARAMETERS - 1981

COPE
Bargara

Figure 29
C 16.1

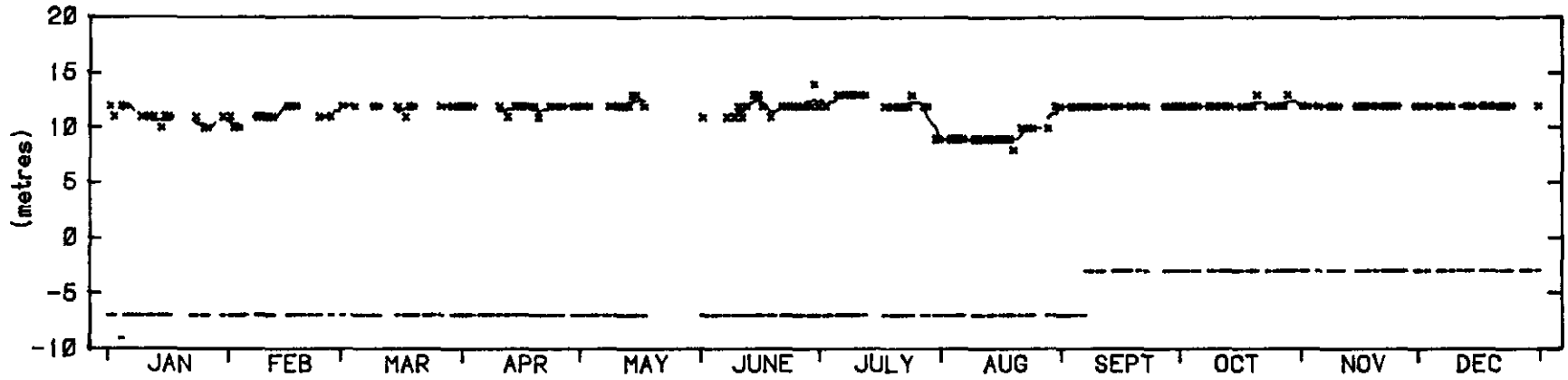
Beach Protection Authority

COPE - Coastal Observation Programme Engineering

WOONGARRA SHIRE

BARGARA

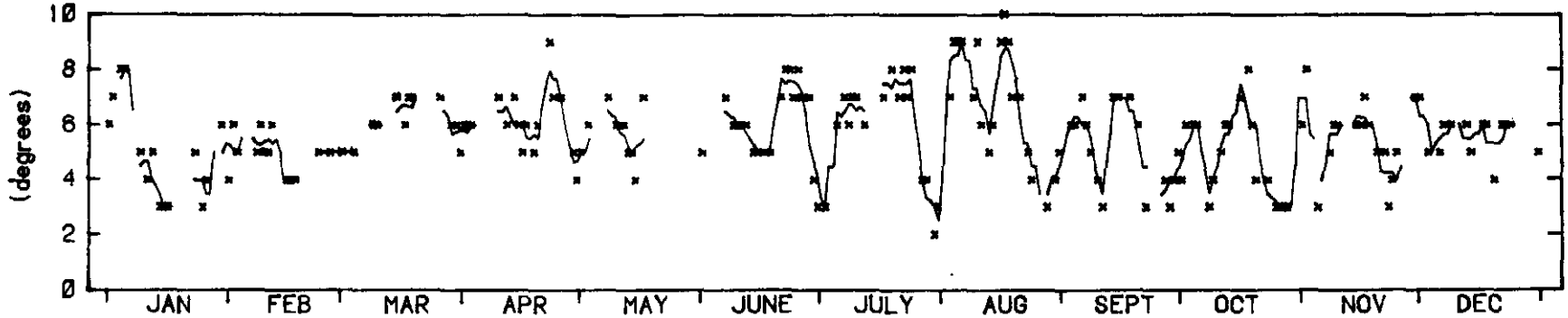
1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1982

xxxxx Indicates Distance to Fixed Contour : 184 Observations Fixed Contour Level isapprox 1.0 m above AHD

— Indicates Distance to Vegetation Line : 231 Observations



FORESHORE SLOPE - 1982

Five Day Moving Average

No. of Observations : 184

BEACH PROFILE PARAMETERS - 1982

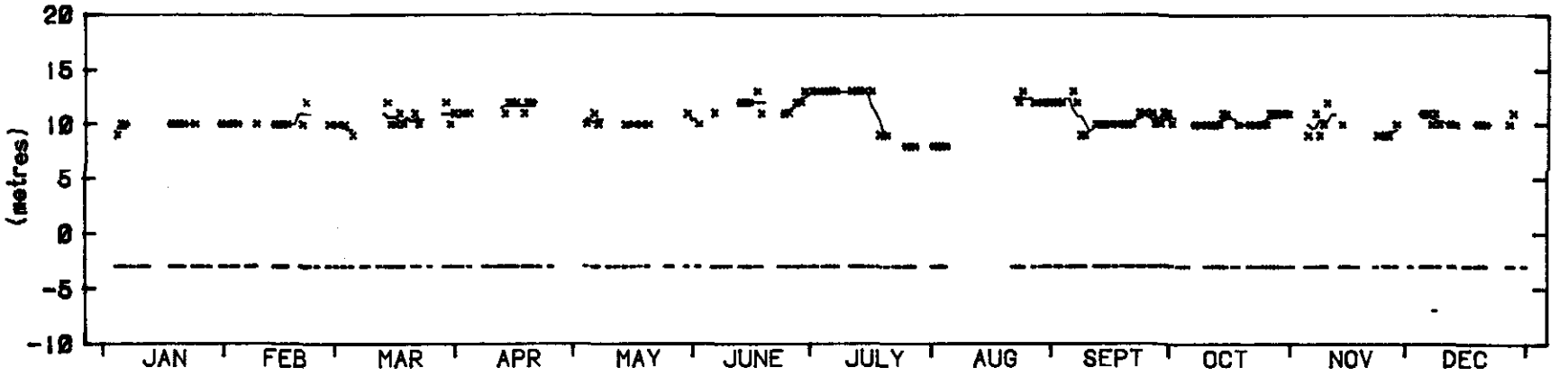
COPE
Bargara

Figure 30
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

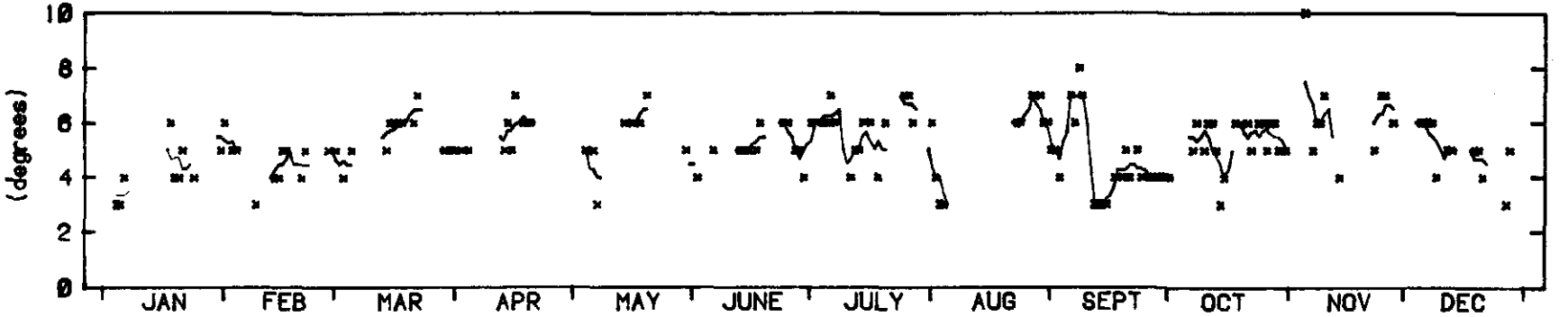
WOONGARRA SHIRE BARGARA 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1983

Indicates Distance to Fixed Contour : 151 Observations Fixed Contour Level is approx 1.0 m above AHD

