Department of Science, Information Technology, Innovation and the Arts

Beach Surveys and Data Assessment, Gold Coast Region

COPE Data – Burleigh

Coastal Impacts Unit

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1. Introduction

1.1 Preamble

The Coastal Observation Program Engineering (COPE) data collection system was designed to collect data at selected sites along the Queensland coast to assist in the understanding of coastal processes and the way these processes affect the coast line. COPE was managed for the Beach Protection Authority (BPA) (now disbanded) by the Department of Harbours and Marine up until 1989 and then by the Coastal Management Branch in what is now the Department of Environment and Heritage Protection (DEHP). COPE data was progressively analysed and reports at selected sites were compiled up to mid 1996[1] when the program was abandoned. After that date very little further analysis was carried out, however all data was archived for possible future use. Guardianship of this data rests with the Coastal Impacts Unit of the Department of Science, Information Technology, Innovation and the Arts (DSITIA).

For this report, raw data was provided by DSITIA for North Burleigh – COPE Site 102 and Burleigh Heads – COPE Site 106. Part of the Burleigh Heads data set has been previously analysed by the BPA, and as such, only the unanalysed portion has been included in this report. This data had not been pre-processed to identify errors in the recordings and/or errors from the transfer of the data from the recording sheets to the computer data file.

In December 2013, the Coastal Impacts Unit of DSITIA commissioned GHD to compile a report on the COPE data from the North Burleigh and Burleigh Heads site, with North Burleigh being located between Fifth Avenue and Sixth Avenue, just north of the end of Fifth Avenue, and Burleigh Heads located between First Avenue and Second Avenue, just south of the end of Second avenue. The report is modelled on the Mooloolaba 2 site report compiled in 2010 by GHD for the Sunshine Coast Regional Council (SCRC).

DSITIA provided the following data:

1. Recorded raw data in the form of a text file – this was data compiled directly from the recording sheets;
2. Sieve data from the analysis of the sand samples collected by the observers at the site;
3. Beach profile data collected by the observers at the site and subsequent data collected by staff from DSITIA at Deagon; and
4. Photographs and other relevant information about the two Burleigh COPE Stations extracted from BPA files.

GHD, through its Principal Coastal Engineer, Paul O'Keeffe, a former engineer to the BPA, was able to source other background information on the COPE program and make assessments of the data analysis based on first-hand experience with the COPE program.

In addition, the BPA Beach Conservation newsletters were reviewed for any articles on the COPE program relating to the Burleigh site. Articles specific to the Burleigh site are reproduced in Appendix B.

[1] This date concurs with the recollection of Paul O'Keeffe (GHD) and Sel Sultmann (DEHP), Coastal Engineer and Dune Conservationist respectively for the BPA at the time that the COPE program was finalised.

Reference documents and technical papers that have been used to assist in the preparation of this report are listed in Section 4.

1.2 The Program

The BPA required basic data on the behaviour of Queensland's beaches in order to provide evidence based coastal management advice to Local Authorities. The COPE project aimed to collect information on wind, waves and beach behaviour in areas where extensive investigations were not practical and where otherwise little or no data existed.

The project was based on the recruitment of volunteer observers who were prepared to record a series of basic parameters daily for at least a three year period. The COPE project was operational from late in 1971 to about mid-1996[2] .

1.3 Site Selection

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

1. The general shoreline configuration and the possibility of extrapolation of data to other adjacent beaches;
2. The distribution of stations along Queensland's coastline; and
3. The need to correlate the COPE data with planned or existing data collection programs.

1.4 Instruments

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

- 30 m tape measure;
- Wind meter;
- Stop watch;
- 2.0 metre measuring sticks;
- Recording forms; and
- Fluorescent dye.
- 1.5 m support stick (as suggested in Appendix A – Instructions for filling out COPE recording form); and
- Hand level (as suggested in Appendix A – Instructions for filling out COPE recording form).

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

[2] Refer previous footnote

1.5 Observers

The majority of COPE observers were volunteers. Some stations were also operated by Government and Local Authority employees who carried out the observations as part of their official duties.

1.6 Accuracy

Individual observers differed in their subjective assessment of the various parameters recorded as part of the COPE program. Wave parameters such as height, and angle of approach together with surf zone width and the location of vegetation line all required visual assessment. The accuracy of recorded details varied from observer to observer and possibly from recording to recording. Although the BPA was confident that all observers made their observations to the best of their ability and accepted these observations without adjustment, the existence of random and non-random errors in the recorded data was to be expected.

Problems associated with the use of data containing these errors are minimised in a number of ways as follows:

1. Regular visits were made to the COPE stations by the BPA's COPE Field Officer to provide a check on any bias introduced into the recordings by incorrect observation procedures.
2. It was determined that, with a large number of observations taken on a regular basis, a reasonable assessment can be made of the average values of the observed parameters provided the observation errors are random. A minimum recording period of three years was adopted for the analysis and publication of the data, in order to minimise the effects of random errors.
3. Five day moving averages are applied to observations of the various beach width and foreshore slope parameters to filter out random errors.
4. Pre-processing of the raw data was undertaken to remove obvious errors from either recording errors and/or or errors from the transfer of the data from the recording sheets to the computer data file. For this report, these errors and how they were corrected have been documented in the Data Presentation section.

For these reasons, the BPA concluded that published COPE data can be used with confidence provided the above inherent limitations are recognised.

1.7 Presentation of Data

The purpose of this report is to present COPE data for North Burleigh for the three year period from 1972 to 1974 and Burleigh Heads for the seven and a half year period between 1987 and 1994, and the continued profile data supplied by DSITIA from 1994 – 2010 in a useful statistical form.

The three and seven and a half year periods can be considered to be representative of the long term average meteorological condition and the statistics presented on wind, wave and beach movements can be regarded as typical of the ambient conditions. However, this recording period is 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 given to the influence of such events on trends of long term beach behaviour.

2. Station Particulars

2.1 Location

North Burleigh and Burleigh Heads are located on the Gold Coast and are situated approximately 80 km south of Brisbane on the South East Queensland coastline. The beach is approximately 2 km long extending from north of the Burleigh Head National Park to south of Mick Schamburg Park. The location of the North Burleigh COPE station is between Fifth and Sixth Avenues, just north of Fifth Avenue, as shown on Figure 1a and 1c. The location of the Burleigh Heads COPE station is between First and Second Avenues, just south of Second Avenue, as shown on Figure 1b and 1c.

The North Burleigh was the first COPE station site and was used as a pilot to refine requirements and operations of the COPE program[3]. Note that the North Burleigh COPE pole is a timber pole that is still in place (January 2014) – refer Photo 1 in Section 2.4.

2.2 Observers

From information available from the BPA file for this station, the observer for the North Burleigh site was Mr L A Lawson, and the observer for the Burleigh Heads site was Mr Bill Patterson. A photograph of Mr Patterson from Beach Conservation No 47 is reproduced below.

COPE observer at Burleigh Heads, Bill Patterson records the level of the beach at the COPE reference pole. The graduations on the pole are also used to measure the cross-section shape of the beach.

2.3 Reports from Beach Conservation

Beach Conservation was the title of the newsletter of the Beach Protection Authority of Queensland and was published quarterly between September 1970 and June 1990. Various aspects of the COPE program were frequently featured in the newsletter including two main articles on the operation of the program in April 1977 (Issue No 27) and June 1990 (Issue No 69). Relevant articles that are related to the Burleigh Heads COPE station site have been extracted and are reproduced in Appendix B.

[3] Pers. Comm. Dean Patterson, former Executive Engineer Beach Protection, Department of Harbours and Marine to Paul O'Keeffe, Principal Coastal Engineer, GHD – Feb 2014

2.4 Site History

Listed below is information compiled from the BPA files for these sites, including details of the installation and maintenance of the Burleigh Heads COPE pole.

North Burleigh:

- 17 January 1972 – Observations commenced; and
- 31 October 1974 – Observations ceased.

Burleigh Heads:

- 1 January 1981 – Observations commenced;
- 13 March 1981 – COPE pole installed by Gold Coast City Council (GCCC); and
- 10 April 1994 – Observations ceased.

Photo 1: North Burleigh COPE Pole, December 2012

Source: Dean Patterson

Photo 2: Burleigh Heads COPE Pole, February 1994

Source: BPA file

2.5 Observed Parameters

The observers at the North Burleigh site recorded the majority of observations in the morning at 1030am, whereas the observations at Burleigh Heads were usually recorded between 6am and 8am

The old format recording sheet used for North Burleigh is shown in Figure 2a (refer Section 6) and has been used with the following information being recorded:

- Wave period (s);
- Wave height (m);
- Wave angle at breaker (degrees);
- Wave type;
- Surf zone width (m);
- Presence of offshore bar;
- Wind speed (kn);
- Wind direction (cardinal direction);
- State of tide;
- Berm elevation (m);
- Distance to berm (m);
- Berm elevation (m);
- Distance to vegetation (m);
- Foreshore slope (degrees);

- Longshore current speed (m/min);
- Longshore current direction; and
- Sand level at COPE reference pole (m).

The data collected from Burleigh Heads was recorded on the new format recording sheet as shown in Figure 2c, with the following parameters being recorded:

- Wave height (average) (m);
- Wave height (maximum) (m);
- Wave height method;
- Wave period (s);
- Wave direction (degrees);
- Surf zone width (s);
- Longshore current speed (m/min);
- Longshore current direction;
- Distance from shore (m);
- Presence of offshore bar;
- Wind speed (mph);
- Wind direction (degrees);
- Fixed contour elevation (m);
- Distance to fixed contour (m);
- Distance to vegetation line (m);
- Sand level at COPE reference pole (m); and
- Sand sample.

Surf zone width was measured as the time (in seconds) it took for a wave to transgress the surf zone from its break point until its final run-up position.

All directions in this report are magnetic. Sector bearings derived from True North were converted to magnetic bearings using the magnetic variation shown on marine charts.

At North Burleigh, the first sand sample was taken in January 1973, with monthly samples taken from then on. At Burleigh Heads, the first sand sample was taken in May 1981, with monthly samples taken for the next few years, and then samples taken every few months from then on.

A profile of the beach was recorded at Burleigh Heads at least monthly throughout the recording period with additional profiles recorded within the month depending on the state of the beach and the occurrence of storm events. In addition, staff from the DSITIA recorded beach profiles at the COPE site periodically from 1996 to 2010. No profiles were recorded at North Burleigh during this period.

2.6 Tidal Information

Tidal information from the 1993 Official Tide Tables (DoT 1993) for Snapper Rocks (Coolangatta) is presented in Table 1. The levels have been adjusted to a Lowest Astronomical Tide (LAT) datum of zero.

It should be noted that in 2010, the tidal plane levels were updated for the current Tidal Datum Epoch 1992 - 2011, using the latest available tidal observations, prediction information and allowance for sea level rise. The current tidal plane levels are provided in the 2013 Official Tide Tables (MSQ 2013) and the levels for Snapper Rocks (Coolangatta) are presented in Table 1. The datum is LAT.

Table 1: Tidal Planes

Tidal Plane	1993 (m LAT)	2013 (m LAT)
Highest Astronomical Tide (HAT)	2.09	2.11
Mean High Water Springs (MHWS)	1.63	1.64
Mean High Water Neaps (MHWN)	1.34	1.32
Australian Height Datum (AHD)	0.98	0.98
Mean Sea Level (MSL)	0.97	0.97
Mean Low Water Neaps (MLWN)	0.61	0.49
Mean Low Water Springs (MLWS)	0.31	0.20

The tidal plane levels have changed slightly, however, the value of the AHD relative to the tidal planes has remained constant.

2.7 Beach Description

The North Burleigh station exhibited the following characteristics:

- Typical beach slopes: Foreshore slope was measured for the entirety of the recording period and was in the range of 1 to 10 degrees with an average slope of 4 degrees (by inspection of Figure 44 to Figure 46);
- Beach width: Monthly profile were not taken, thus beach width cannot be inferred;
- D_{50} grain size: 0.24 mm averaged over 22 samples collected over the two years (1973 – 1974); and
- Adjoining landform: Vegetated sand dunes seaward of parkland.

No images of the beach were found that corresponded with the time of the COPE program.

The Burleigh Heads station exhibits the following characteristics:

- Typical beach slopes: Foreshore slope can be inferred from the beach width measurements and the monthly profiles. The beach slope oscillated between 2 to 6 degrees, with an average of 3 degrees;
- Beach width: Varied from 20 to 120 m measured from the seaward toe of the frontal dune to the Low Water Mark over the 19 year period (1987 - 2010) (by inspection of the monthly beach profile Figure 49 to Figure 61); and
- D_{50} grain size: 0.29 mm averaged over 64 samples collected over the two years (1973 – 1974).
- Adjoining landform: Vegetated sand dunes seaward of parkland.

Images of Burleigh Heads beach are provided in Photos 3a and 3b.

Photo 3a: Burleigh Heads, February 1994 – Looking north

Photo 3b: Burleigh Heads, February 1994 – Looking south

2.8 Meteorological Events

The following cyclones were recorded by the Brisbane Bureau of Meteorology as having tracks within 400 km of Burleigh between January 1972 and December 1974, and January 1982 and December 2006. It is considered that these meteorological events may have had some effect on the condition of the Burleigh beaches.

- Cyclone KIRSTY: 24 February – 1 March 1973;

- Cyclone WANDA: 20 – 25 January 1974;
- Cyclone PAM: 3 – 6 February 1974;
- Cyclone ZOE: 6 – 13 March 1974;
- Cyclone ALICE: 21 – 22 March 1974;
- Cyclone ABIGAIL: 22 January – 1 February 1982;
- Cyclone GRACE: 11 – 20 January 1984;
- Cyclone LANCE: 3 – 7 April 1984;
- Cyclone PIERRE: 17 – 24 February 1985;
- Cyclone NANCY: 28 January – 8 February 1990;
- Cyclone DAMAN: 15 – 18 February 1992;
- Cyclone FRAN: 5 – 16 March 1992;
- Cyclone REWA: 28 December 1993 – 21 January 1994;
- Cyclone VIOLET: 3 – 6 March 1995;
- Cyclone GERTIE: 17 – 22 December 1995; and
- Cyclone KERRY: 8 – 18 January 2005.

In addition, Cyclone ROGER, 12 – 21 March 1993, seemed to have an impact on the beach conditions which can be observed in Figure 63. This cyclone was outside the 400 km zone. Other cyclones that also occurred outside the 400 km radius to Burleigh were Cyclone BETSY 10 – 13 January 1992, Cyclone YALI 17 – 27 March 1998 and Cyclone HAMISH 5 – 12 March 2009. See Figure 64 and Figure 65 for the cyclone tracks for a 400 km radius centred just east of Burleigh (so as to include the aforementioned cyclones) over the recording period of 1972 – 1974 and 1982 – 2006. More recent records were unavailable for plotting in this format at the time of compiling this report.

2.9 Station Supervision

The observers were instructed in the recording program by the BPA COPE Field Officer and the initial instruction period was followed by regular visits to the station during the period of recordings presented in this report.

Installation of the reference pole for this station was carried out by the GCCC. Maintenance of the pole was carried out by the BPA COPE Field Officer.

3. Data

3.1 General

COPE data for the combined three and seven and a half year periods from January 1972 to October 1974, and August 1987 to April 1994 for North Burleigh and Burleigh Heads respectively, is presented in the tables in Section 5 Tabular Results and the figures in Section 6 Data Presentation. 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 m above beach level. At North Burleigh, the wind direction was recorded as a cardinal direction, and the speed was recorded in knots (kn). From 17 March 1986, at Burleigh heads, wind direction was recorded in degrees by compass, and the speed was recorded in miles per hour (mph). Wind speed data in this report is presented in metres per second (m/s).

A summary of annual wind speed direction percentage occurrences is shown as a wind rose in Figure 3 and Figure 4.

3.3 Waves

The average and maximum breaker height (trough to crest) was usually estimated to the nearest 0.1 metre. Previous studies (Patterson and Blair, 1983) have shown that the estimate of average breaker height is comparable with the equivalent deep water significant wave height. The wave height was measured using one of the methods described on page two of the new format recording sheet (Figure 2d), the method chosen being dependent on the wave height.

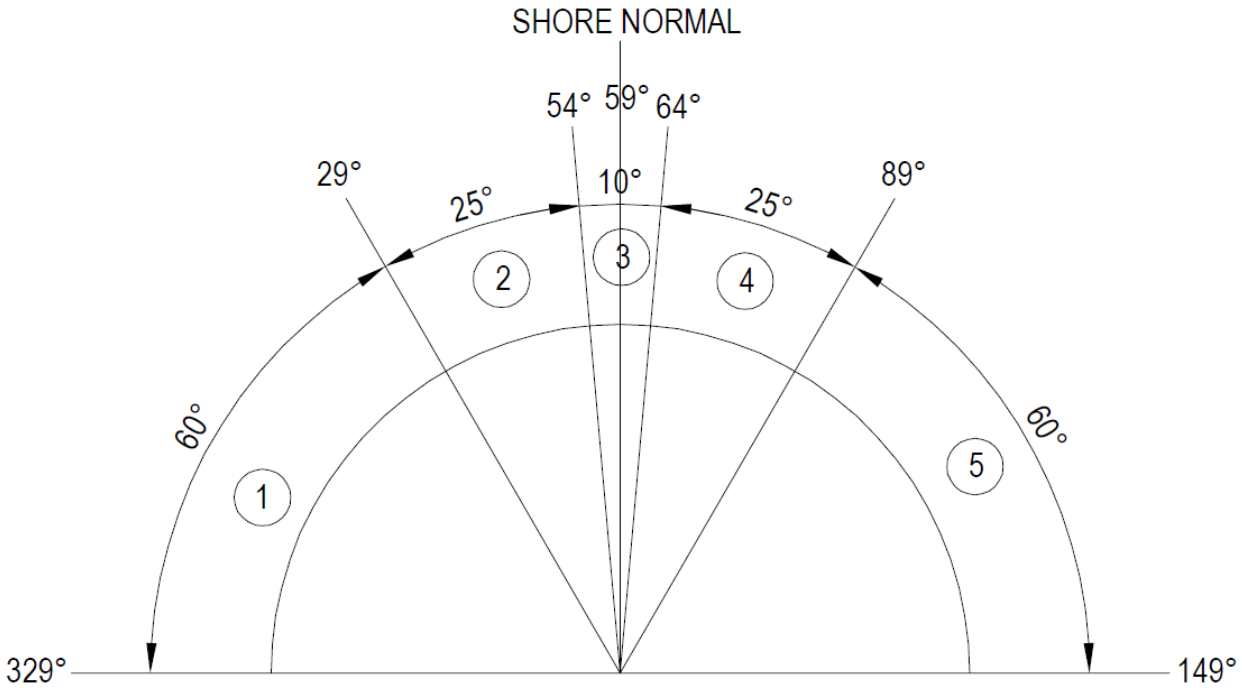
The observers estimated the wave period by recording the time taken for eleven wave crests (the duration of 10 waves) to pass a point.