Indicates Distance to Vegetation Line : 184 Observations



FORESHORE SLOPE - 1983

Five Day Moving Average

No. of Observations : 151

BEACH PROFILE PARAMETERS - 1983

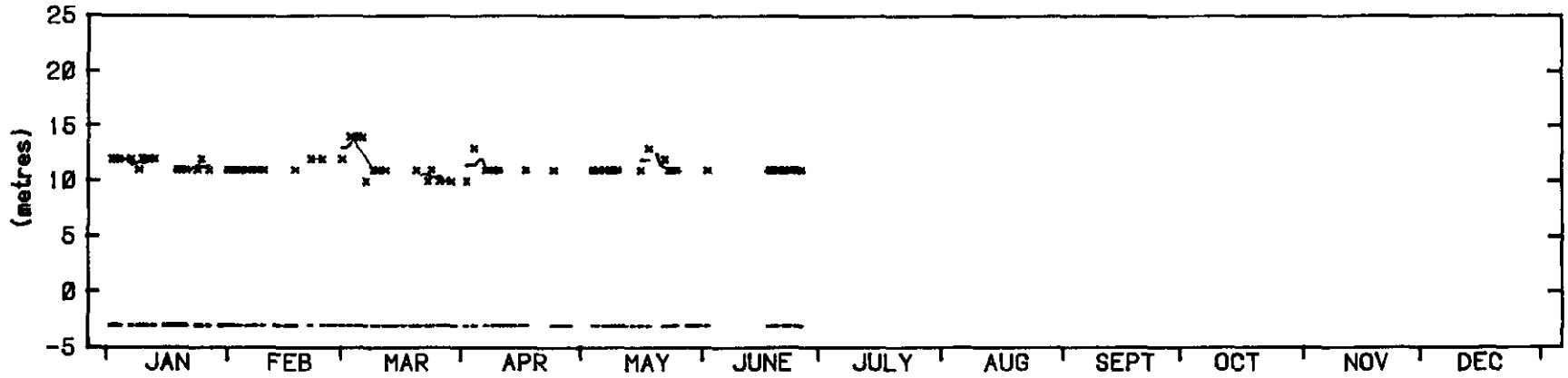
COPE
Bargara

Figure 31
C 16.1

Beach Protection Authority

COPE - Coastal Observation Programme Engineering

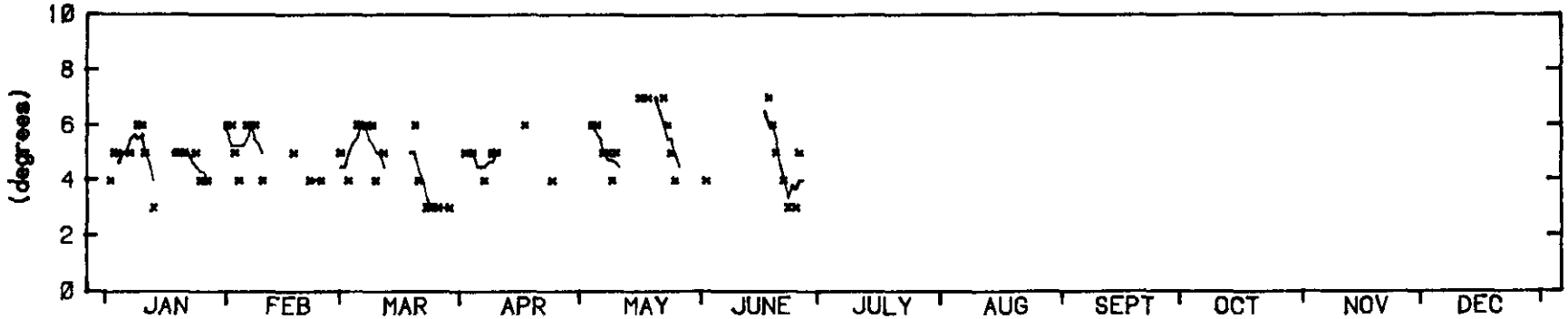
WOONGARRA SHIRE BARGARA 1201



DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1984

Indicates Distance to Fixed Contour : 66 Observations Fixed Contour Level is approx 1.0 m above AHD

Indicates Distance to Vegetation Line : 118 Observations



FORESHORE SLOPE - 1984

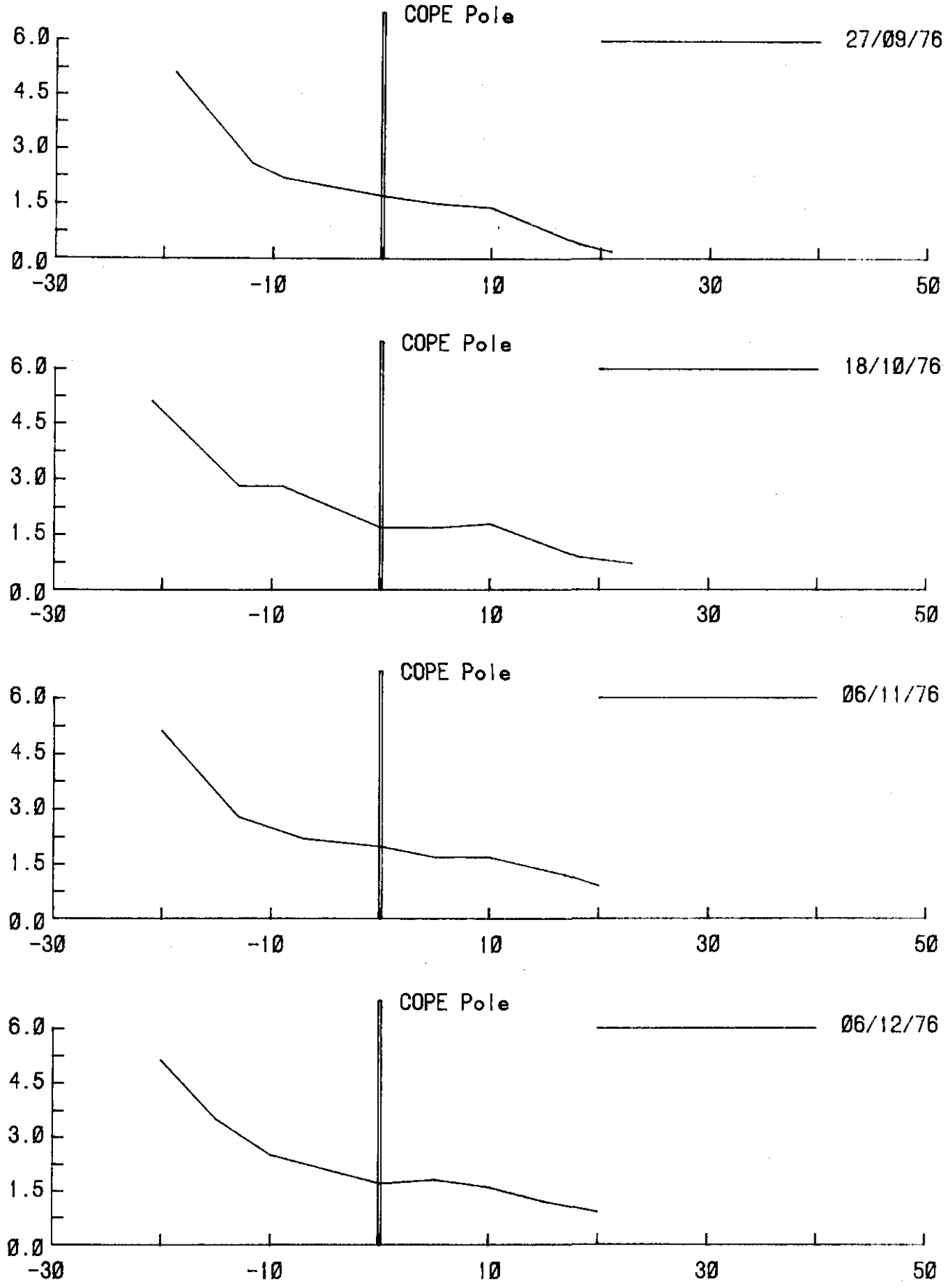
Five Day Moving Average

No. of Observations : 66

BEACH PROFILE PARAMETERS - 1984

COPE Bargara

Figure 32 C 16.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres

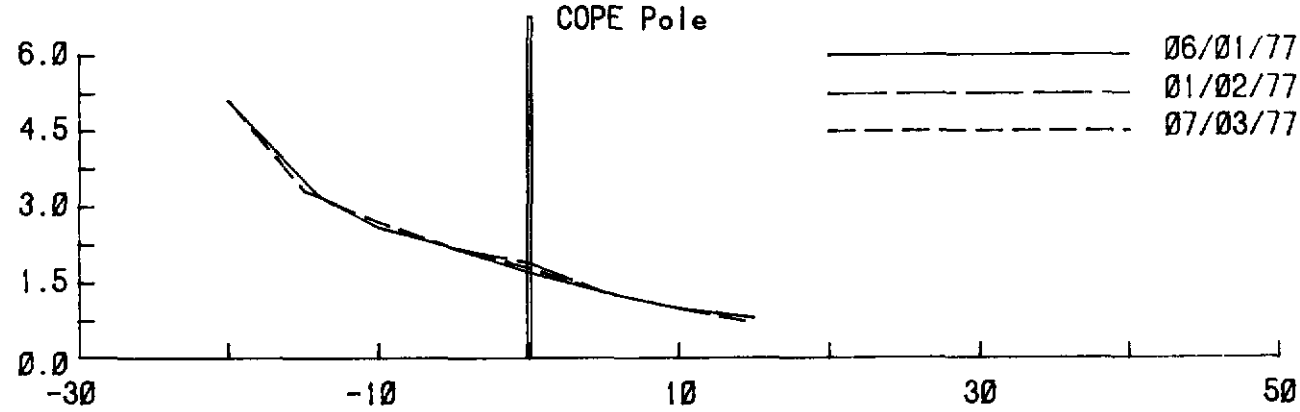
Beach Protection Authority

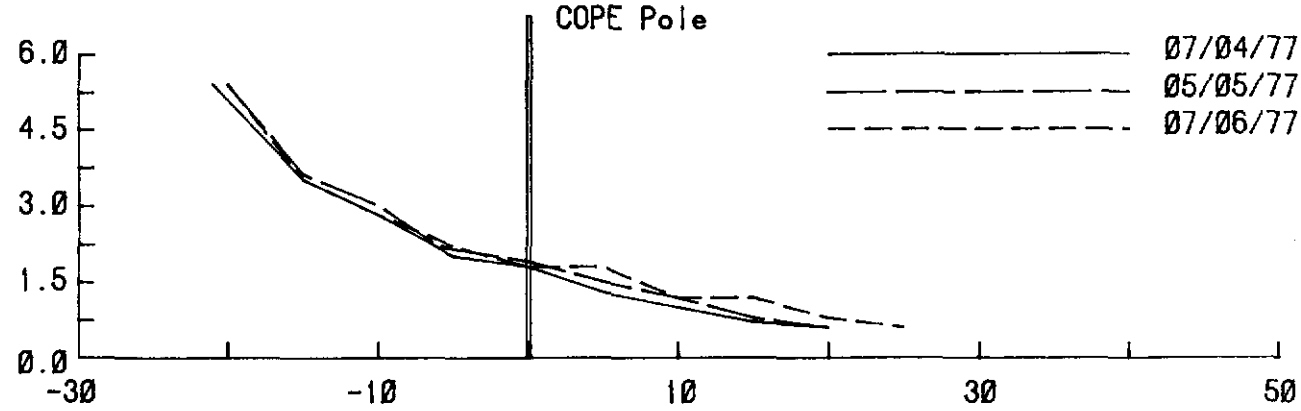