Wave direction at North Burleigh was recorded using the protractor in Figure 2b placed parallel to the shore. However, the Burleigh Heads wave direction was recorded as a compass bearing (refer Figure 2d) which was then converted to a sector, as shown in the following paragraph.

Wave direction is estimated as one of five direction sectors in relation to the shore normal direction from which the waves were approaching the beach. The compass bearings for the sectors are displayed in Table 2 and in the diagram below:

Table 2: Sector Directions

Sector	Direction
1	329° to 28°
2	29° to 53°
3	54° to 64°
4	65° to 89°
5	90° to 149°



Note: At both Burleigh COPE stations, the shore normal direction is approximately 59 degrees east of magnetic north.

Statistical representations of the observed wave data include:

- The percentage of wave height recordings which exceed any given wave height for all directions combined (Figure 5 and Figure 6);
- The percentage occurrence of various combinations of wave heights, periods and directions (Figure 7 to Figure 10);
- Surf zone width with an indication of existence or otherwise of an offshore bar (Figure 11 to Figure 21); and
- Tabulation of the occurrence of various wave heights, periods, types and directions (Table 1 to Table 6).

3.4 Longshore Currents

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

The readings were then converted to a velocity which was plotted on a daily basis (Figure 22 to Figure 32). A summary table for the mean upcoast and downcoast components and overall annual averages are provided on each of these yearly figures.

3.5 Beach Profile Parameters

Fixed contour elevation was measured by using the supplied level and the 1.5 m support pole. The observer would stand the pole in the top of the berm, and by using the level, would site and record the elevation from the graduated COPE pole. The distance to the fixed contour was recorded using a tape measure. The fixed contour has been interpreted as being on top of a berm.

Sand level at the reference pole and the distance to the vegetation line were also recorded.

Changes in these parameters with time indicate how the beach moves in response to varying wave conditions. Plots of these parameters are shown in Figure 33 to Figure 43.

Foreshore slope was also recorded from 1972 – 1974 by placing the support pole on the sand, and by using the level, a slope was recorded. Refer to Figure 44 to Figure 46 for the results.

Figure 47 and Figure 48 show summaries of monthly averages of the distance to berm and the distance to vegetation line for the full recording period.

3.6 Monthly Beach Profiles

Measurements of beach profiles at Burleigh Heads were usually taken monthly. However, if the beach experienced appreciable erosion or accretion during the month, the observer was requested to take an additional beach profile. Monthly beach profiles are shown in Figure 49 to Figure 57. Further profiles are also available in Figure 58 to Figure 61. These profiles were not recorded as part of the COPE data collection program, but were recorded by staff from DSITIA. It should be noted that the profile taken on 1 August 1987 has been repeated in each graph so comparisons between profiles can be easily made.

It should be noted that profiles were not taken at the North Burleigh COPE station.

3.7 Sand Sample Particle Size Distribution

At North Burleigh, a total of 22 sand samples were collected over the two years (1973 to 1974) and 64 sand samples were collected at Burleigh Heads over 15 years (1981 – 1995) when the station was operational and subsequently. The data indicates that each sample underwent a standard sieve analysis to determine the particle size distribution and the average D_{50} size of 0.24 mm for the first site and a D_{50} size of 0.29 mm for the second site was derived from the data.

4. References

1. BC No 27 – Jones, C.M., *COPE (Coastal Observation Programme Engineering)*, Beach Conservation newsletter No 21, October 1975.
2. BC No 69 – Andrews, M.J. and Blair, R.J., *Coastal Observation Programme – Engineering (COPE)*, Beach Conservation newsletter No. 69, June 1990.
3. DoT 1993 - 1993 *Official Tide Tables*, Queensland Department of Transport, 1993
4. Mooloolaba 2 COPE Report 2010 – GHD Pty Ltd, *COPE Data Mooloolaba 2*, for Sunshine Coast Regional Council, August 2010.
5. MSQ 2013 – 2013 *Official Tide Tables*, Maritime Safety Queensland, 2013.
6. Patterson & Blair 1983 - Patterson, D.C. and Blair, R.J., *Visually Determined Wave Parameters*, 6th Australian Conference on Coastal and Ocean Engineering, Gold Coast, July 1983.
7. Robinson & Jones 1977 – 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.

5. Tabular Results

Table 3: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. North Burleigh. Year 1972

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave Type %						Wave Direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	11	7.636	2.036	11	0.0	90.9	9.1	0.0	0.0	11	0.0	0.0	27.3	72.7	0.0	0.0
Feb	23	7.111	2.019	23	4.3	73.9	0.0	0.0	0.0	23	0.0	0.0	39.1	39.1	0.0	0.0
Mar				No data recorded												
Apr				No data recorded												
May				No data recorded												
Jun				No data recorded												
Jul	16	7.563	1.356	16	0.0	100.0	0.0	0.0	0.0	16	0.0	31.3	43.8	25.0	0.0	0.0
Aug	23	8.043	1.409	23	43.5	56.5	0.0	0.0	0.0	23	0.0	13.0	65.2	21.7	0.0	0.0
Sep	26	7.0	1.8	26	0.0	53.8	0.0	0.0	0.0	26	0.0	0.0	30.8	57.7	0.0	0.0
Oct	13	7.2	1.5	13	23.1	76.9	0.0	0.0	0.0	13	0.0	0.0	53.8	46.2	0.0	0.0
Nov	21	8.6	1.7	21	4.8	85.7	9.5	0.0	0.0	21	0.0	0.0	33.3	66.7	0.0	0.0
Dec	17	6.7	1.4	17	0.0	94.1	0.0	0.0	0.0	17	0.0	35.3	58.8	0.0	0.0	0.0
Whole Year	150	7.5	1.6	150	10.0	76.0	2.0	0.0	0.0	150	0.0	9.3	44.0	40.7	0.0	0.0

Table 4: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. North Burleigh. Year 1973

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave Type %						Wave Direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	28	6.773	1.573	28	10.7	75.0	10.7	0.0	0.0	28	0.0	0.0	10.7	67.9	0.0	0.0
Feb	28	7.396	1.925	28	7.1	57.1	0.0	0.0	0.0	28	0.0	0.0	0.0	85.7	0.0	0.0
Mar	31	7.516	1.145	31	0.0	6.5	3.2	0.0	0.0	31	0.0	0.0	16.1	64.5	19.4	0.0
Apr	30	6.95	1.133	30	0.0	50.0	0.0	0.0	0.0	30	0.0	0.0	26.7	73.3	0.0	0.0
May	31	7.068	1.097	31	22.6	77.4	0.0	0.0	0.0	31	0.0	0.0	29.0	71.0	0.0	0.0
Jun	30	7.43	0.92	30	0.0	50.0	0.0	0.0	0.0	30	0.0	0.0	16.7	83.3	0.0	0.0
Jul	16	7.913	1.875	16	25.0	75.0	0.0	0.0	0.0	16	0.0	31.3	56.3	12.5	0.0	0.0
Aug	16	8.381	0.975	16	0.0	100.0	0.0	0.0	0.0	16	0.0	6.3	0.0	93.8	0.0	0.0
Sep	6	6.6	0.9	6	0.0	100.0	0.0	0.0	0.0	6	0.0	16.7	33.3	50.0	0.0	0.0
Oct				No data recorded												
Nov				No data recorded												
Dec				No data recorded												
Whole Year	216	7.3	1.3	216	7.4	58.8	1.9	0.0	0.0	216	-1.4	3.2	19.0	70.4	2.8	0.0

Table 5: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. North Burleigh. Year 1974

Month	No. of observations	Mean Wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)												
				Wave Type %						Wave Direction (sector)%						
				No of obs.	SP	PLNG	PS	S	Calm	No. of obs.	1	2	3	4	5	Calm
Jan	31	9.748	2.097	31	0.0	90.3	9.7	0.0	0.0	31	0.0	0.0	0.0	93.5	6.5	0.0
Feb	22	8.191	1.645	22	0.0	90.9	9.1	0.0	0.0	22	0.0	0.0	0.0	59.1	40.9	0.0
Mar	31	8.387	2.019	31	6.5	45.2	29.0	19.4	0.0	31	0.0	0.0	9.7	90.3	0.0	0.0
Apr	27	9.622	1.448	27	3.7	18.5	18.5	59.3	0.0	27	0.0	0.0	48.1	33.3	0.0	0.0
May	4	7.5	1.3	4	0.0	0.0	50.0	50.0	0.0	4	0.0	0.0	25.0	75.0	0.0	0.0
Jun	30	12.46	1.603	30	0.0	6.7	30.0	63.3	0.0	30	0.0	0.0	56.7	43.3	0.0	0.0
Jul	31	13.5	0.729	31	3.2	6.5	0.0	87.1	3.2	31	0.0	19.4	80.6	0.0	0.0	0.0
Aug	28	11.07	1.137	27	0.0	3.7	0.0	96.3	0.0	27	0.0	29.6	40.7	29.6	0.0	0.0
Sep				Recording Ceased												
Oct																
Nov																
Dec																
Whole Year	204	10.1	1.5	203	2.0	35.5	14.8	47.3	0.5	203	-1.0	6.9	34.5	50.7	5.4	0.0

Table 6: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1987

Month	No. observations	Mean w ave period (s)	Mean w ave height (m)	Percentage occurrences - w ave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan										
Feb										
Mar										
Apr										
May										
Jun										
Jul	30	7.6	1.1	30	0.0	16.7	46.7	36.7	0.0	0.0
Aug	31	7.9	1.1	31	0.0	22.6	51.6	25.8	0.0	0.0
Sep	30	7.2	0.8	30	10.0	50.0	26.7	13.3	0.0	0.0
Oct	31	7.1	0.9	31	3.2	45.2	48.4	3.2	0.0	0.0
Nov	14	6.5	0.8	14	7.1	50.0	28.6	14.3	0.0	0.0
Dec	5	6.8	0.8	5	40.0	20.0	0.0	40.0	0.0	0.0
Whole Year	141	7.2	0.9	141	5.0	34.8	40.4	19.9	0.0	0.0

Table 7: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1988

Month	No. observations	Mean w ave period (s)	Mean w ave height (m)	Percentage occurrences - w ave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	8.4	1.4	31	0.0	32.3	51.6	16.1	0.0	0.0
Feb	29	7.2	1.0	29	0.0	44.8	34.5	20.7	0.0	0.0
Mar	30	8.0	1.2	30	0.0	30.0	43.3	26.7	0.0	0.0
Apr	30	8.3	1.5	30	0.0	26.7	46.7	26.7	0.0	0.0
May	31	7.8	0.9	31	0.0	29.0	71.0	0.0	0.0	0.0
Jun	26	7.9	1.2	26	0.0	30.8	69.2	0.0	0.0	0.0
Jul	31	7.3	1.0	31	0.0	32.3	61.3	6.5	0.0	0.0
Aug	31	7.2	0.9	31	0.0	48.4	35.5	16.1	0.0	0.0
Sep	30	7.8	0.9	30	0.0	56.7	36.7	6.7	0.0	0.0
Oct	20	6.6	0.7	20	5.0	95.0	0.0	0.0	0.0	0.0
Nov	28	7.5	1.0	28	3.6	57.1	21.4	17.9	0.0	0.0
Dec	31	7.4	1.4	31	0.0	54.8	38.7	6.5	0.0	0.0
Whole Year	348	7.6	1.1	348	0.6	43.4	43.7	12.4	0.0	0.0

Table 8: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1989

Month	No. observations	Mean w ave period (s)	Mean w ave height (m)	Percentage occurrences - w ave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	7.8	1.1	31	0.0	22.6	71.0	6.5	0.0	0.0
Feb	28	8.0	1.3	28	0.0	42.9	53.6	3.6	0.0	0.0
Mar	31	7.9	1.2	31	0.0	74.2	22.6	3.2	0.0	0.0
Apr	30	8.6	1.5	30	0.0	13.3	80.0	6.7	0.0	0.0
May	31	7.5	1.1	31	0.0	38.7	61.3	0.0	0.0	0.0
Jun	26	7.8	1.0	26	0.0	7.7	80.8	11.5	0.0	0.0
Jul	30	7.6	1.0	30	0.0	30.0	63.3	6.7	0.0	0.0
Aug	30	8.0	1.0	30	0.0	13.3	73.3	13.3	0.0	0.0
Sep	30	7.5	0.8	30	0.0	53.3	46.7	0.0	0.0	0.0
Oct	15	7.2	0.8	15	0.0	66.7	33.3	0.0	0.0	0.0
Nov	30	7.9	0.9	30	0.0	23.3	73.3	3.3	0.0	0.0
Dec	31	7.9	1.0	31	0.0	67.7	29.0	3.2	0.0	0.0
Whole Year	343	7.8	1.1	343	0.0	37.0	58.0	5.0	0.0	0.0

Table 9: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1990

Month	No. observations	Mean w ave period (s)	Mean w ave height (m)	Percentage occurrences - w ave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	7.9	0.9	31	0.0	64.5	32.3	3.2	0.0	0.0
Feb	28	7.7	1.3	28	0.0	42.9	50.0	7.1	0.0	0.0
Mar	30	7.8	1.2	30	0.0	66.7	33.3	0.0	0.0	0.0
Apr	29	8.0	0.9	29	0.0	100.0	0.0	0.0	0.0	0.0
May	31	7.8	0.8	31	0.0	90.3	9.7	0.0	0.0	0.0
Jun	24	7.4	0.8	24	0.0	50.0	33.3	16.7	0.0	0.0
Jul	31	7.2	0.6	31	0.0	71.0	29.0	0.0	0.0	0.0
Aug	31	7.5	0.7	31	0.0	58.1	41.9	0.0	0.0	0.0
Sep	28	7.2	0.7	28	0.0	71.4	21.4	7.1	0.0	0.0
Oct	20	7.4	0.8	20	0.0	85.0	15.0	0.0	0.0	0.0
Nov	23	8.2	0.9	23	0.0	73.9	26.1	0.0	0.0	0.0
Dec	30	8.0	0.8	30	0.0	100.0	0.0	0.0	0.0	0.0
Whole Year	336	7.7	0.9	336	0.0	72.9	24.4	2.7	0.0	0.0

Table 10: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1991

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	7.9	0.8	31	0.0	100.0	0.0	0.0	0.0	0.0
Feb	28	7.8	0.8	28	0.0	82.1	17.9	0.0	0.0	0.0
Mar	31	8.4	1.0	31	0.0	87.1	12.9	0.0	0.0	0.0
Apr	30	8.4	0.9	30	0.0	86.7	13.3	0.0	0.0	0.0
May	31	8.2	1.0	31	0.0	77.4	22.6	0.0	0.0	0.0
Jun	26	7.9	0.7	26	0.0	84.6	15.4	0.0	0.0	0.0
Jul	31	8.1	0.6	31	3.2	77.4	19.4	0.0	0.0	0.0
Aug	31	7.4	0.6	31	12.9	74.2	12.9	0.0	0.0	0.0
Sep	30	8.5	0.7	30	10.0	86.7	3.3	0.0	0.0	0.0
Oct	31	8.5	0.7	31	3.2	90.3	6.5	0.0	0.0	0.0
Nov	29	8.4	0.7	29	0.0	86.2	13.8	0.0	0.0	0.0
Dec	31	8.3	0.8	31	0.0	93.5	6.5	0.0	0.0	0.0
Whole Year	360	8.2	0.8	360	2.5	85.6	11.9	0.0	0.0	0.0

Table 11: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1992

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	8.5	0.9	31	0.0	71.0	29.0	0.0	0.0	0.0
Feb	29	7.8	0.8	29	0.0	69.0	27.6	3.4	0.0	0.0
Mar	31	8.2	1.1	31	0.0	64.5	35.5	0.0	0.0	0.0
Apr	16	9.0	1.2	16	0.0	31.3	68.8	0.0	0.0	0.0
May	31	8.2	0.7	31	0.0	38.7	45.2	16.1	0.0	0.0
Jun	19	8.9	1.0	19	0.0	57.9	42.1	0.0	0.0	0.0
Jul	31	7.7	0.6	31	0.0	87.1	12.9	0.0	0.0	0.0
Aug	30	8.2	0.6	30	3.3	83.3	13.3	0.0	0.0	0.0
Sep	30	8.0	0.6	30	6.7	70.0	23.3	0.0	0.0	0.0
Oct	31	8.7	0.9	31	0.0	77.4	22.6	0.0	0.0	0.0
Nov	30	8.3	0.7	30	0.0	86.7	13.3	0.0	0.0	0.0
Dec	29	8.0	0.9	29	0.0	62.1	37.9	0.0	0.0	0.0
Whole Year	338	8.3	0.8	338	0.9	68.3	29.0	1.8	0.0	0.0

Table 12: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1993

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	31	7.9	0.8	31	0.0	83.9	16.1	0.0	0.0	0.0
Feb	28	8.5	0.9	28	0.0	89.3	10.7	0.0	0.0	0.0
Mar	30	8.5	1.1	30	0.0	50.0	36.7	13.3	0.0	0.0
Apr	18	7.7	0.8	18	11.1	88.9	0.0	0.0	0.0	0.0
May				No Data Recorded						
Jun	28	8.5	0.8	28	0.0	35.7	46.4	17.9	0.0	0.0
Jul	31	8.2	1.0	31	0.0	38.7	51.6	9.7	0.0	0.0
Aug	31	8.6	0.8	31	0.0	41.9	58.1	0.0	0.0	0.0
Sep	28	8.6	0.8	28	0.0	57.1	42.9	0.0	0.0	0.0
Oct	30	7.9	0.9	30	0.0	70.0	30.0	0.0	0.0	0.0
Nov	29	7.6	0.8	29	0.0	72.4	27.6	0.0	0.0	0.0
Dec	30	7.8	0.8	30	0.0	60.0	33.3	6.7	0.0	0.0
Whole Year	314	8.1	0.9	314	0.6	61.5	33.4	4.5	0.0	0.0

Table 13: Monthly and annual – mean wave height/mean wave period and wave direction occurrences. Burleigh Heads. Year 1994

Month	No. observations	Mean wave period (s)	Mean wave height (m)	Percentage occurrences - wave direction (sector)						
				No of Obs.	1	2	3	4	5	Calm
Jan	30	8.3	1.1	30	0.0	80.0	20.0	0.0	0.0	0.0
Feb	28	8.3	1.0	28	0.0	64.3	35.7	0.0	0.0	0.0
Mar	31	8.6	1.1	31	0.0	22.6	67.7	9.7	0.0	0.0
Apr	10	7.4	0.9	10	0.0	70.0	30.0	0.0	0.0	0.0
May				Recording Ceased						
Jun										
Jul										
Aug										
Sep										
Oct										
Nov										
Dec										
Whole Year	99	8.2	1.0	99	0.0	56.6	40.4	3.0	0.0	0.0

6. Data Presentation

The data analysis for the North Burleigh and Burleigh Heads COPE stations are presented in the following figures.

LEGEND

COPE Station

Highway

Road

Rail

Watercourse

Suburb

1:10,000 @ A4

0 125 250

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
North Burleigh Heads COPE Data Compilation

Job Number 41-27255
Revision A
Date 12 Mar 2014

Site Plan

Figure 1a

G:\41\27255\GIS\Maps\MXD\41_27255_014_NorthBurleigh_SitePlan_rev_a.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM - Road/2010; GA - Watercourse/2007; DTMR - State Road/2012; ABS - Loclality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS

LEGEND

COPE Station

Highway

Road

Rail

Watercourse

Suburb

1:10,000 @ A4

0 125 250

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Burleigh Heads COPE Data Compilation

Job Number 41-27255
Revision A
Date 12 Mar 2014

Site Plan

Figure 1b

G:\41\27255\GIS\Maps\MXD\41_27255_012_BurleighHeads_SitePlan_rev_a.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM - Road/2010; GA - Watercourse/2007; DTMR - State Road/2012; ABS - Locality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS

LEGEND

COPE Station

Road

Rail

Watercourse

Locality

1:100,000 @ A4

0 1 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
North Burleigh Heads COPE Data Compilation

Job Number 41-27255
Revision A
Date 12 Mar 2014

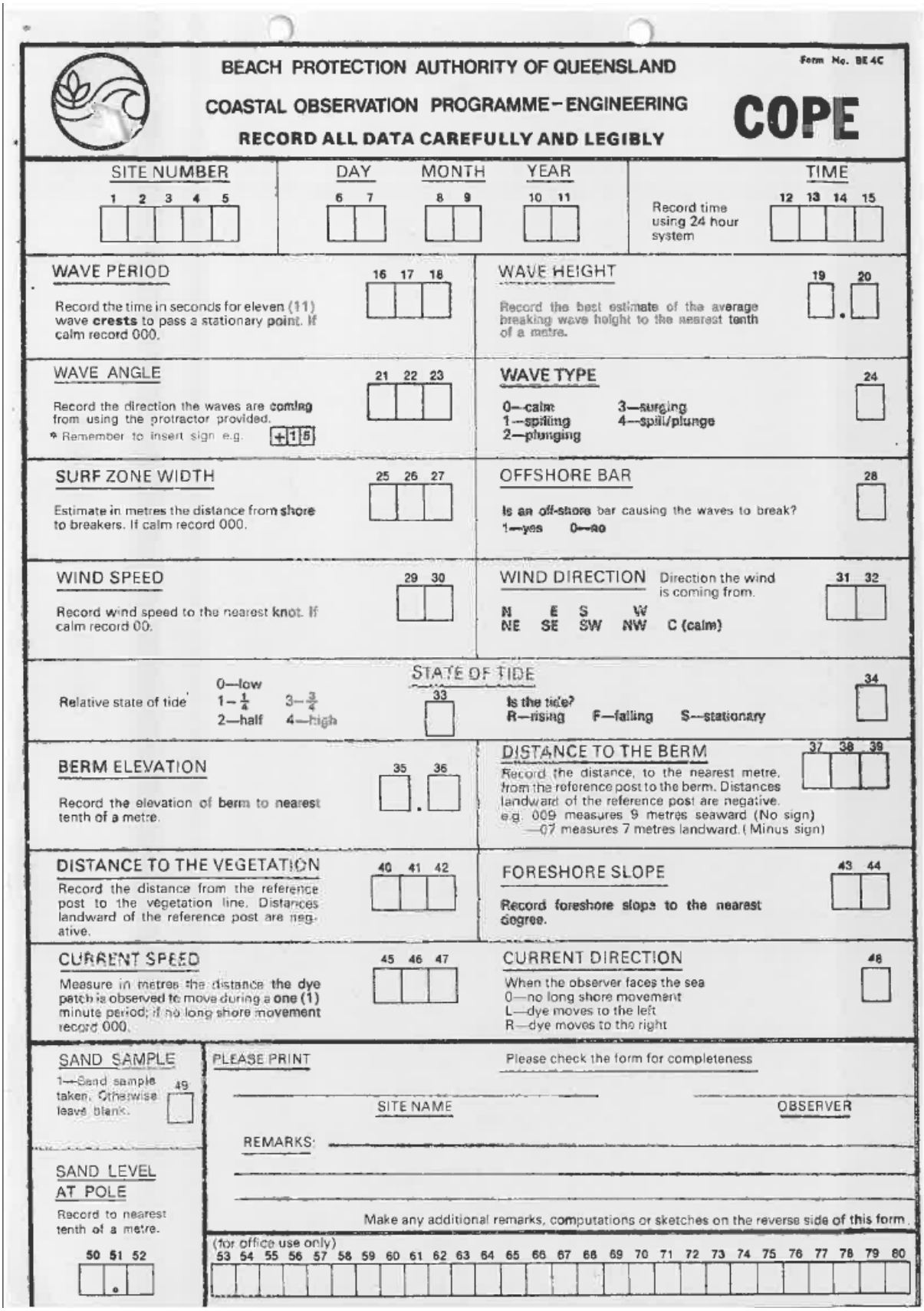
Locality Plan

Figure 1c

G:\41\27255\GIS\Maps\MXD\41_27255_015_BurleighNorthBurleigh_LocalityPlan_rev_a.mxd

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM - Road/2010; GA - Watercourse/2007; DTMR - State Road/2012; ABS - Loclality/2011; Google Earth Pro - Imagery (Extracted 12/12/13). Created by: LS



BEACH PROTECTION AUTHORITY OF QUEENSLAND

Form No. BE 4C

COASTAL OBSERVATION PROGRAMME – ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

SITE NUMBER (1 2 3 4 5) | DAY (6 7) | MONTH (8 9) | YEAR (10 11) | TIME (12 13 14 15) — Record time using 24 hour system

WAVE PERIOD (16 17 18) — Record the time in seconds for eleven (11) wave **crests** to pass a stationary point. If calm record 000.

WAVE HEIGHT (19 . 20) — Record the best estimate of the average breaking wave height to the nearest tenth of a metre.

WAVE ANGLE (21 22 23) — Record the direction the waves are coming from using the protractor provided.
* Remember to insert sign e.g. +15

WAVE TYPE (24)
0—calm
1—spilling
2—plunging
3—surging
4—spill/plunge

SURF ZONE WIDTH (25 26 27) — Estimate in metres the distance from shore to breakers. If calm record 000.

OFFSHORE BAR (28) — Is an off-shore bar causing the waves to break?
1—yes 0—no

WIND SPEED (29 30) — Record wind speed to the nearest knot. If calm record 00.

WIND DIRECTION (31 32) — Direction the wind is coming from.
N NE E SE S SW W NW C (calm)

STATE OF TIDE

Relative state of tide (33)
0—low
1—¼
2—half
3—¾
4—high

Is the tide? (34)
R—rising F—falling S—stationary

BERM ELEVATION (35 . 36) — Record the elevation of berm to nearest tenth of a metre.

DISTANCE TO THE BERM (37 38 39) — 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)

DISTANCE TO THE VEGETATION (40 41 42) — Record the distance from the reference post to the vegetation line. Distances landward of the reference post are negative.

FORESHORE SLOPE (43 44) — Record foreshore slope to the nearest degree.

CURRENT SPEED (45 46 47) — Measure in metres the distance the dye patch is observed to move during a one (1) minute period; if no long shore movement record 000.

CURRENT DIRECTION (48)
When the observer faces the sea
0—no long shore movement
L—dye moves to the left
R—dye moves to the right

SAND SAMPLE (49)
1—Sand sample taken. Otherwise leave blank.

PLEASE PRINT

Please check the form for completeness

SITE NAME

OBSERVER

REMARKS:

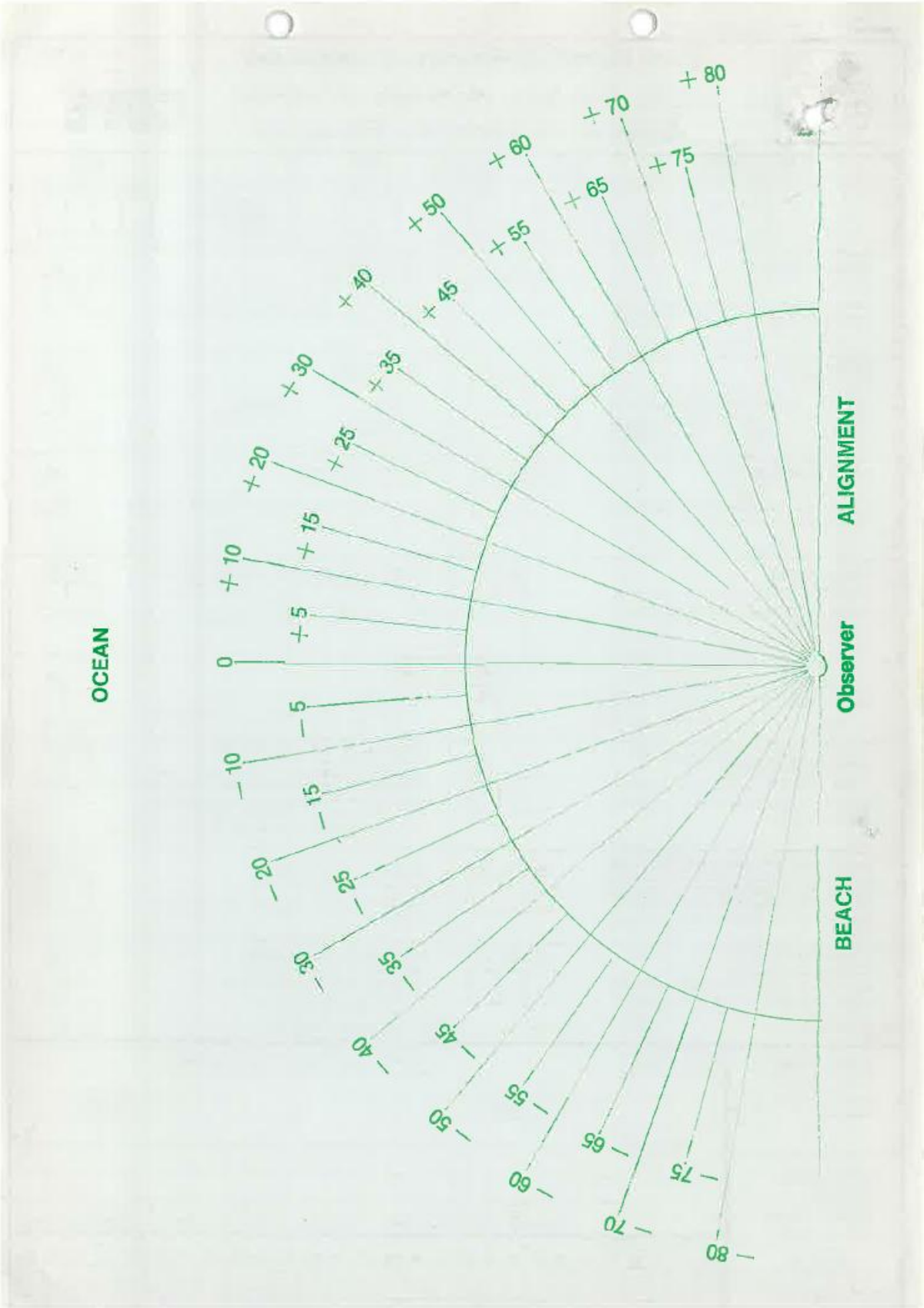
Make any additional remarks, computations or sketches on the reverse side of this form.

SAND LEVEL AT POLE (50 51 52)
Record to nearest tenth of a metre.

(for office use only) (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)

Figure 2a

COPE Recording Sheet – Old Format, Page 1

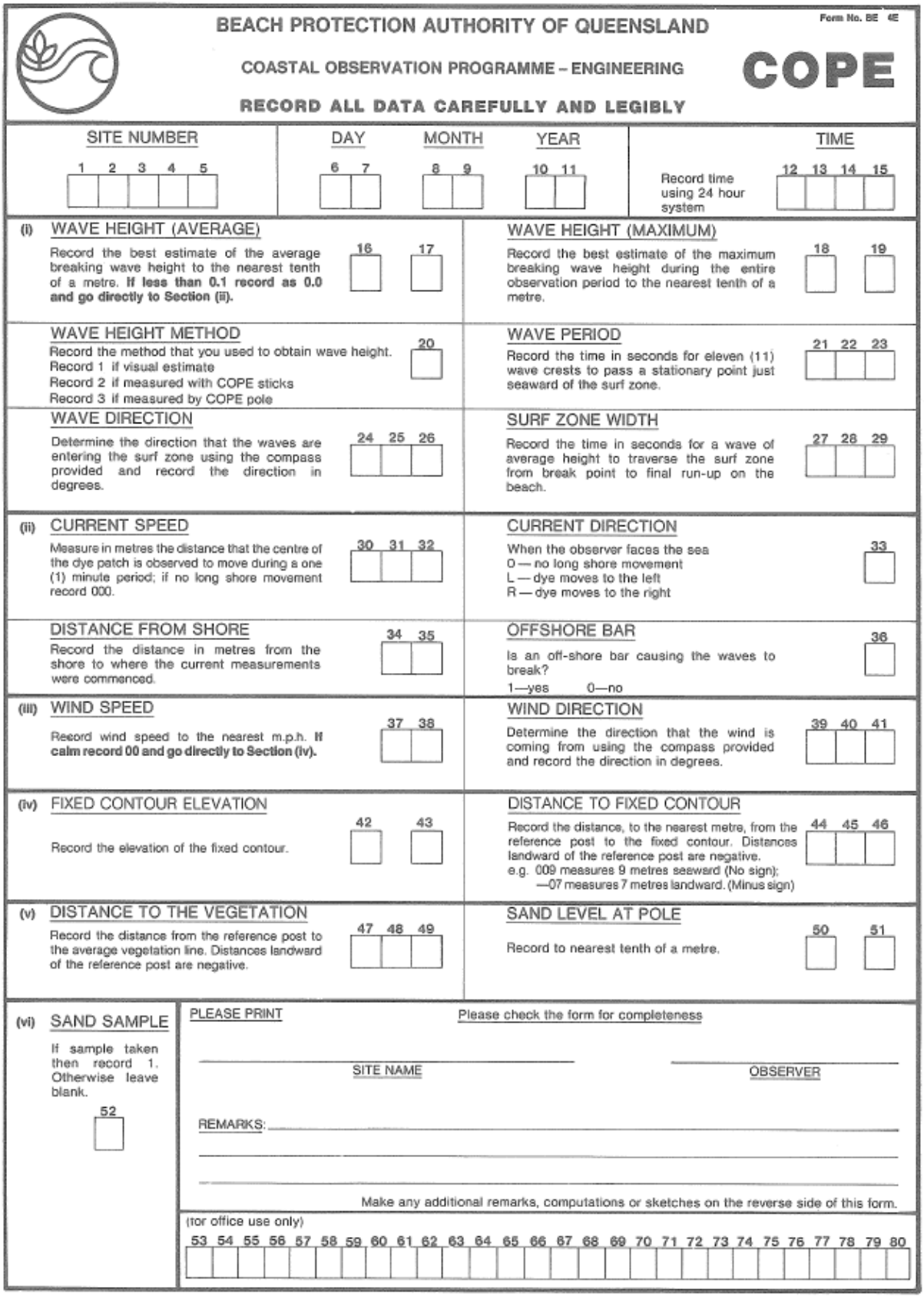


Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Burleigh COPE Data Compilation

Job Number	41-27255
Revision	A
Date	10 Jan 2014

Figure 2b

COPE Recording Sheet – Old Format, Page 2



BEACH PROTECTION AUTHORITY OF QUEENSLAND

Form No. BE 4E

COASTAL OBSERVATION PROGRAMME – ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

SITE NUMBER (1 2 3 4 5) | DAY (6 7) | MONTH (8 9) | YEAR (10 11) | TIME (Record time using 24 hour system) (12 13 14 15)

(i) WAVE HEIGHT (AVERAGE)
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).** (16 17)

WAVE HEIGHT (MAXIMUM)
Record the best estimate of the maximum breaking wave height during the entire observation period to the nearest tenth of a metre. (18 19)

WAVE HEIGHT METHOD
Record the method that you used to obtain wave height. (20)
Record 1 if visual estimate
Record 2 if measured with COPE sticks
Record 3 if measured by COPE pole

WAVE PERIOD
Record the time in seconds for eleven (11) wave crests to pass a stationary point just seaward of the surf zone. (21 22 23)

WAVE DIRECTION
Determine the direction that the waves are entering the surf zone using the compass provided and record the direction in degrees. (24 25 26)

SURF ZONE WIDTH
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. (27 28 29)

(ii) CURRENT SPEED
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. (30 31 32)

CURRENT DIRECTION
When the observer faces the sea (33)
O — no long shore movement
L — dye moves to the left
R — dye moves to the right

DISTANCE FROM SHORE
Record the distance in metres from the shore to where the current measurements were commenced. (34 35)