MONTHLY BEACH PROFILES

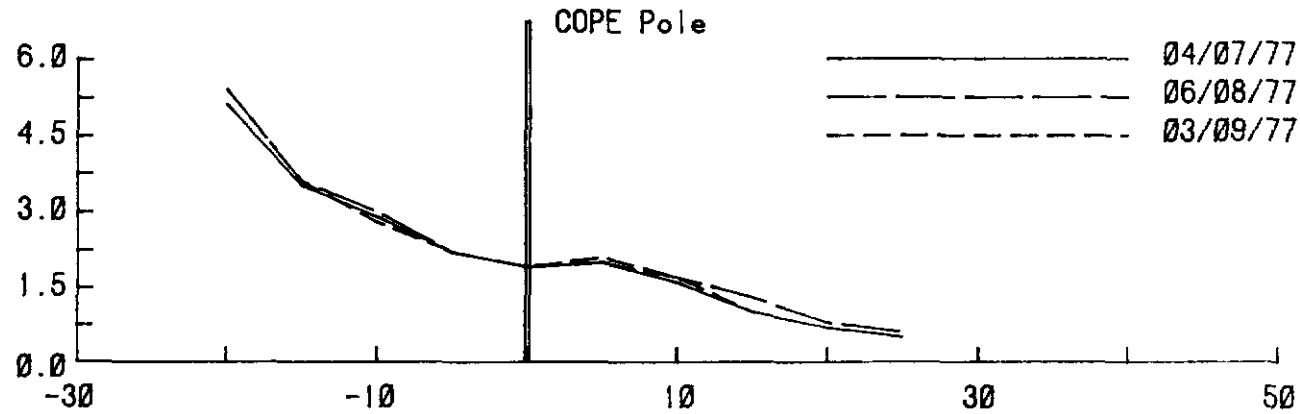
1976

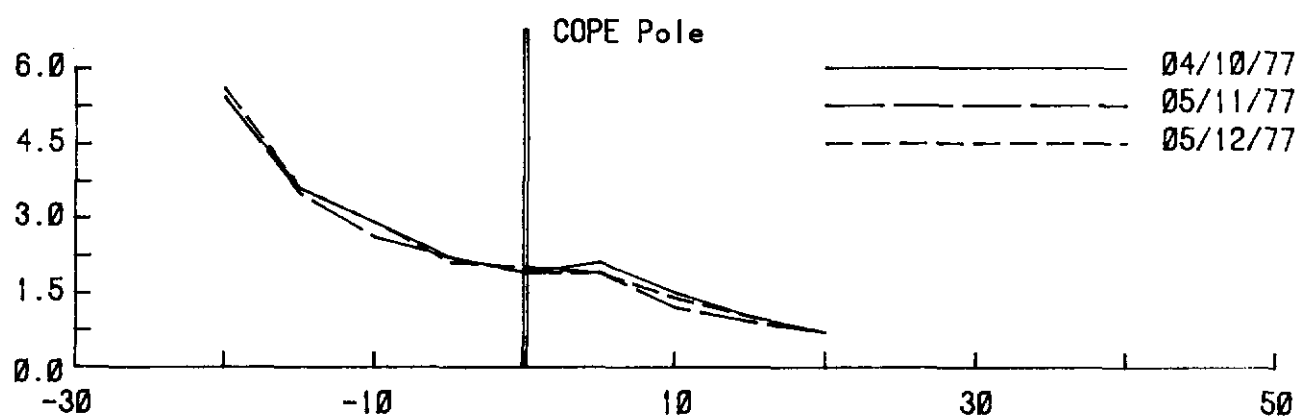
COPE
Bargara

Figure **33**
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

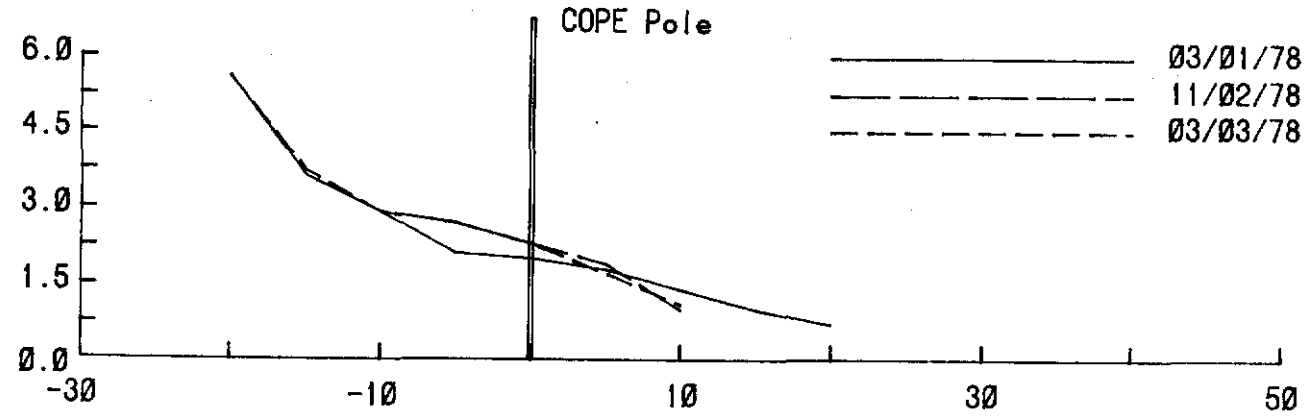
Beach Protection Authority

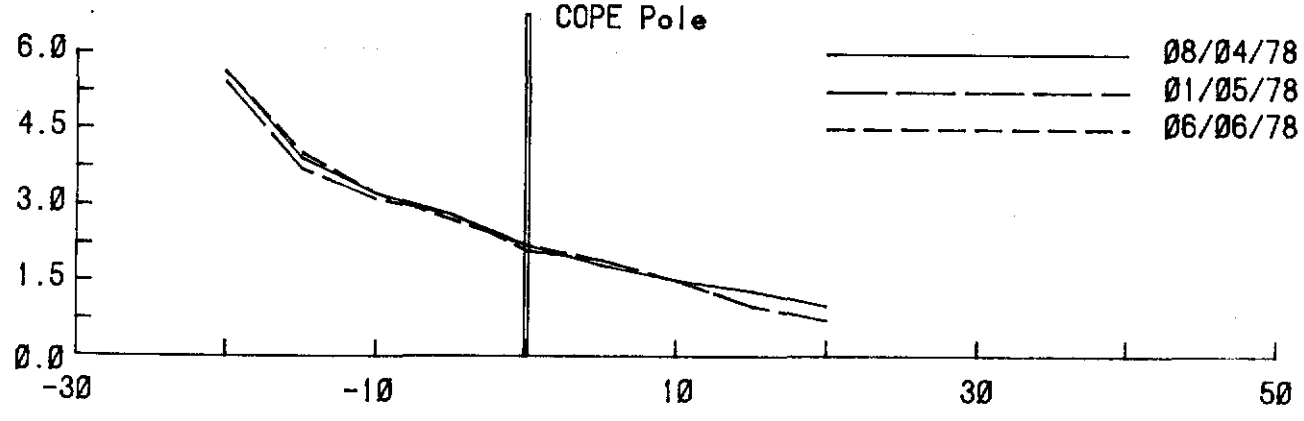
MONTHLY BEACH PROFILES

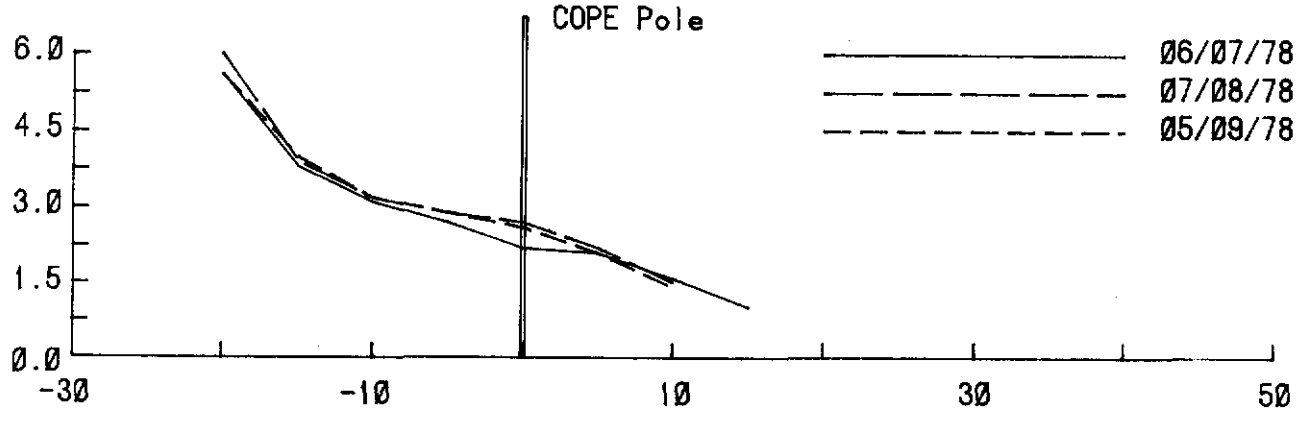
1977

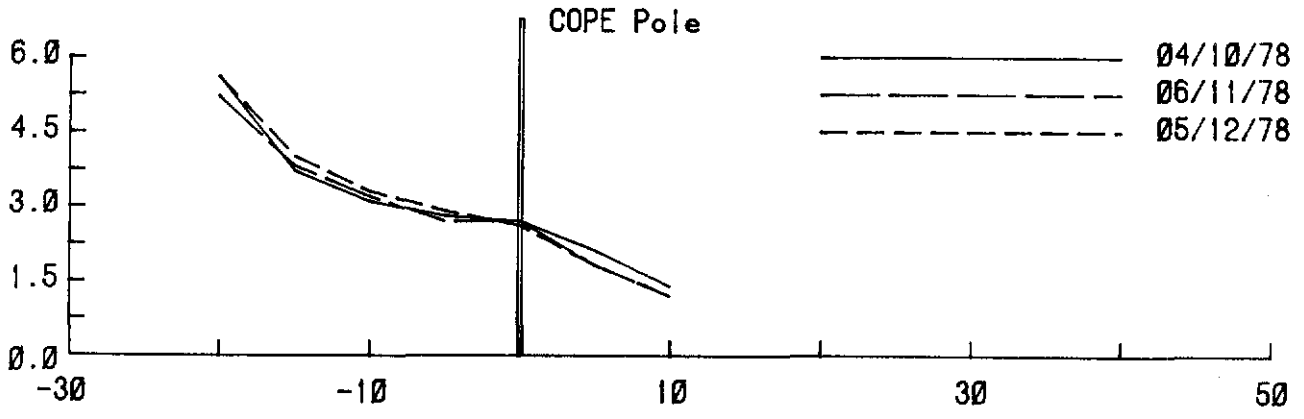
COPE
Bargara

Figure 34
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

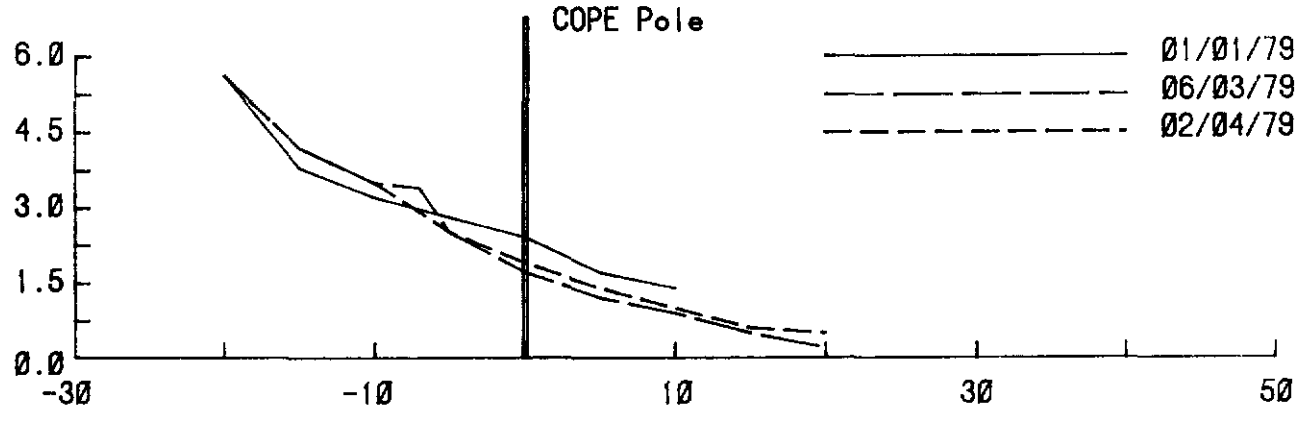
Beach Protection Authority

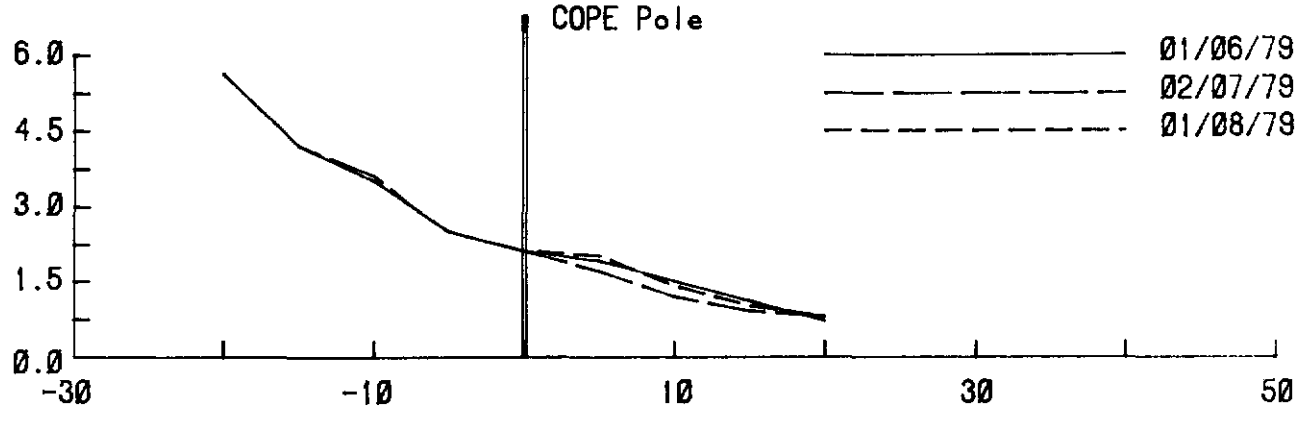
MONTHLY BEACH PROFILES

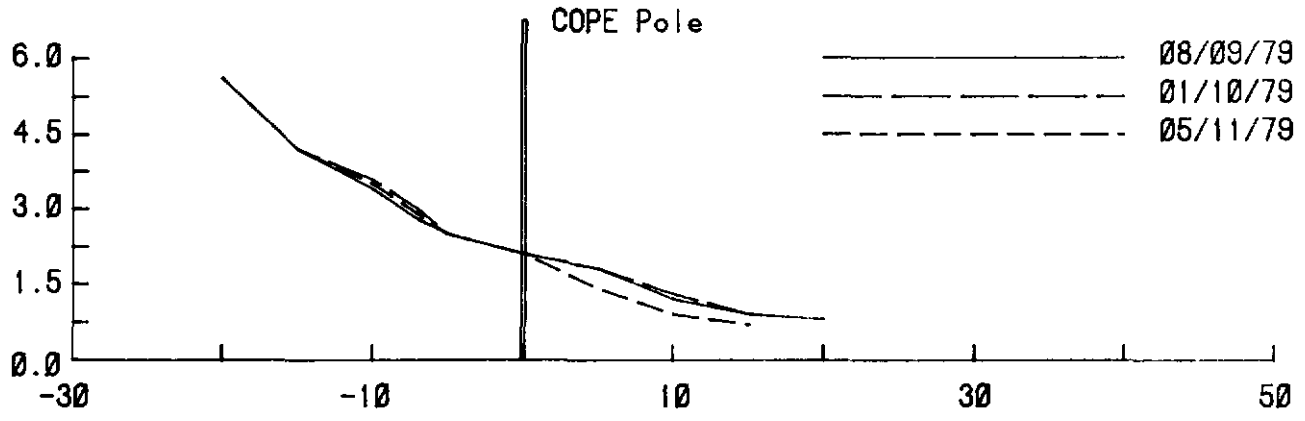
1978

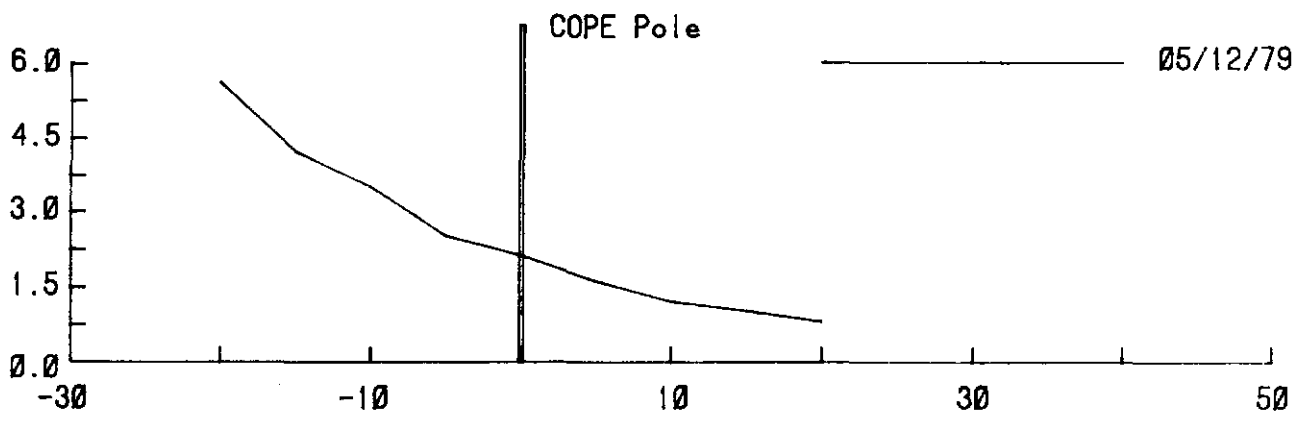
COPE
Bargara

Figure 35
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