OFFSHORE BAR
Is an off-shore bar causing the waves to break? (36)
1—yes 0—no

(iii) WIND SPEED
Record wind speed to the nearest m.p.h. **If calm record 00 and go directly to Section (iv).** (37 38)

WIND DIRECTION
Determine the direction that the wind is coming from using the compass provided and record the direction in degrees. (39 40 41)

(iv) FIXED CONTOUR ELEVATION
Record the elevation of the fixed contour. (42 43)

DISTANCE TO FIXED CONTOUR
Record the distance, to the nearest metre, from the reference post to the fixed contour. Distances landward of the reference post are negative. (44 45 46)
e.g. 009 measures 9 metres seaward (No sign);
—07 measures 7 metres landward. (Minus sign)

(v) DISTANCE TO THE VEGETATION
Record the distance from the reference post to the average vegetation line. Distances landward of the reference post are negative. (47 48 49)

SAND LEVEL AT POLE
Record to nearest tenth of a metre. (50 51)

(vi) SAND SAMPLE
If sample taken then record 1. Otherwise leave blank. (52)

PLEASE PRINT — Please check the form for completeness

SITE NAME _____ OBSERVER _____

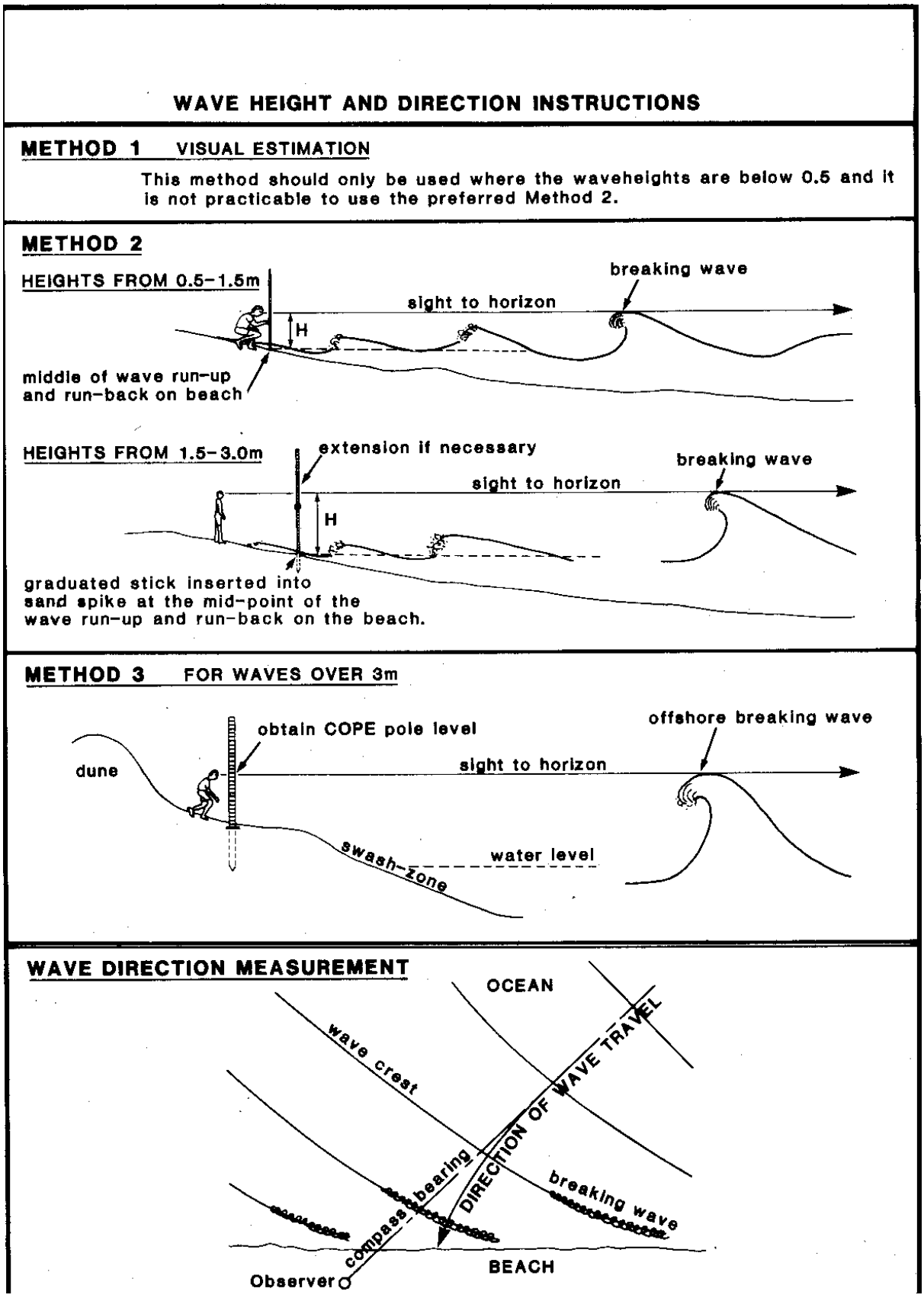
REMARKS: _____

Make any additional remarks, computations or sketches on the reverse side of this form.

(for office use only) (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)

Figure 2c

COPE Recording Sheet – New Format, Page 1



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Burleigh COPE Data Compilation

Job Number	41-27255
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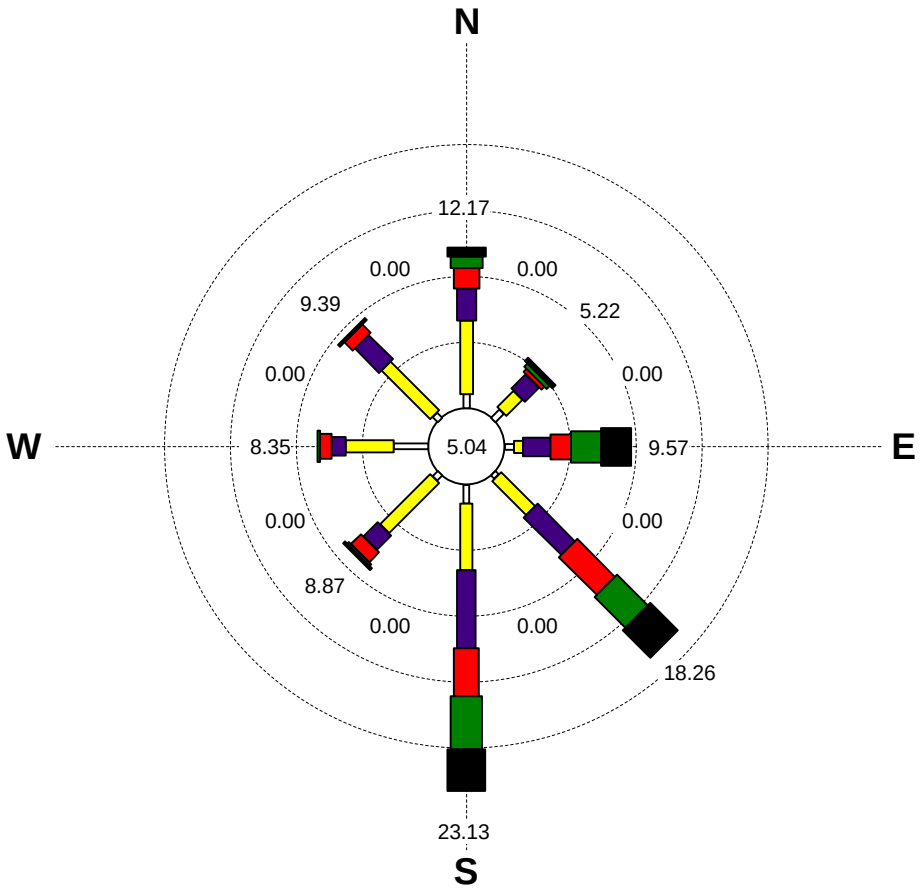
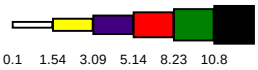
Figure 2d

COPE Recording Sheet – New Format, Page 2

Wind Data - All Observations
Figure 3
North Burleigh: January 1972 - October 1974





Wind Speed (Meters Per Second)

Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

DIR	0.1	1.54	3.09	5.14	8.23	10.8
N	1.04	5.57	2.43	1.57	0.87	0.70
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.87	1.74	1.57	0.35	0.35	0.35
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.70	0.70	2.09	1.57	2.26	2.26
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	0.35	3.65	4.00	4.00	3.30	2.96
SSE	0.00	0.00	0.00	0.00	0.00	0.00

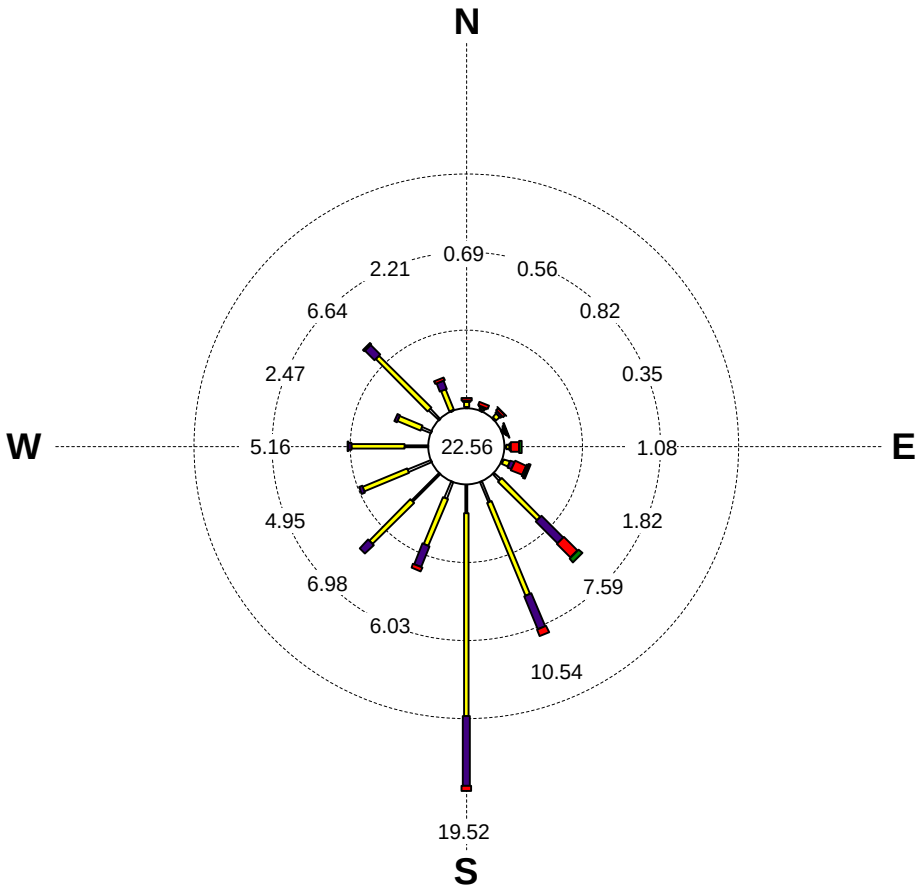
TOTAL OBS = 575 MISSING OBS = 0

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

DIR	0.1	1.54	3.09	5.14	8.23	10.8
S	1.39	5.04	5.91	3.65	4.00	3.13
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.52	5.39	1.57	1.04	0.17	0.17
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	2.61	3.65	1.04	0.87	0.17	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.52	5.22	2.61	0.87	0.00	0.17
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 29 PERCENT CALM = 5.04

Wind Data - All Observations
Figure 4
Burleigh Heads: July 1987 - April 1994



Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

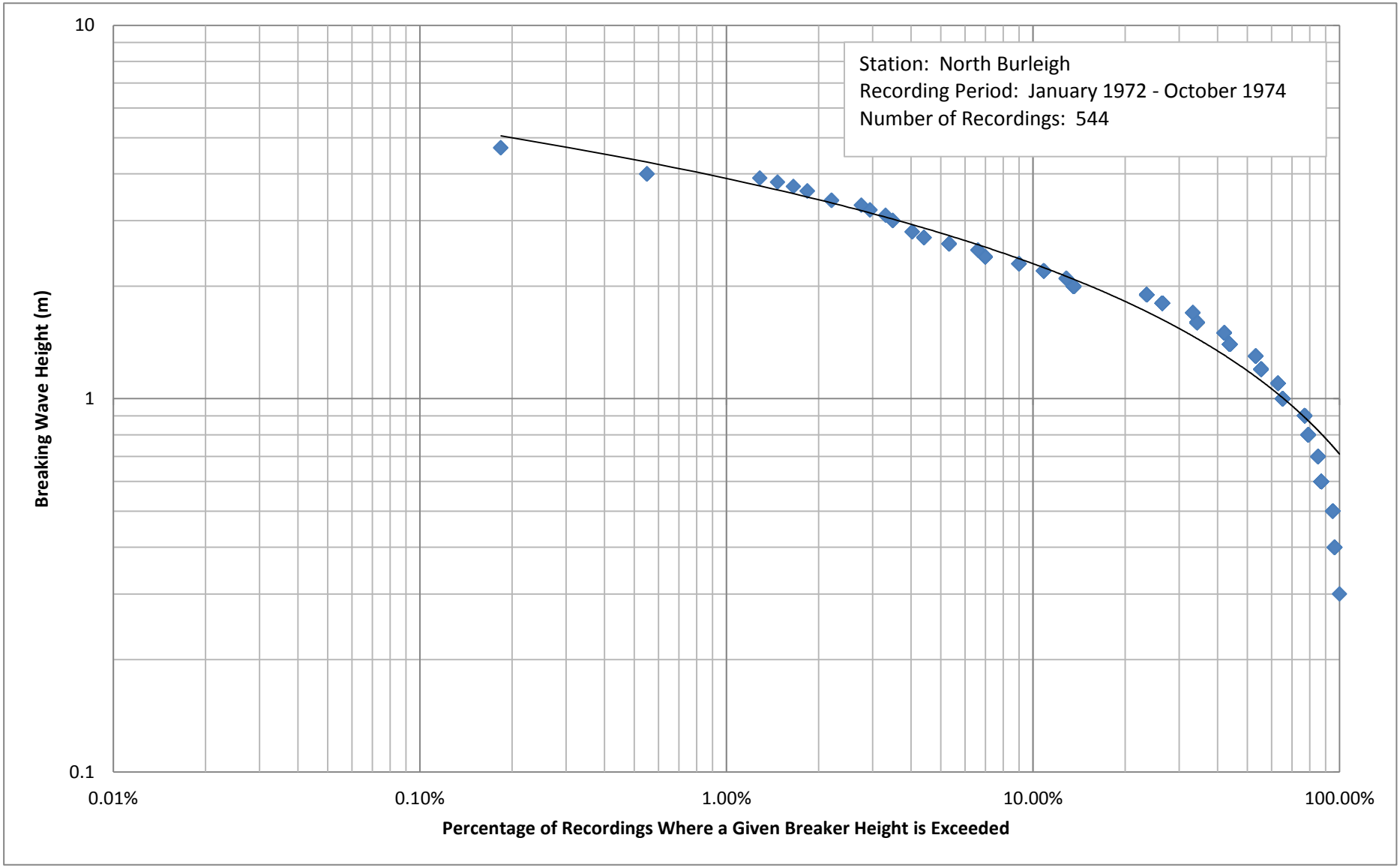
DIR	0.1	1.54	3.09	5.14	8.23	10.8
N	0.09	0.35	0.09	0.17	0.00	0.00
NNE	0.13	0.13	0.09	0.22	0.00	0.00
NE	0.09	0.35	0.17	0.17	0.04	0.00
ENE	0.09	0.09	0.04	0.09	0.00	0.04
E	0.09	0.22	0.09	0.52	0.17	0.00
ESE	0.09	0.39	0.30	0.78	0.13	0.13
SE	0.56	3.51	1.95	1.21	0.35	0.00
SSE	1.39	6.42	2.30	0.43	0.00	0.00

TOTAL OBS = 2305 MISSING OBS = 0

PERCENT OCCURRENCE: Wind Speed (Meters Per Second)
LOWER BOUND OF CATEGORY

DIR	0.1	1.54	3.09	5.14	8.23	10.8
S	1.78	12.93	4.47	0.35	0.00	0.00
SSW	1.13	3.21	1.43	0.26	0.00	0.00
SW	2.47	3.73	0.78	0.00	0.00	0.00
WSW	1.65	3.08	0.22	0.00	0.00	0.00
W	1.52	3.38	0.22	0.04	0.00	0.00
WNW	0.69	1.61	0.17	0.00	0.00	0.00
NW	0.95	4.69	0.87	0.13	0.00	0.00
NNW	0.09	1.39	0.56	0.17	0.00	0.00