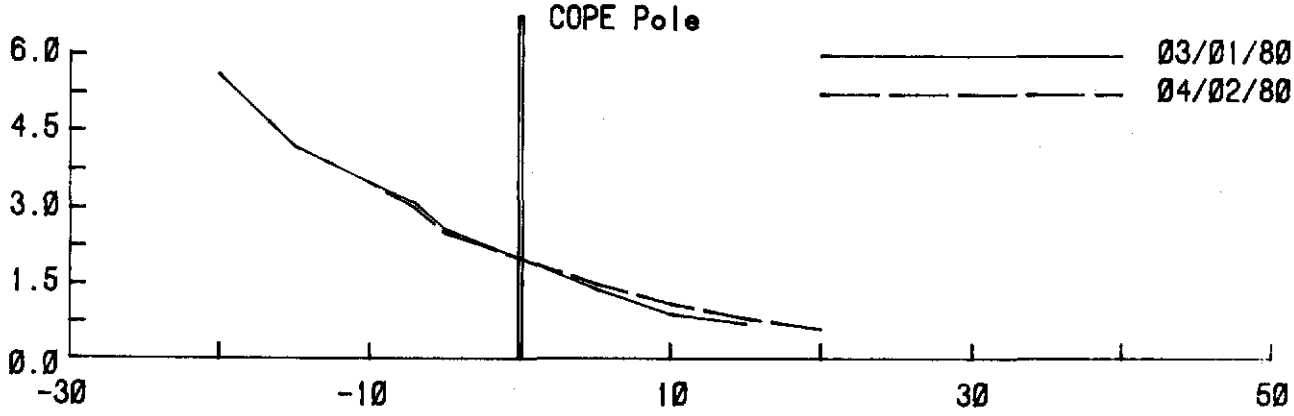
Beach Protection Authority

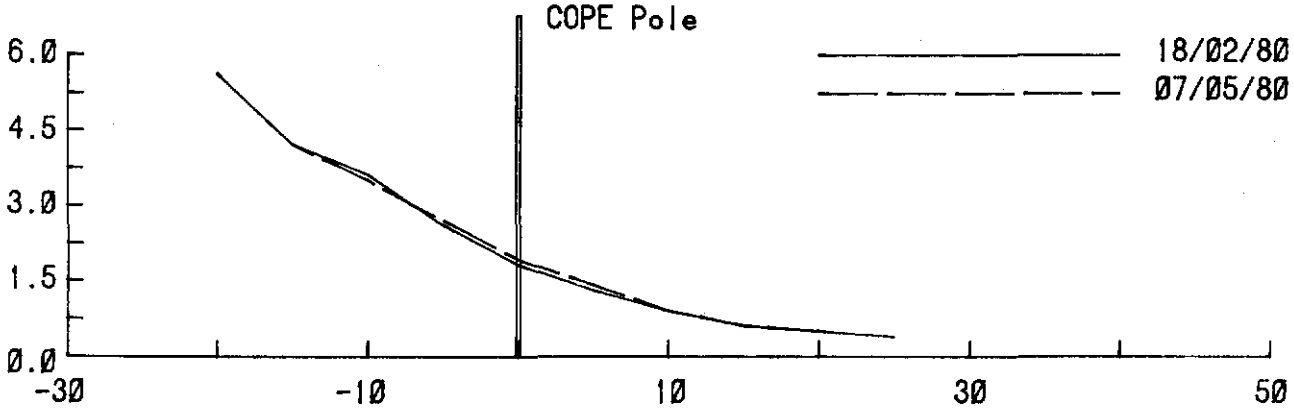
MONTHLY BEACH PROFILES

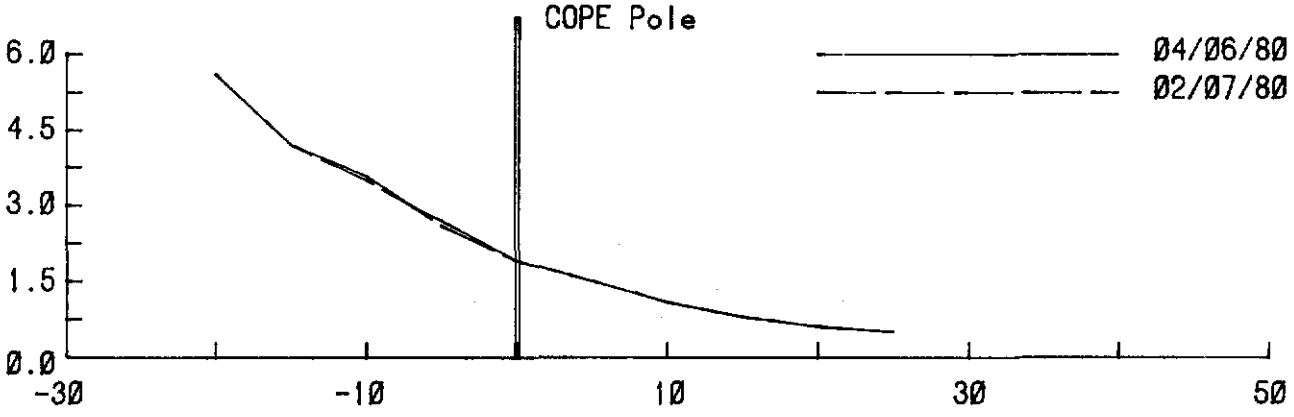
1979

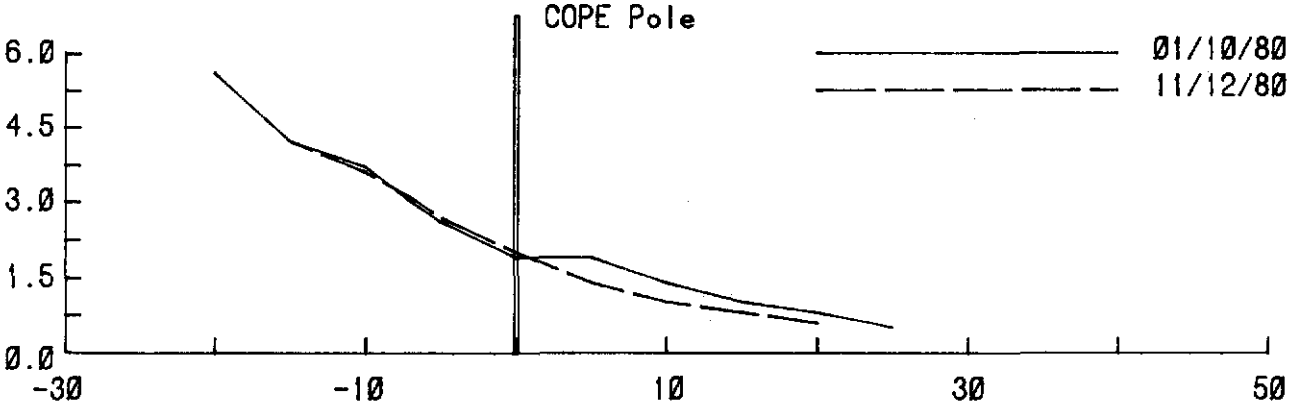
COPE
Bargara

Figure 36
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

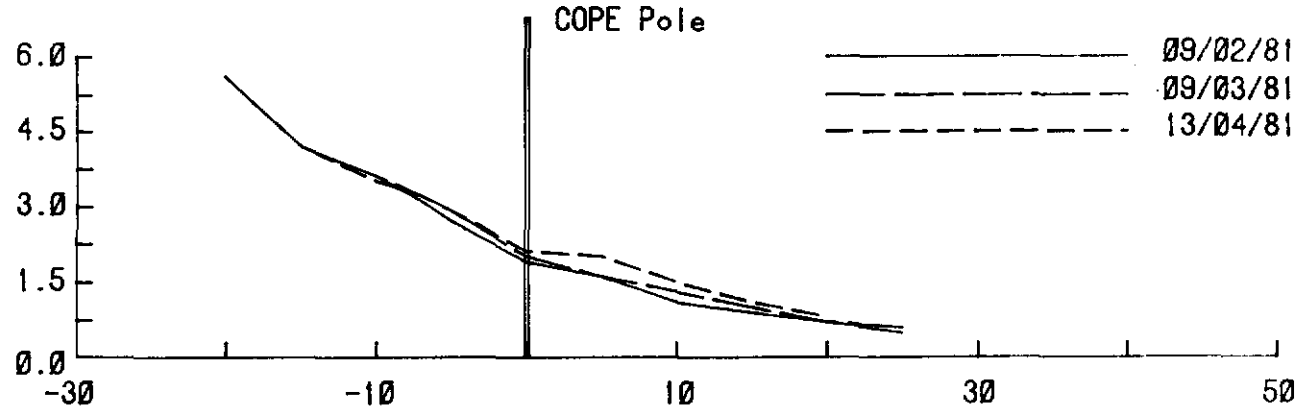
Beach Protection Authority

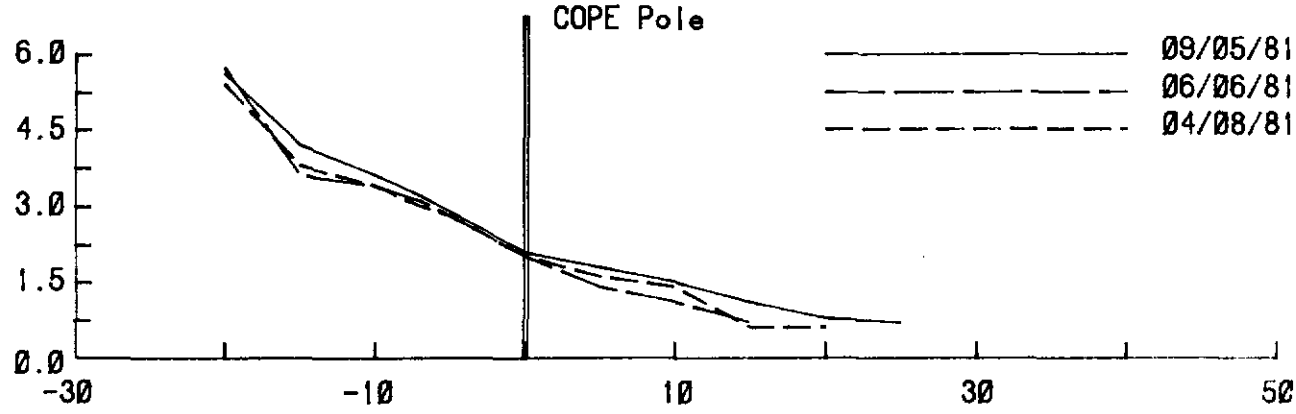
MONTHLY BEACH PROFILES

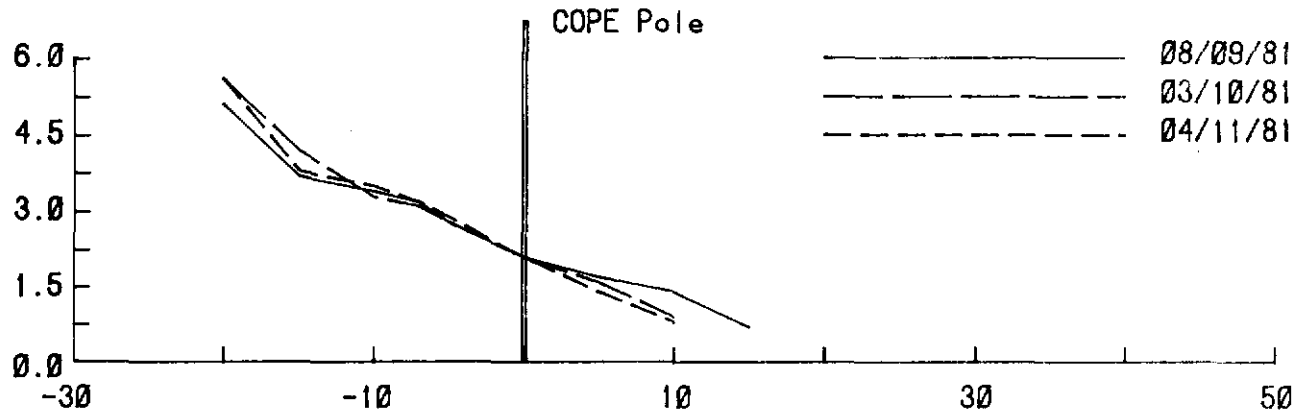
1980

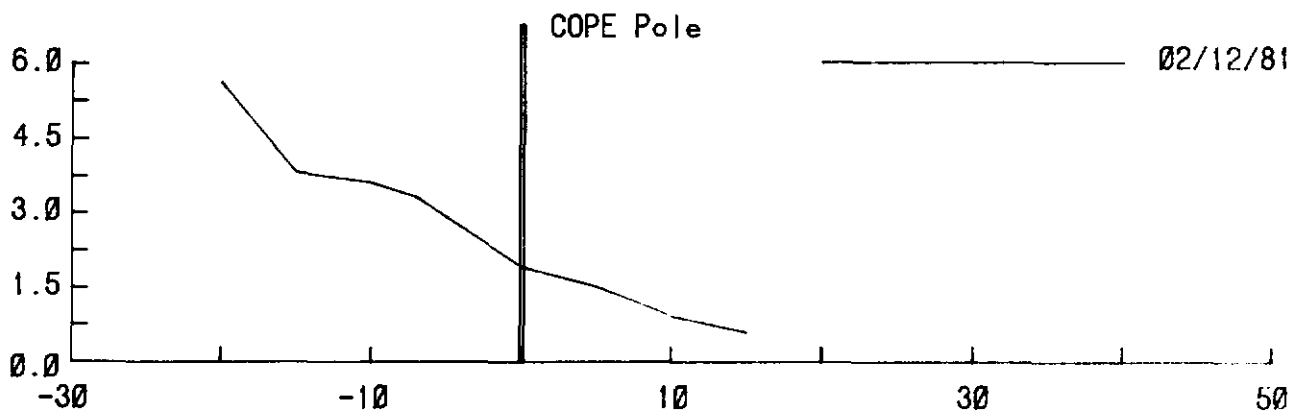
COPE
Bargara

Figure 37
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

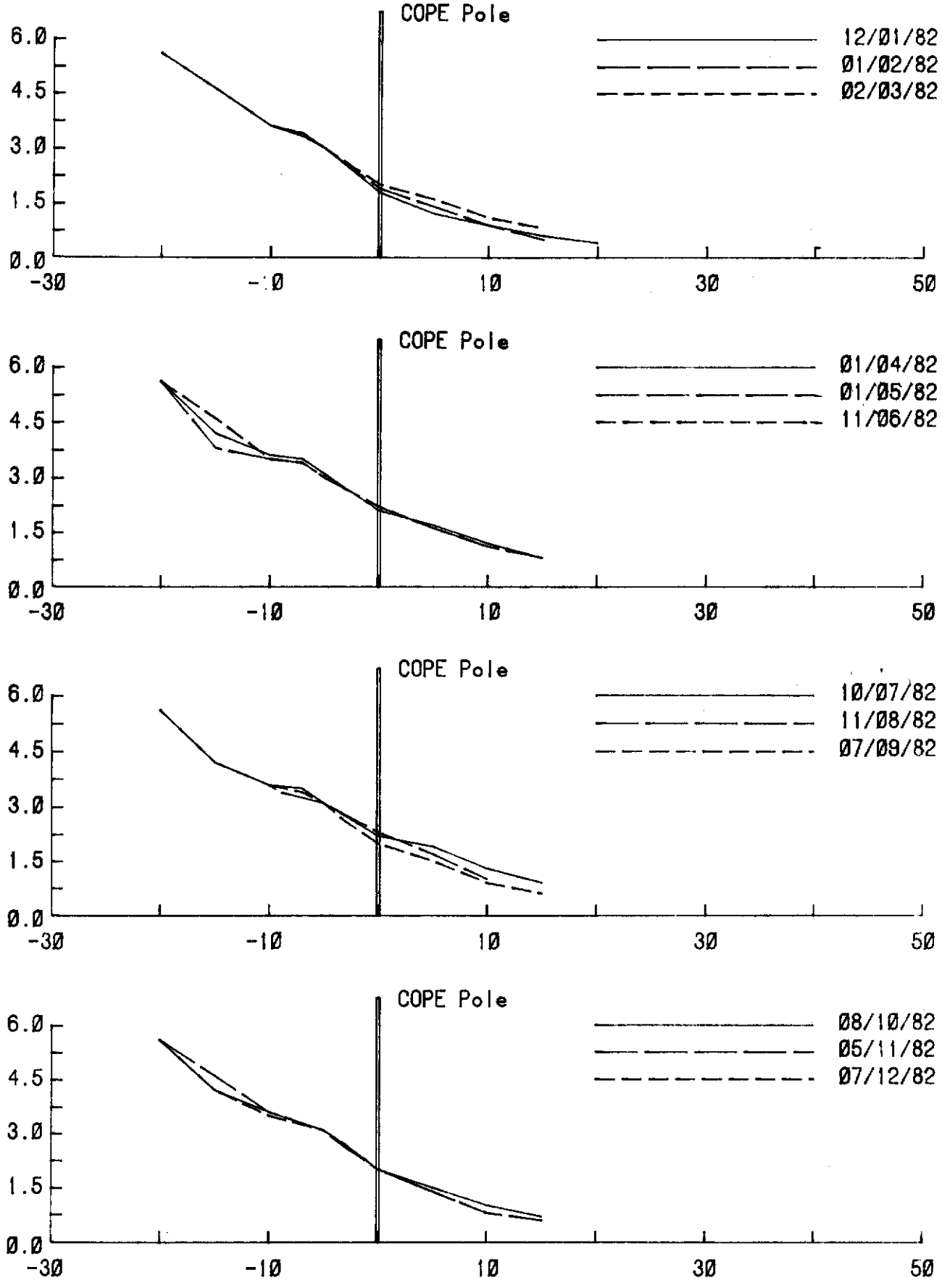
Beach Protection Authority

MONTHLY BEACH PROFILES

1981

COPE
Bargara

Figure 38
C 16.1



Level Datum is A.H.D.