CALM OBS = 520 PERCENT CALM = 22.56



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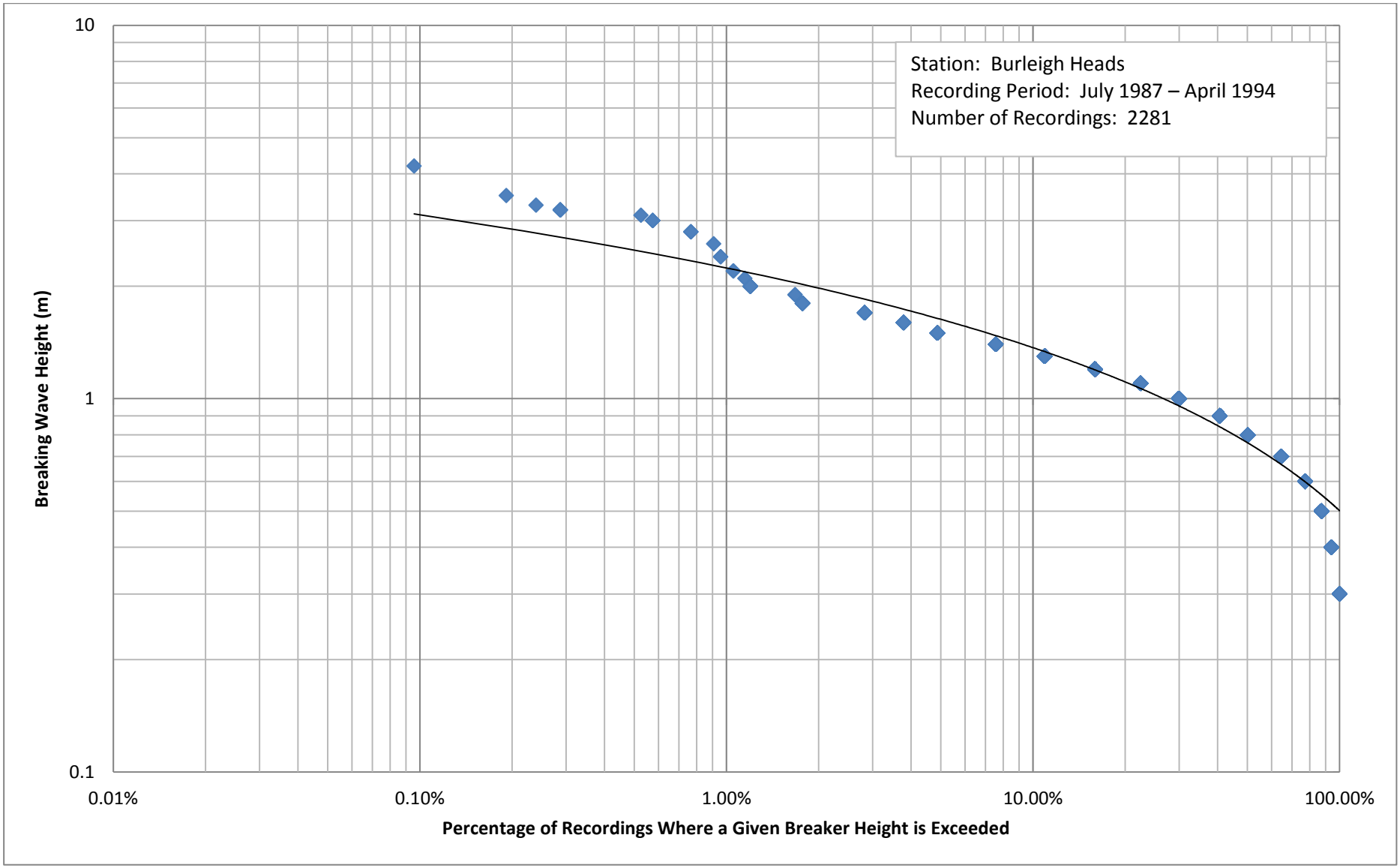
Wave Height Percentage Exceedance

Figure 5



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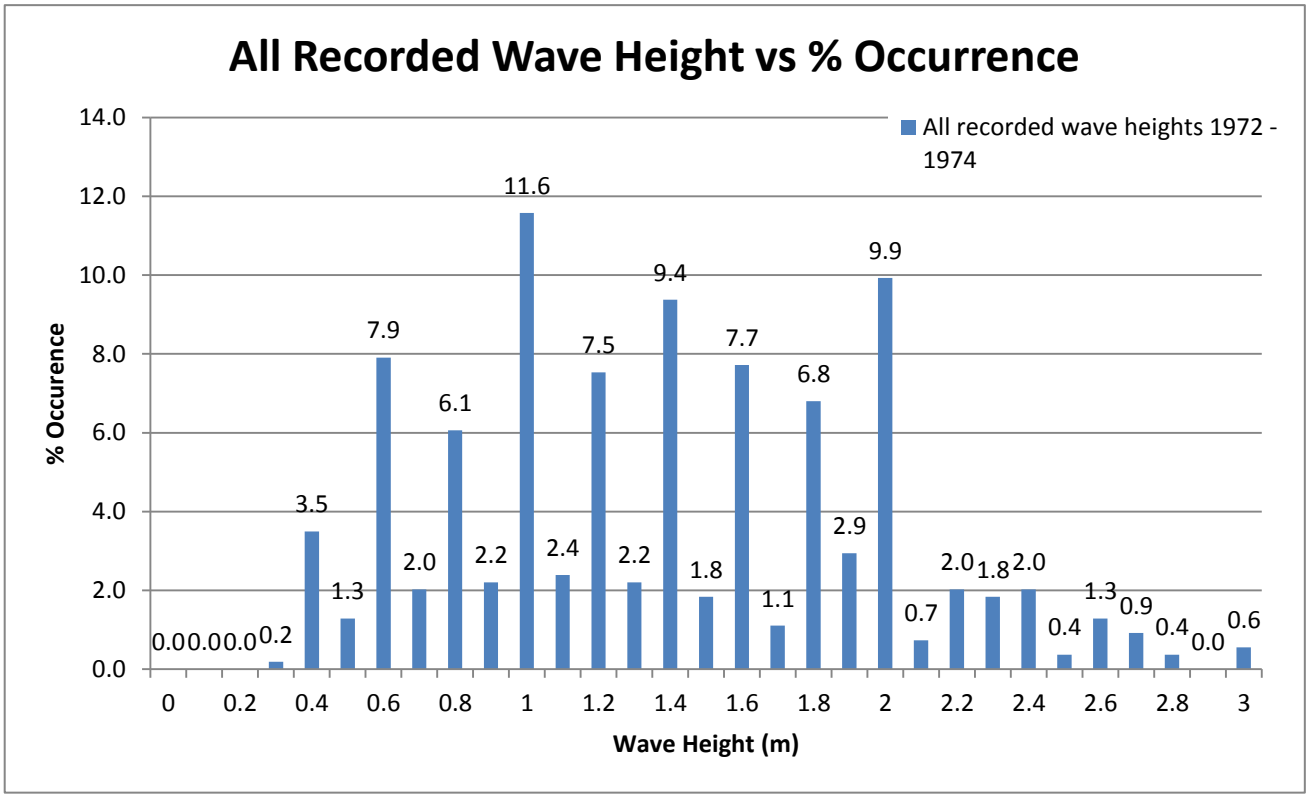
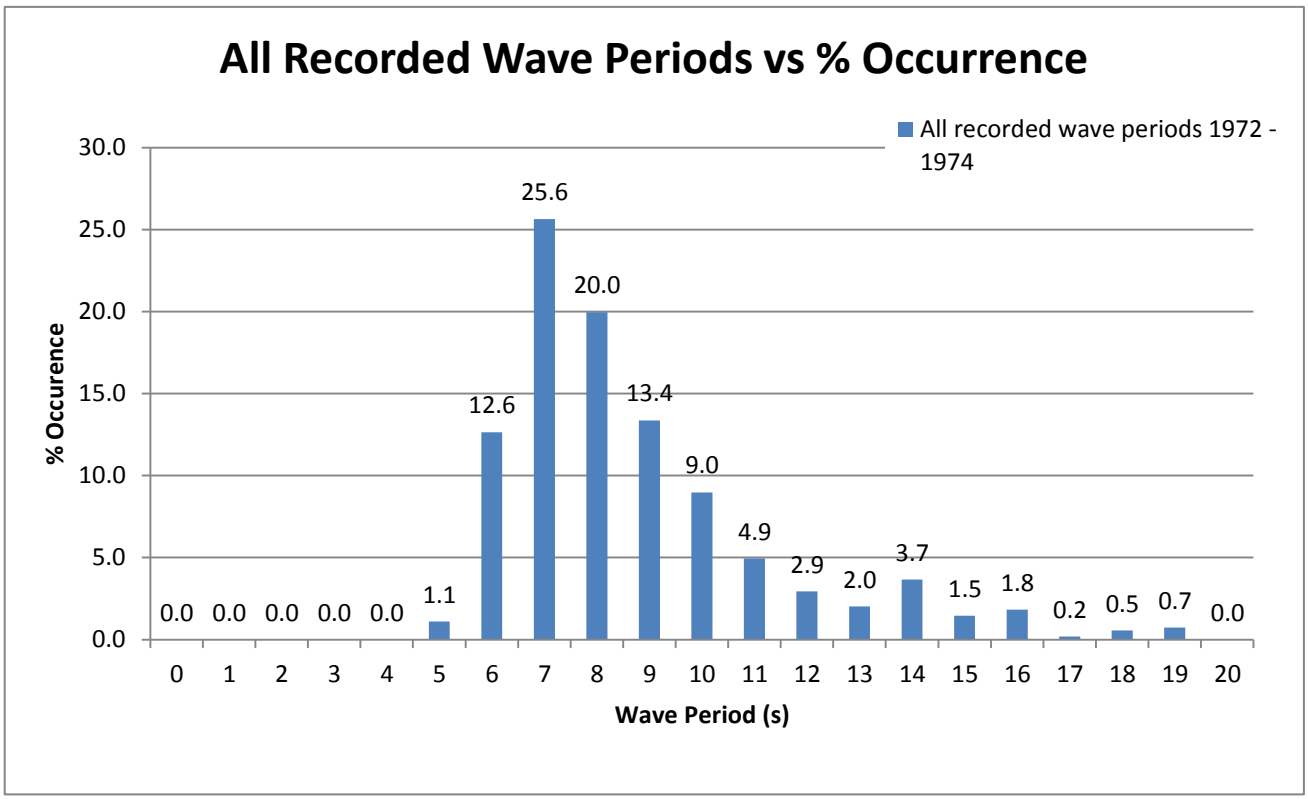
Wave Height Percentage Exceedance

Figure 6





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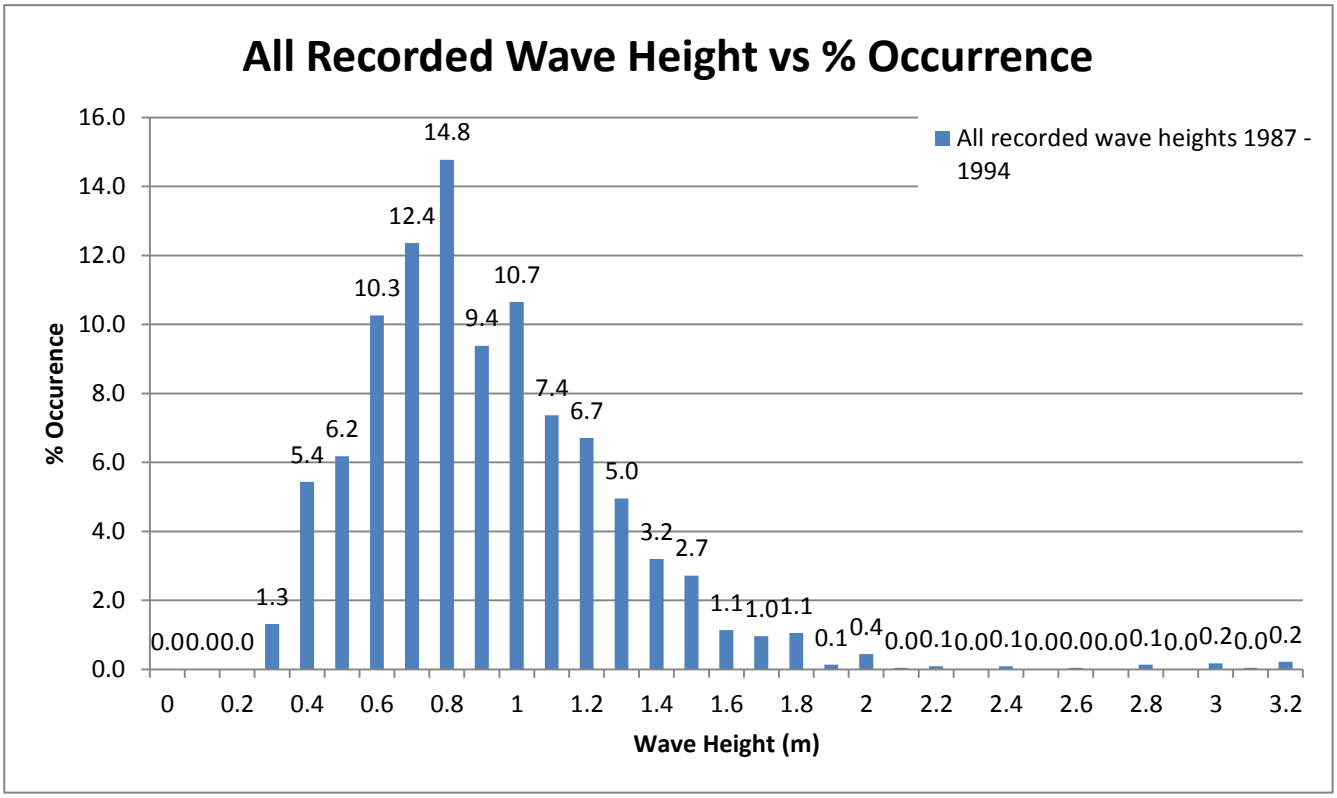
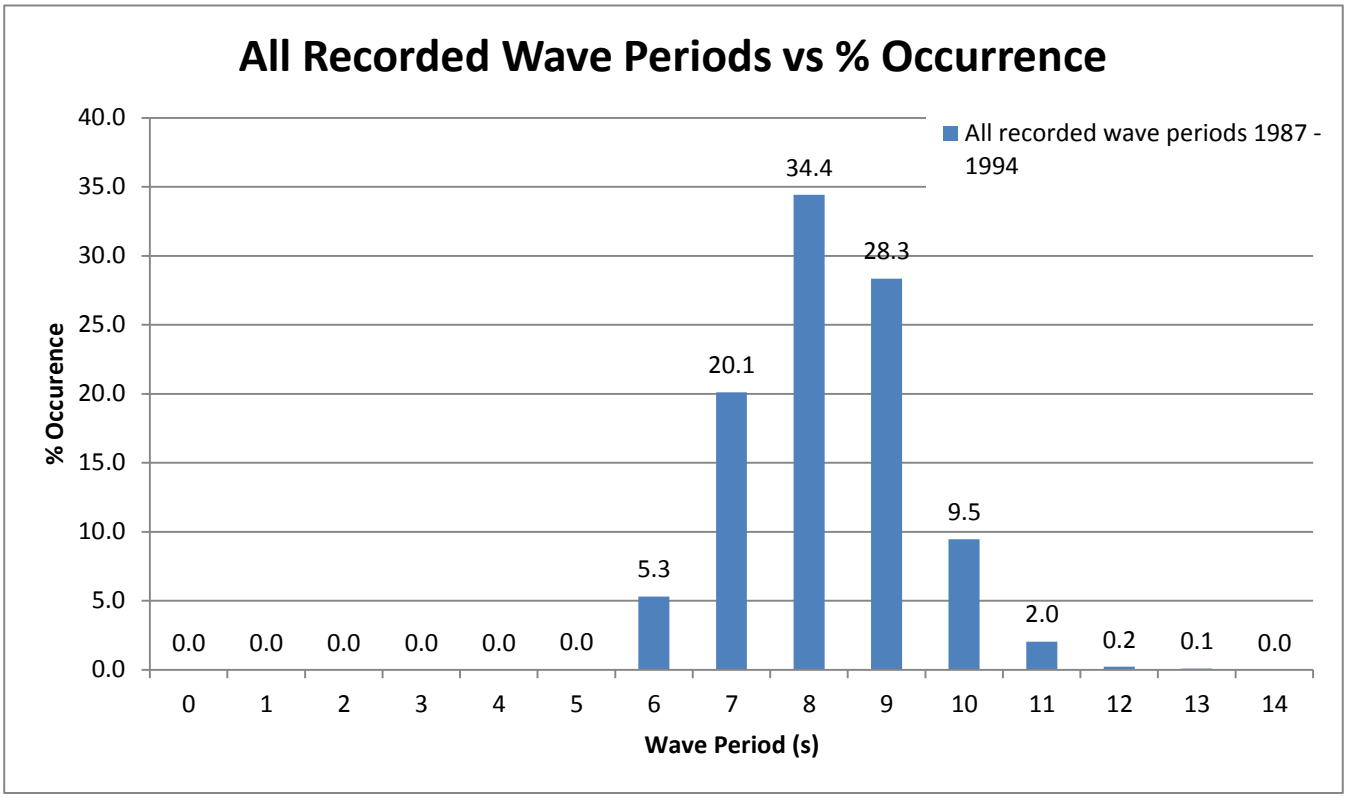
North Burleigh

Figure 7

Percentage Occurrence of Wave Height and Wave Period





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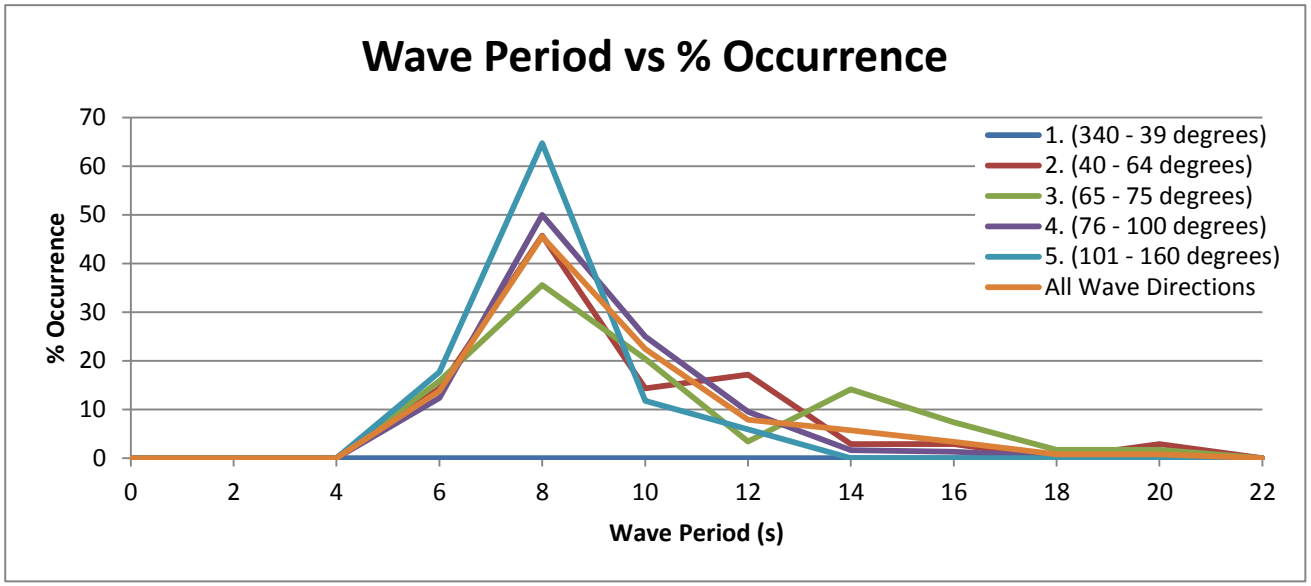
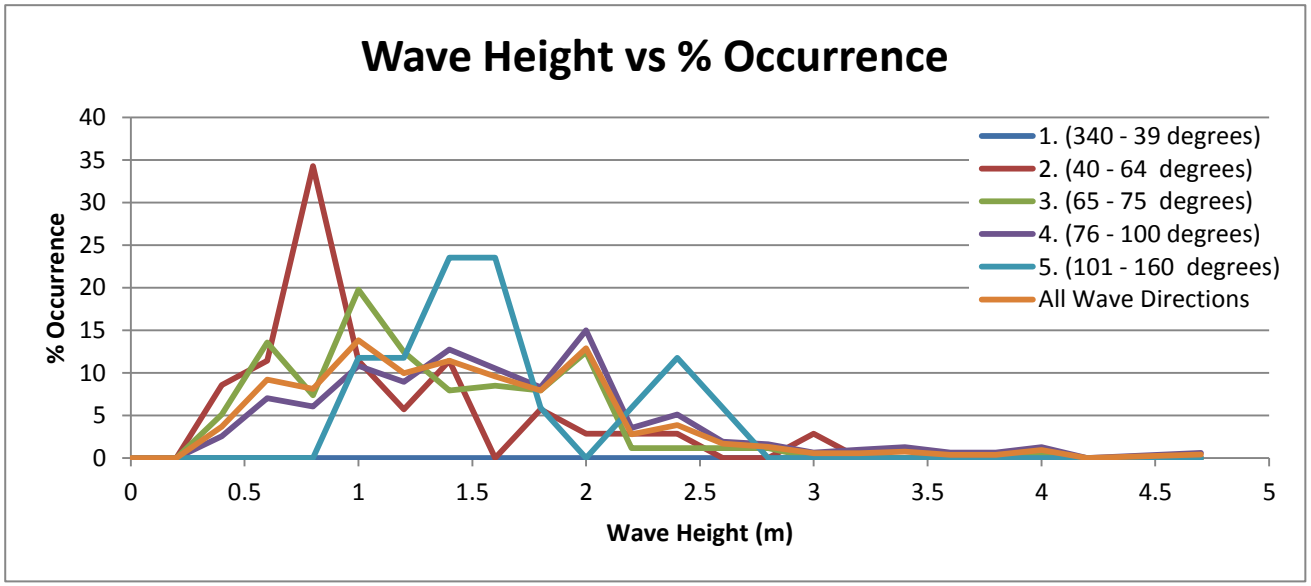
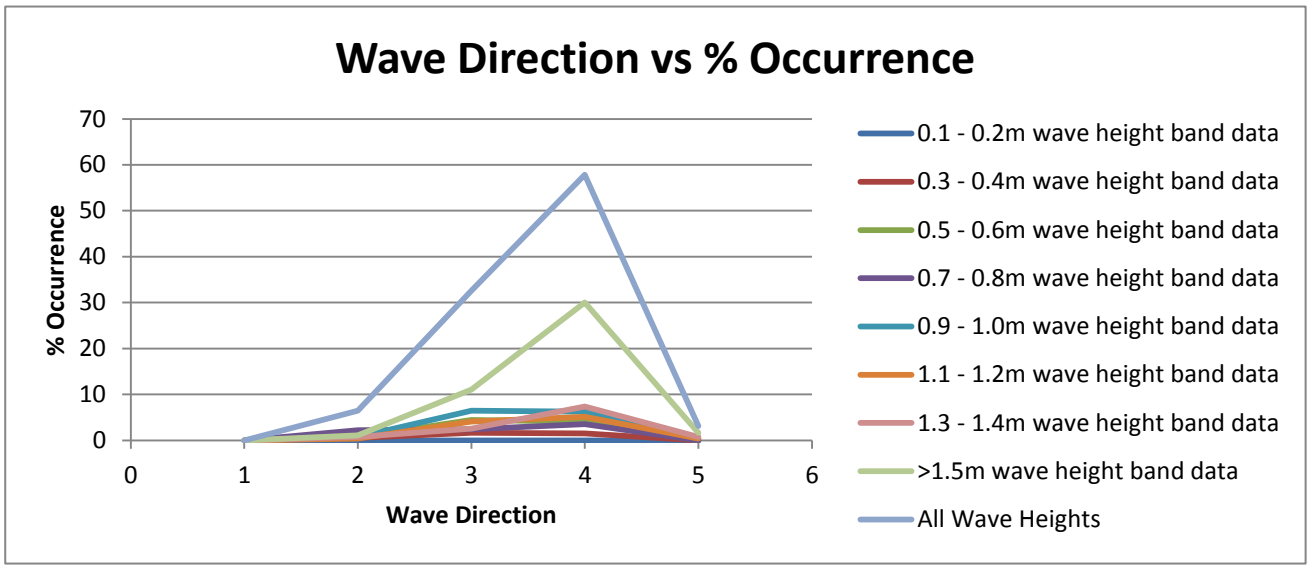
Burleigh Heads **Figure 8**

Percentage Occurrence of Wave Height and Wave Period







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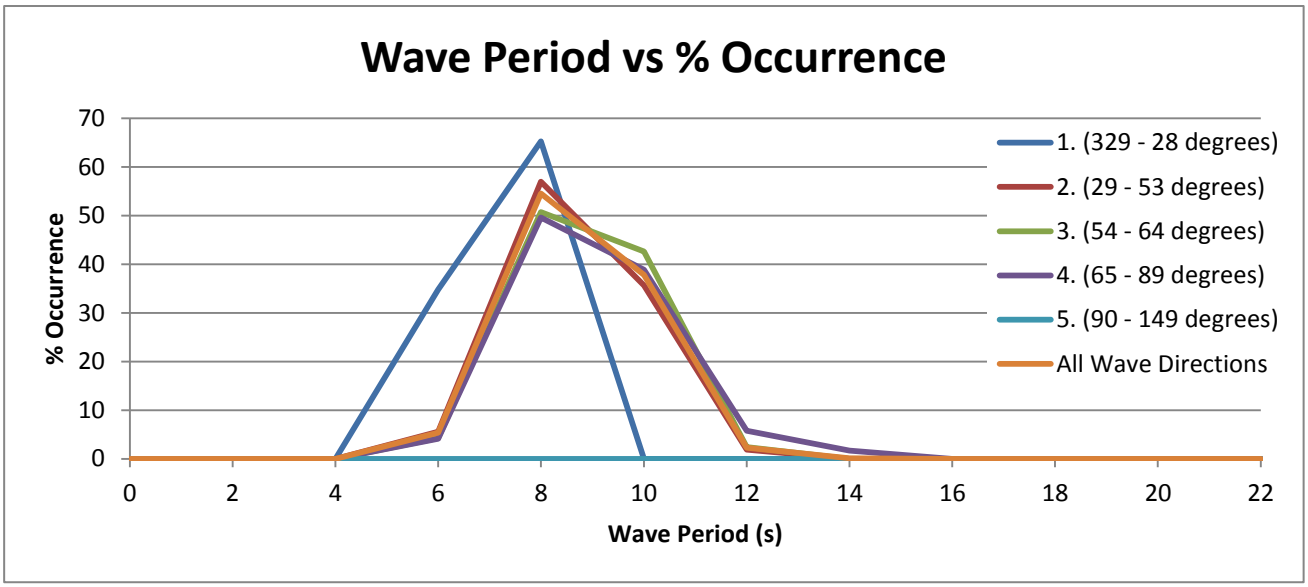
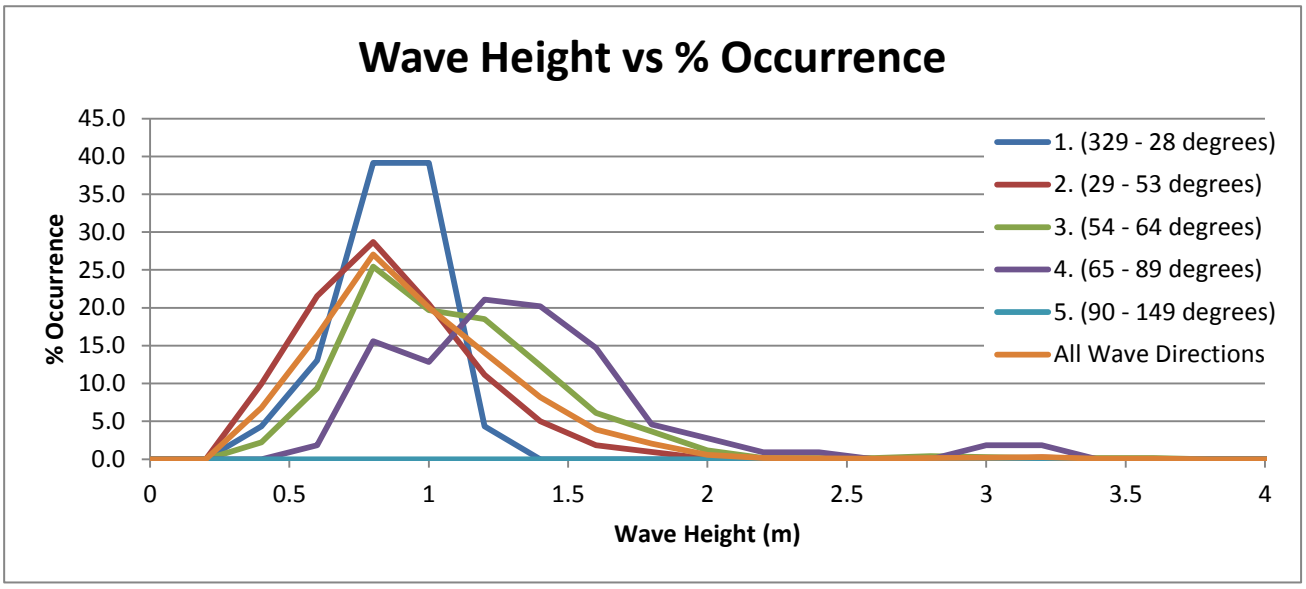
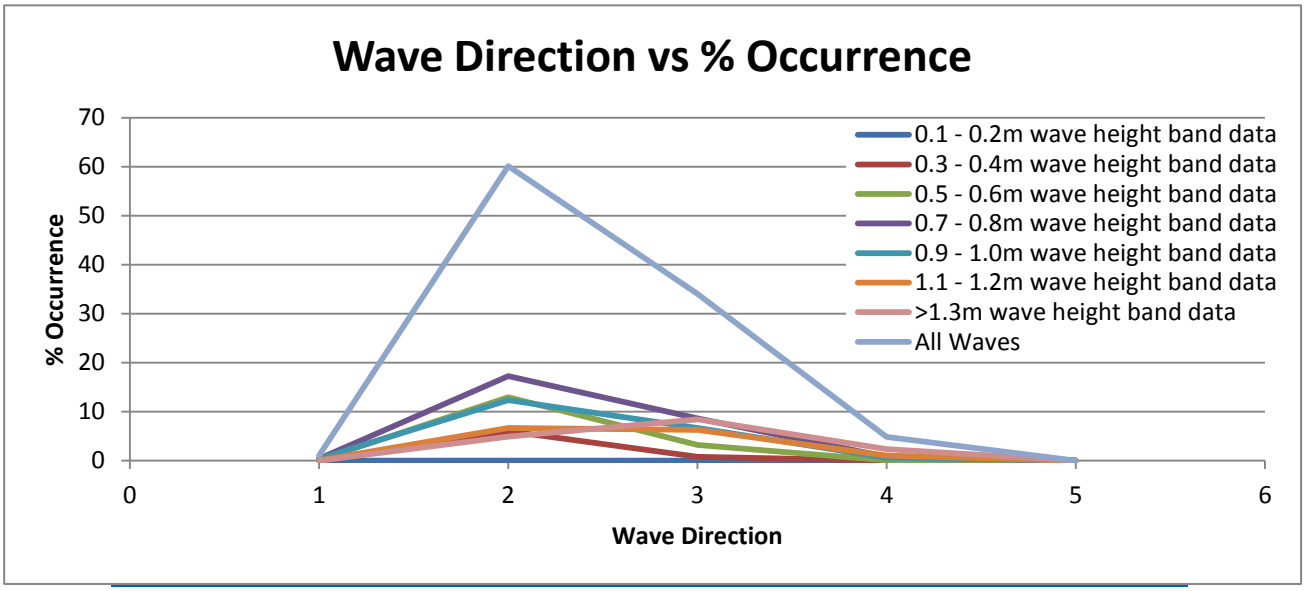
North Burleigh
Wave Direction Analysis

Figure 9







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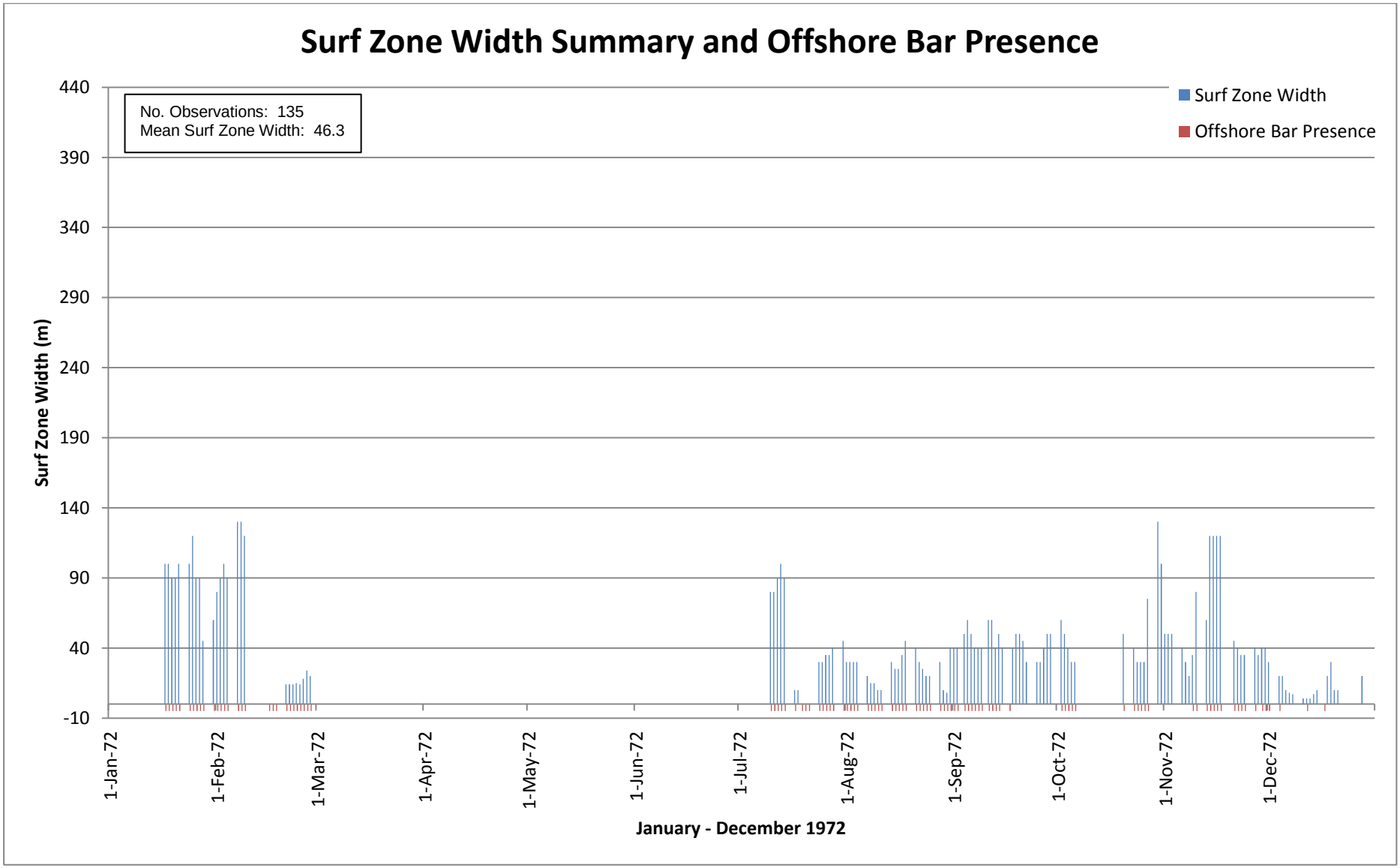
Burleigh Heads
Wave Direction Analysis