Distances and Levels are measured in Metres

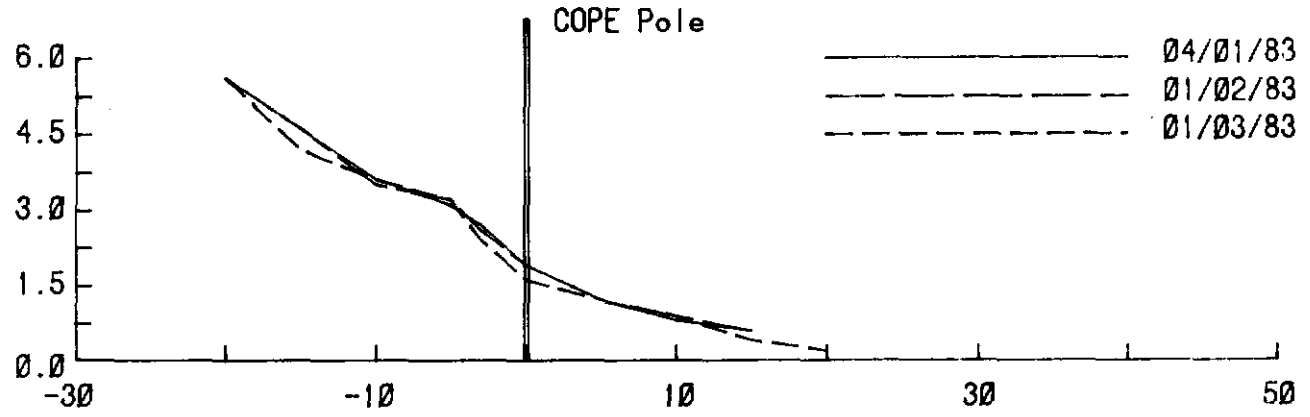
Beach Protection Authority

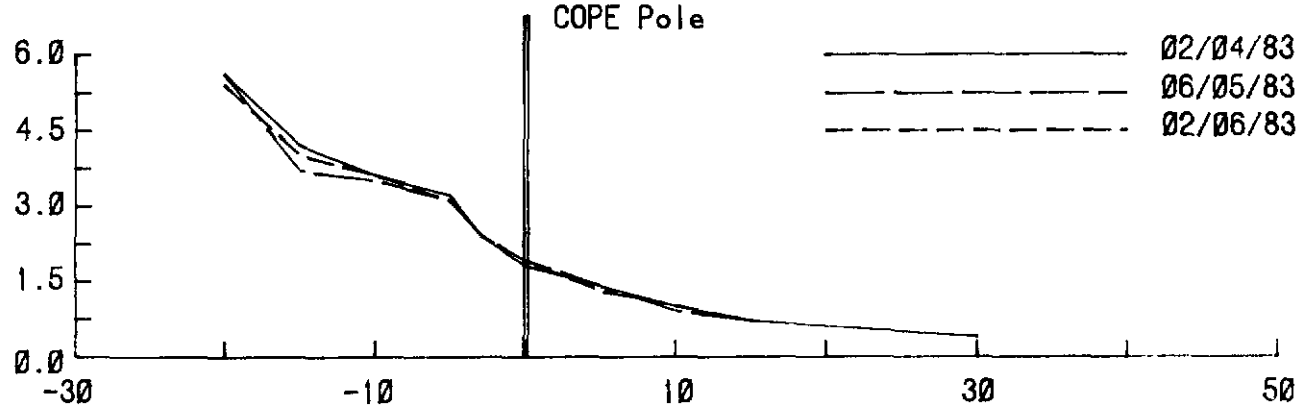
MONTHLY BEACH PROFILES

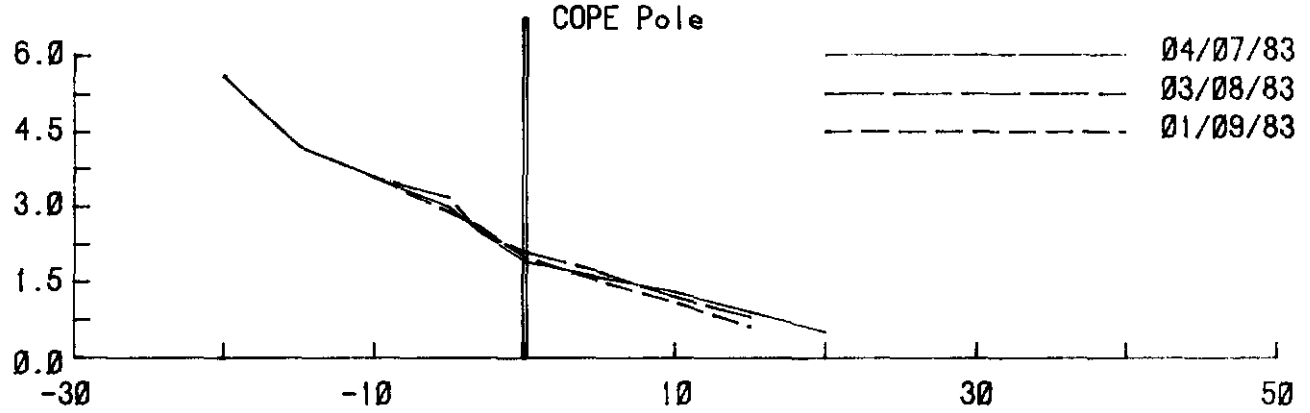
1982

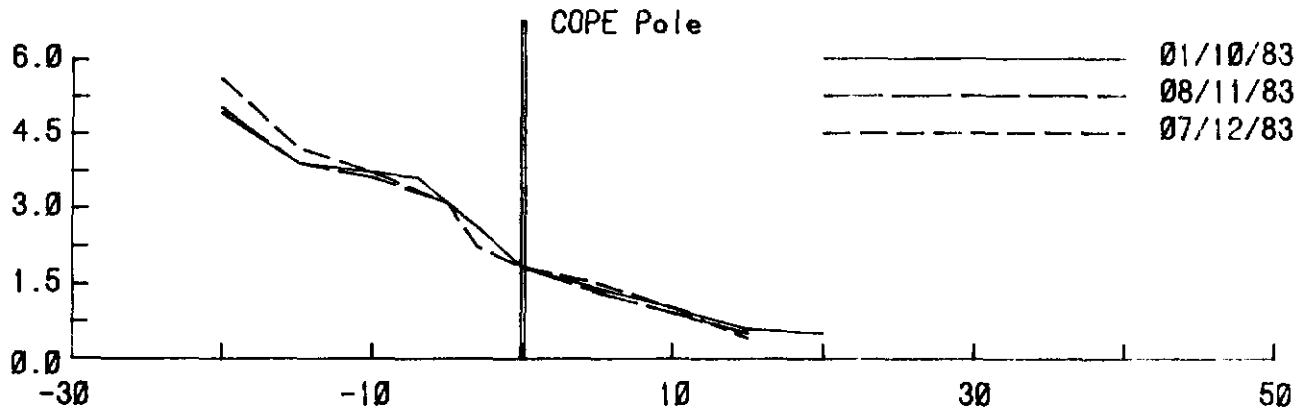
COPE
Bargara

Figure 39
C 16.1









Level Datum is A.H.D.

Distances and Levels are measured in Metres

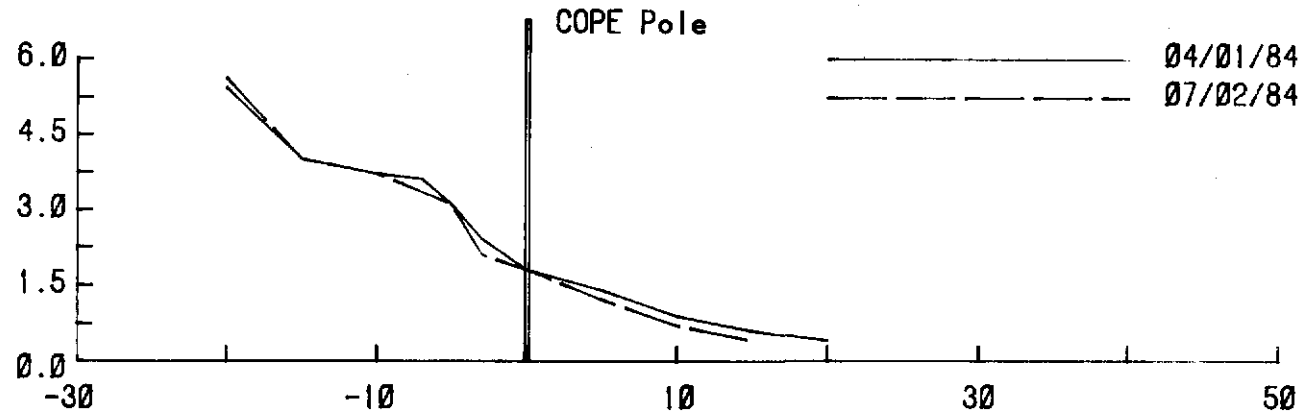
Beach Protection Authority

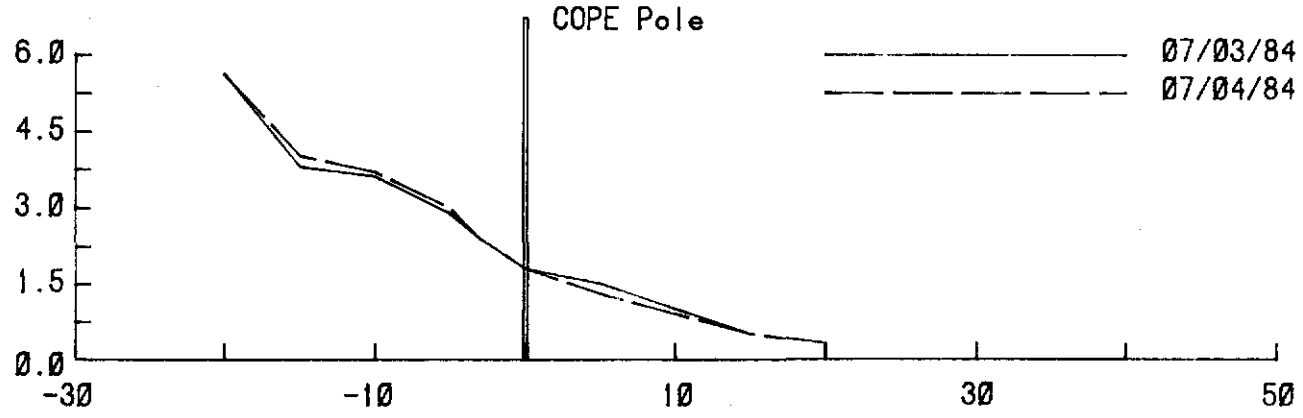
MONTHLY BEACH PROFILES

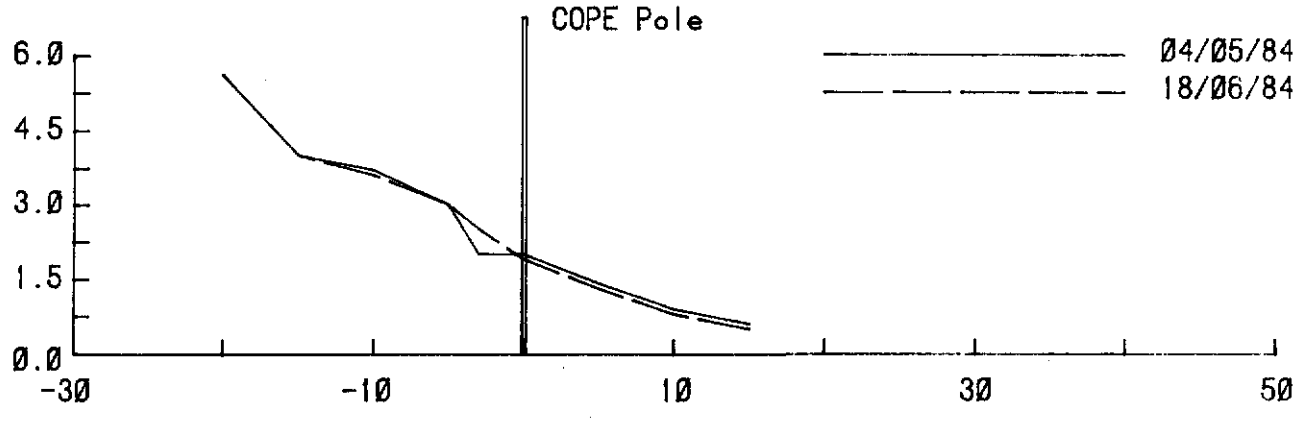
1983

COPE
Bargara

Figure 40
C 16.1







Level Datum is A.H.D.

Distances and Levels are measured in Metres

Beach Protection Authority

MONTHLY BEACH PROFILES

1984

COPE
Bargara

Figure 41
C 16.1