Figure 10



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1972

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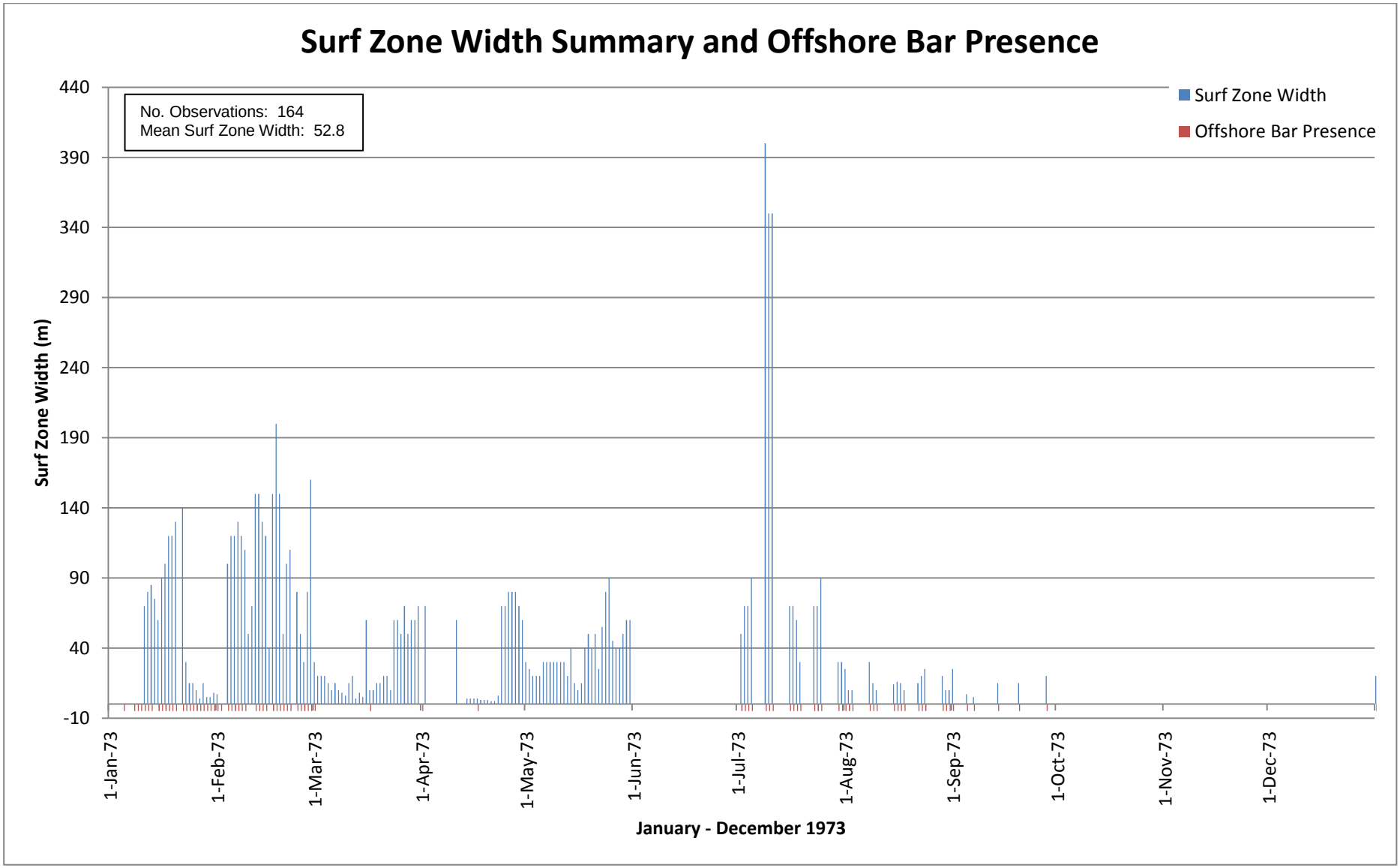
Figure 11



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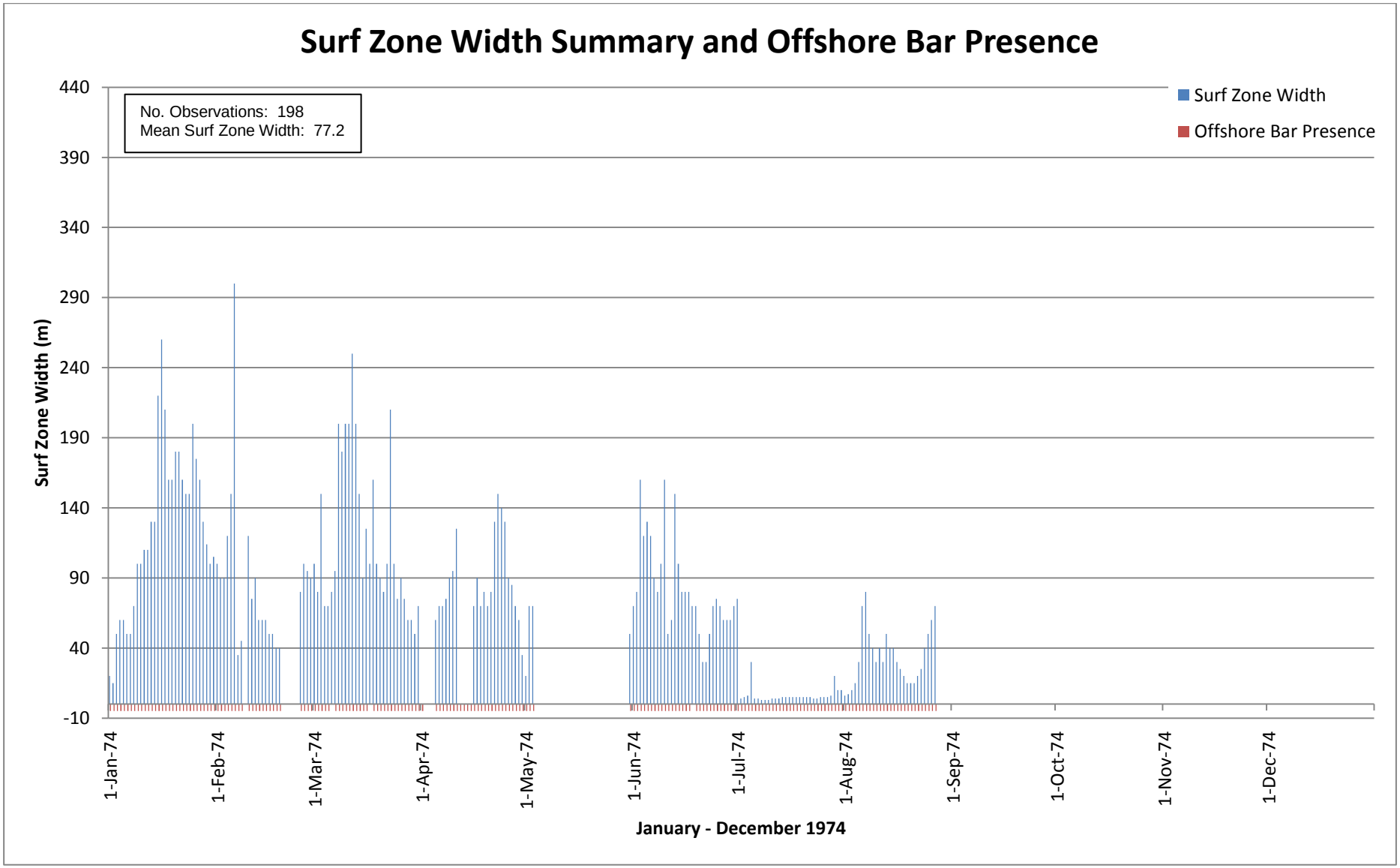
Surf Zone Width - 1973

Figure 12



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1974

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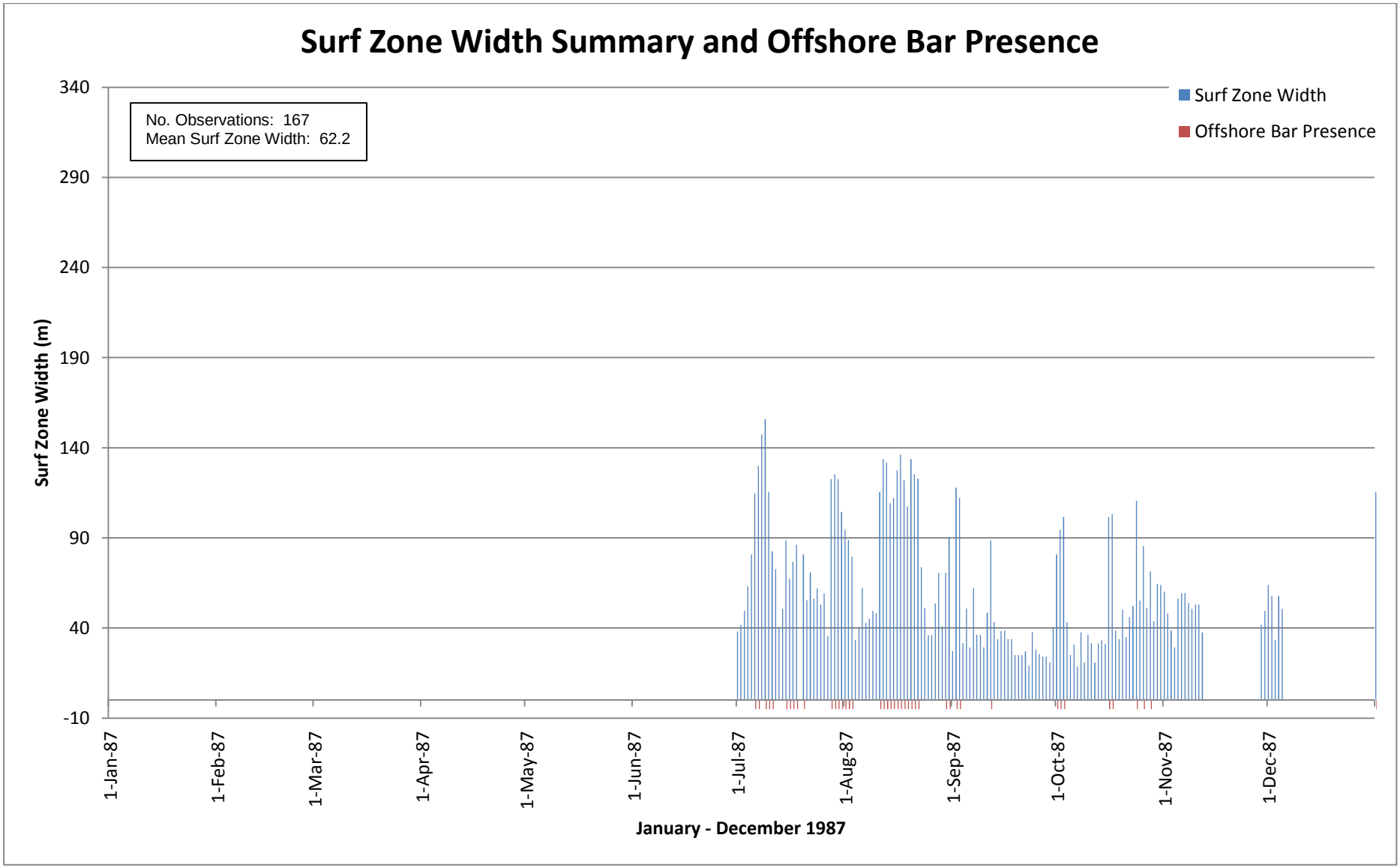
Figure 13



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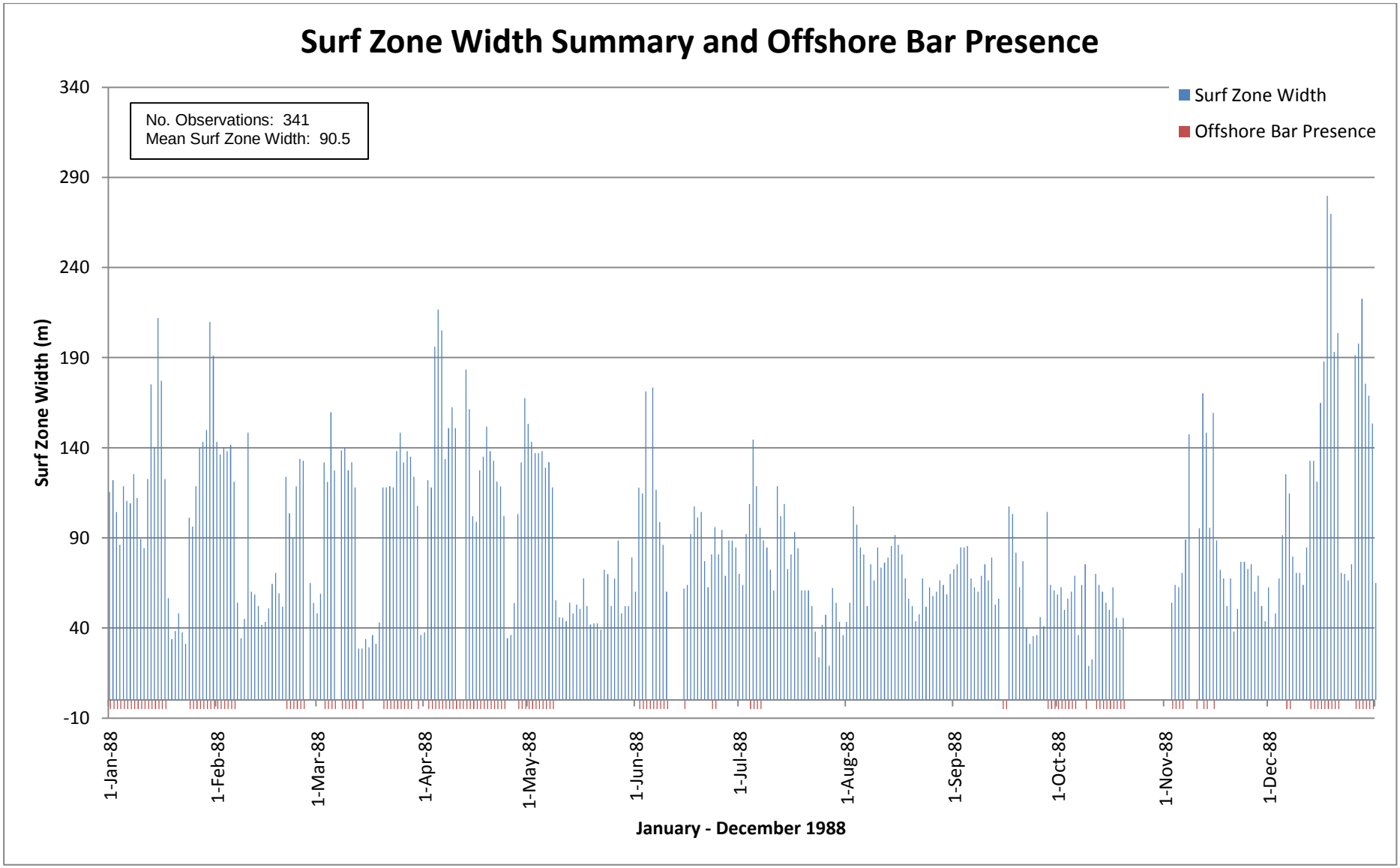
Surf Zone Width - 1987

Figure 14



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1988

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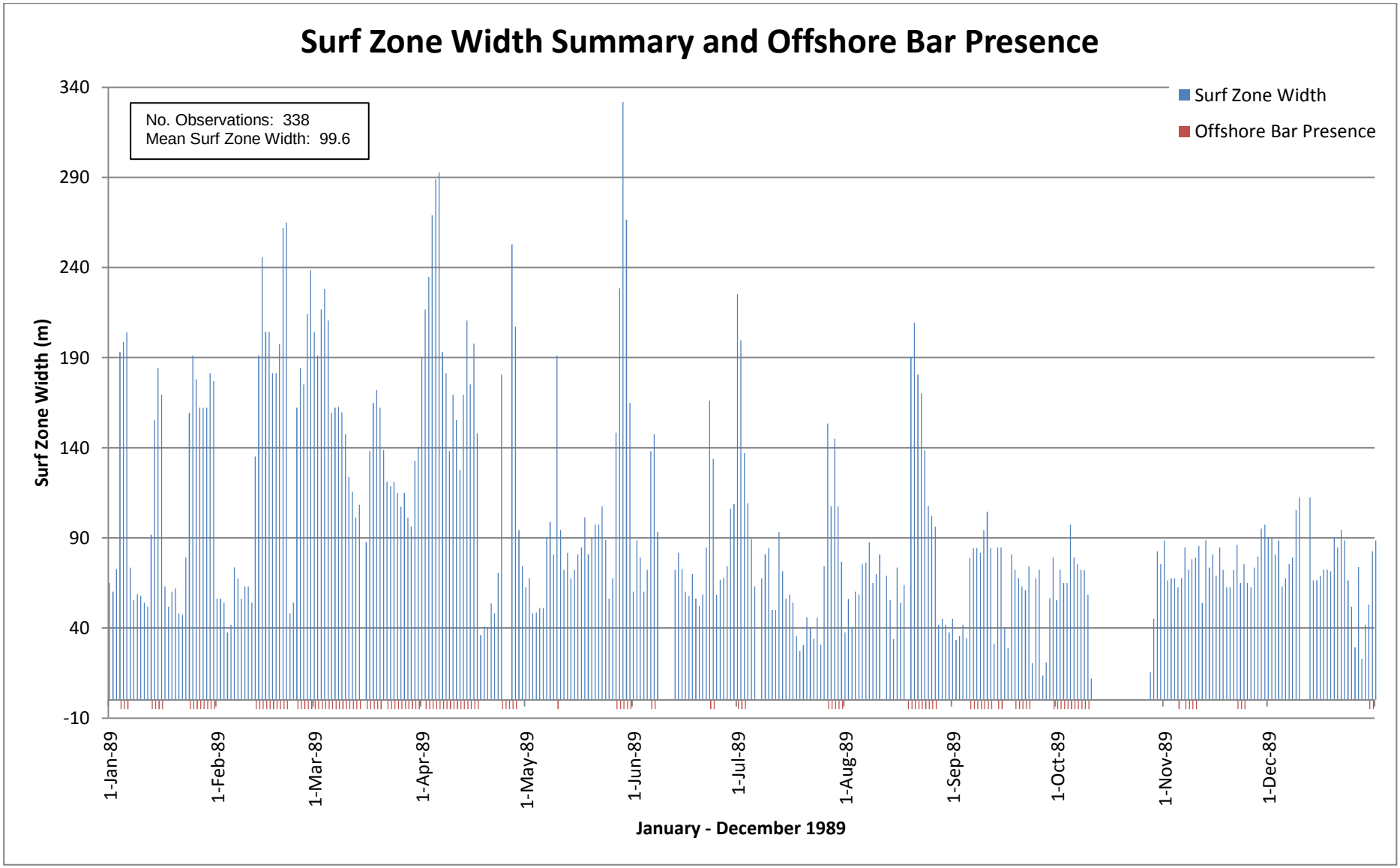
Figure 15



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Surf Zone Width - 1989

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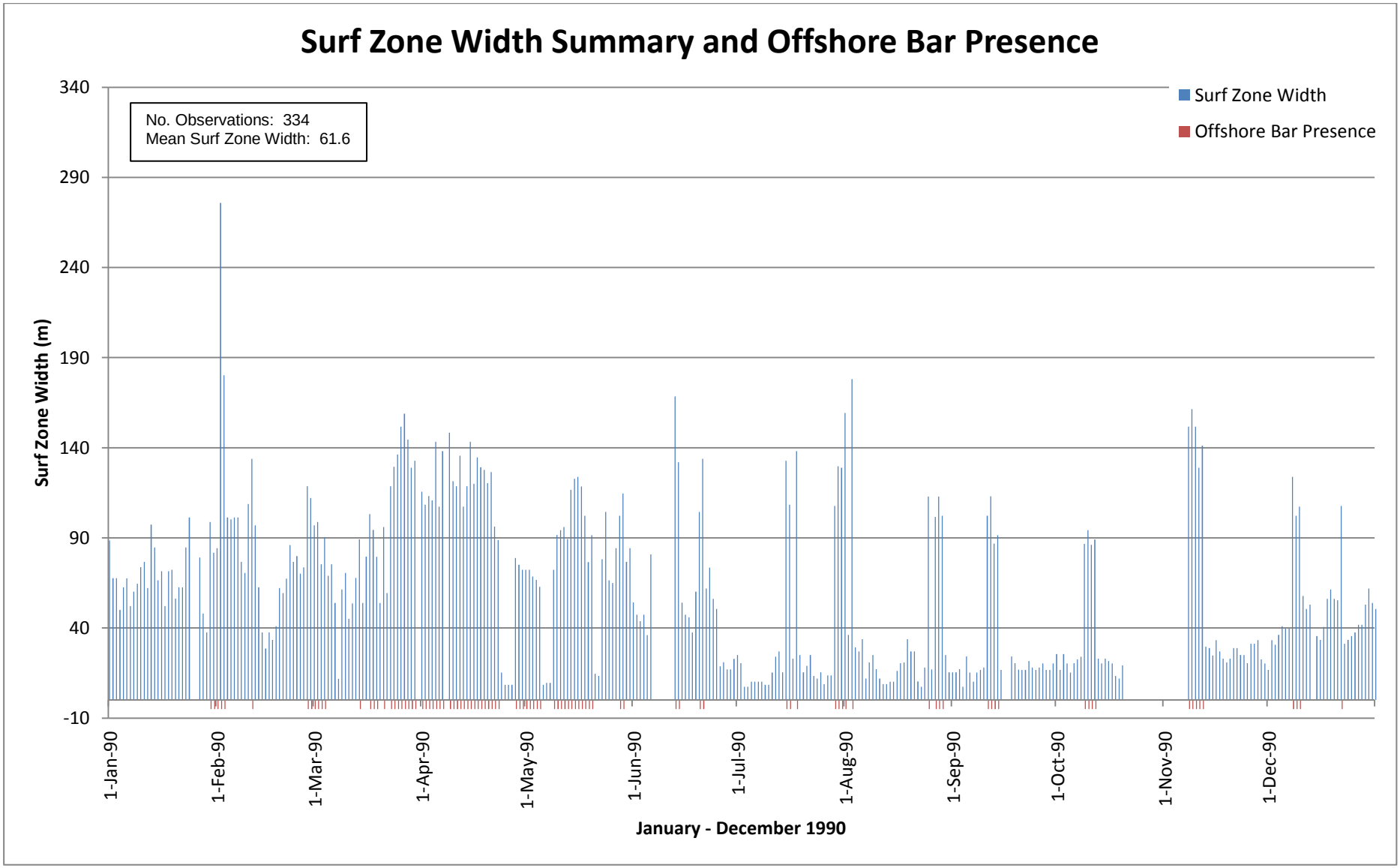
Figure 16



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Surf Zone Width - 1990

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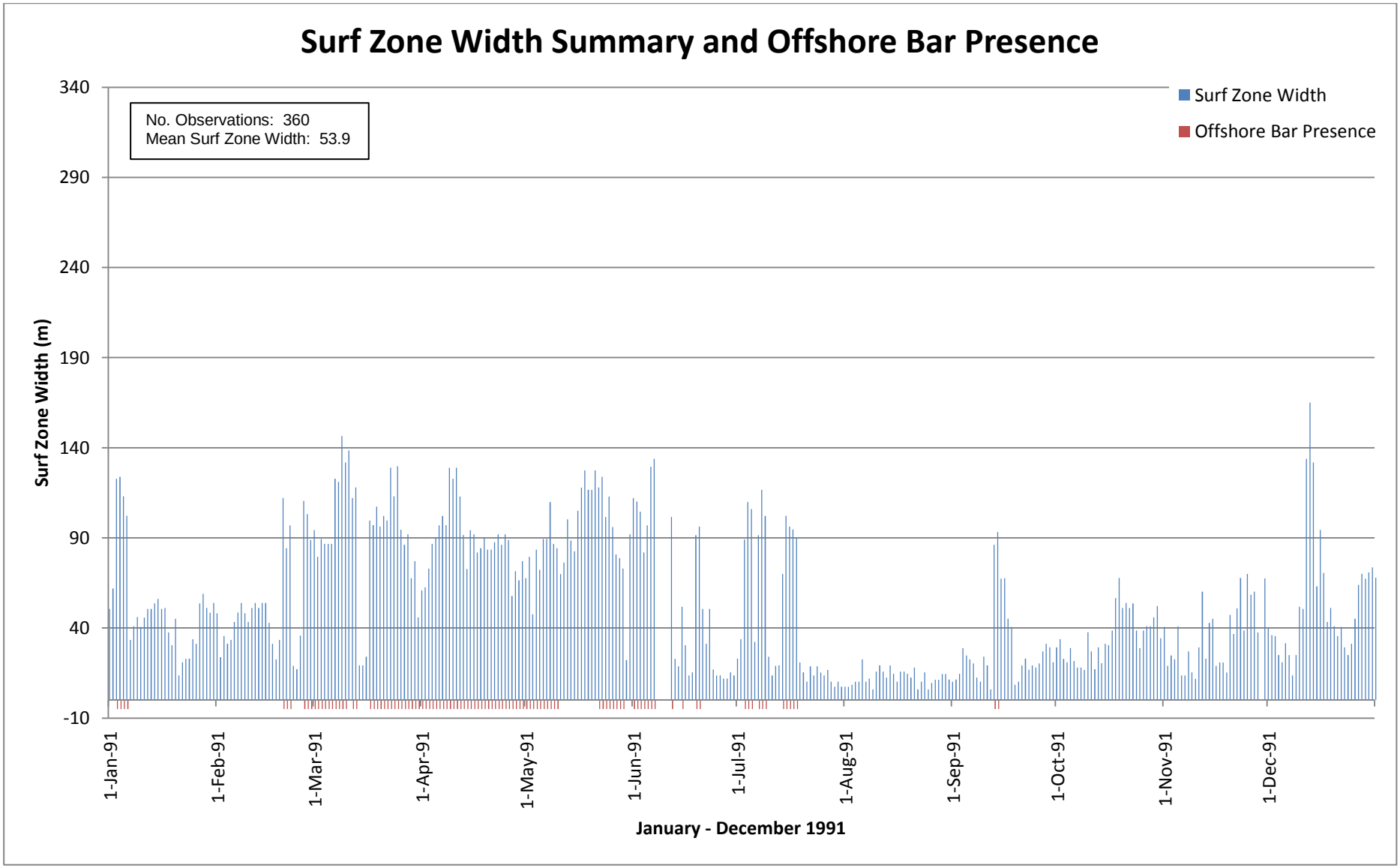
Figure 17



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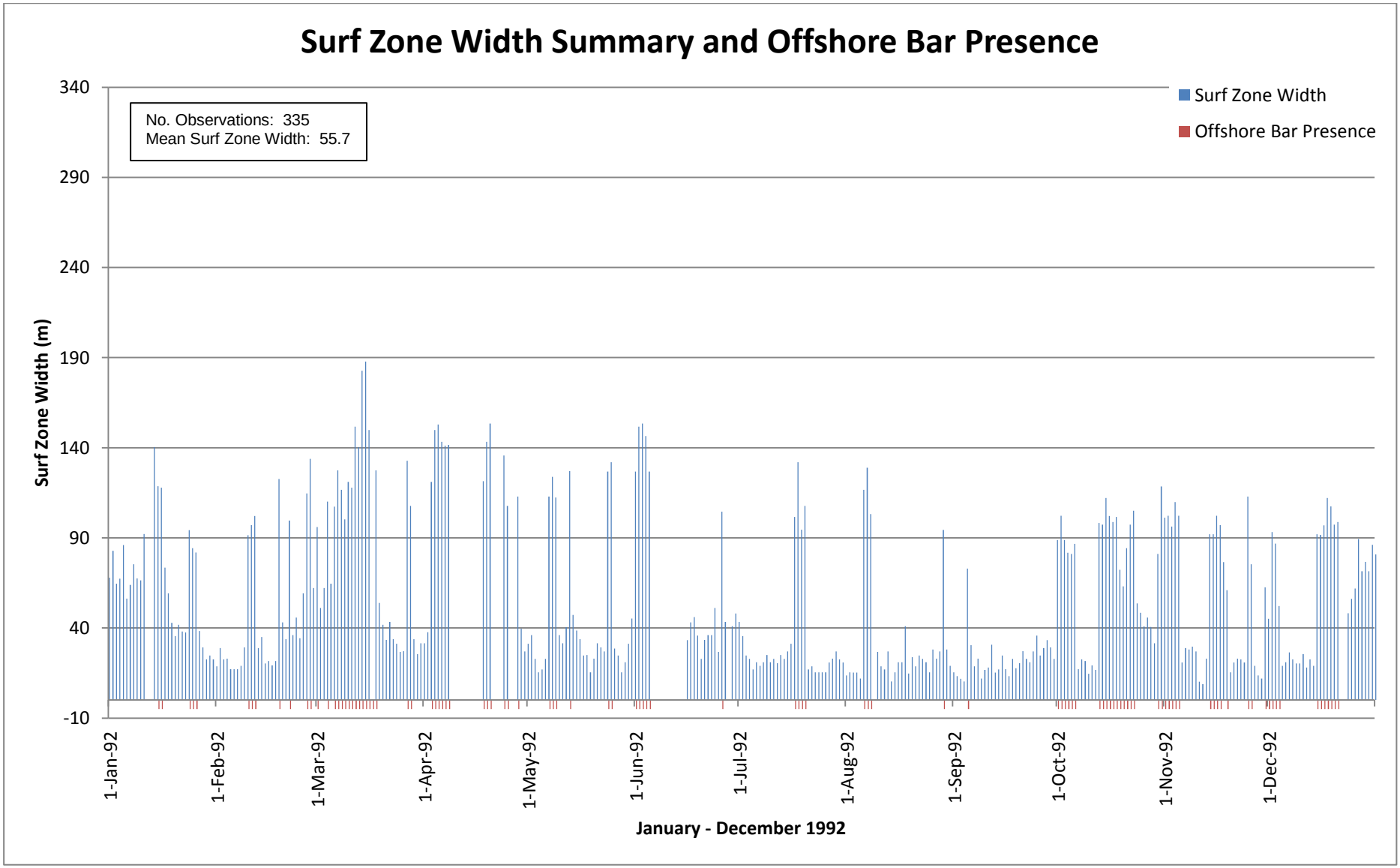
Surf Zone Width - 1991

Figure 18



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Surf Zone Width - 1992

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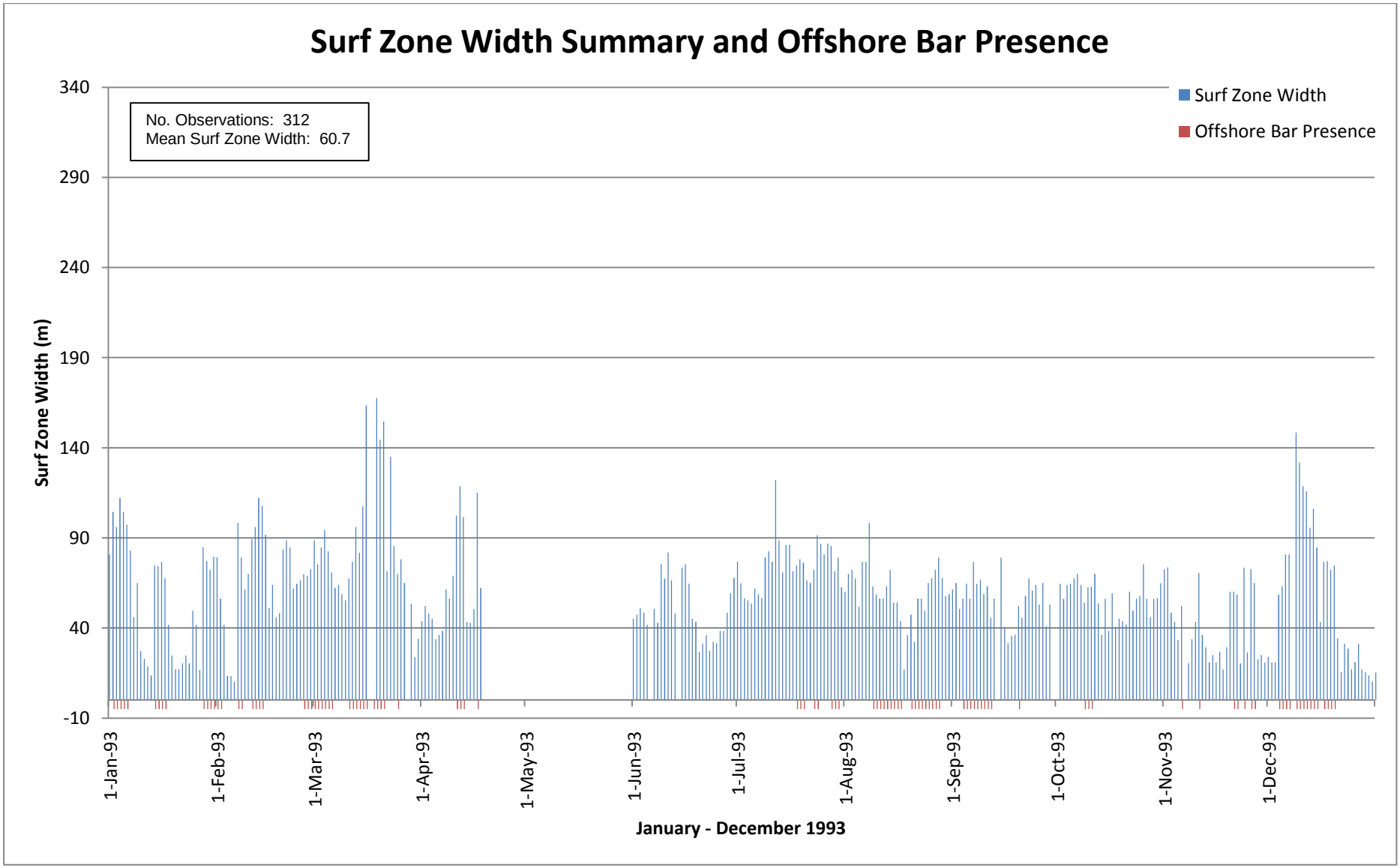
Figure 19



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Surf Zone Width - 1993

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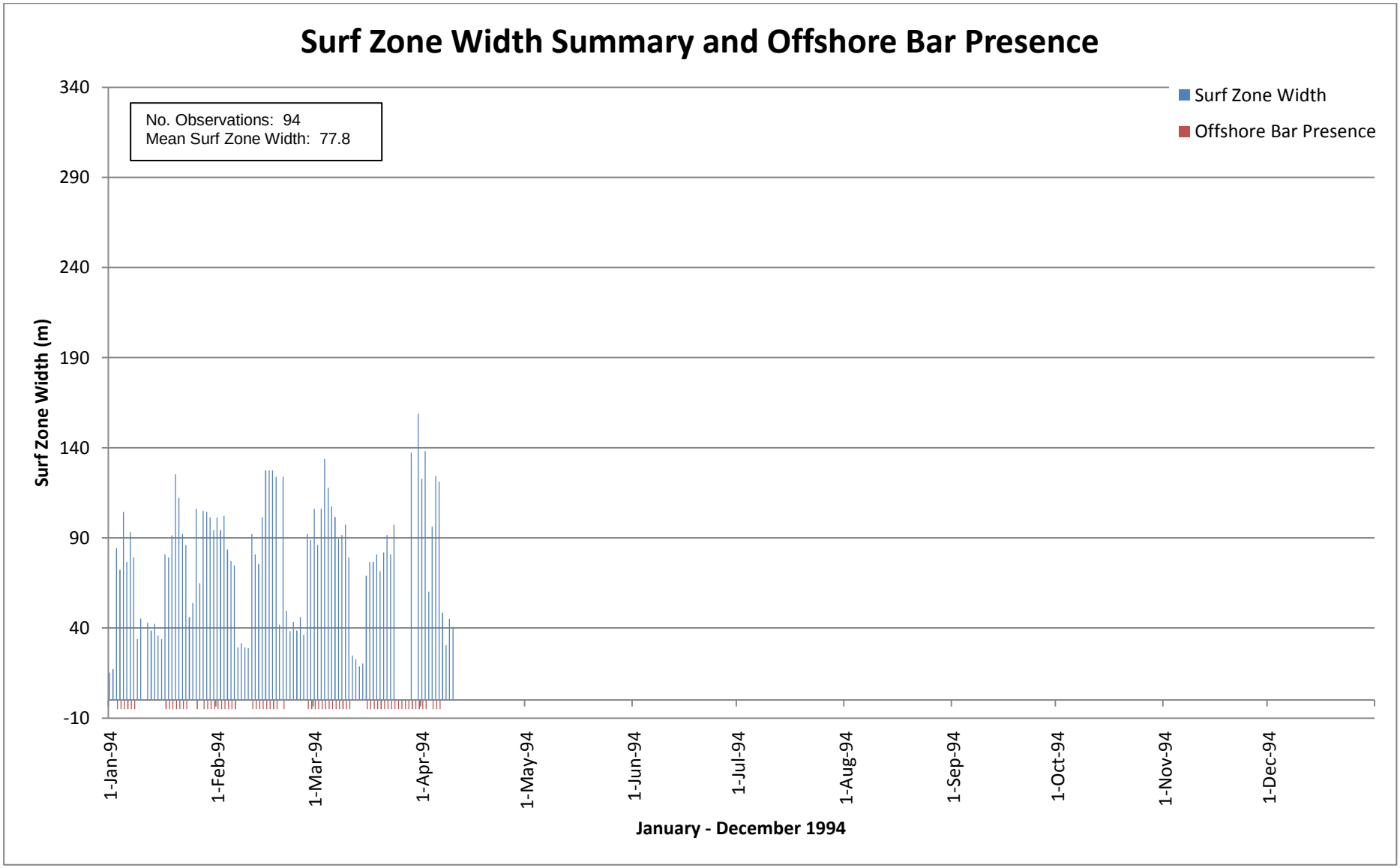
Figure 20



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Surf Zone Width - 1994

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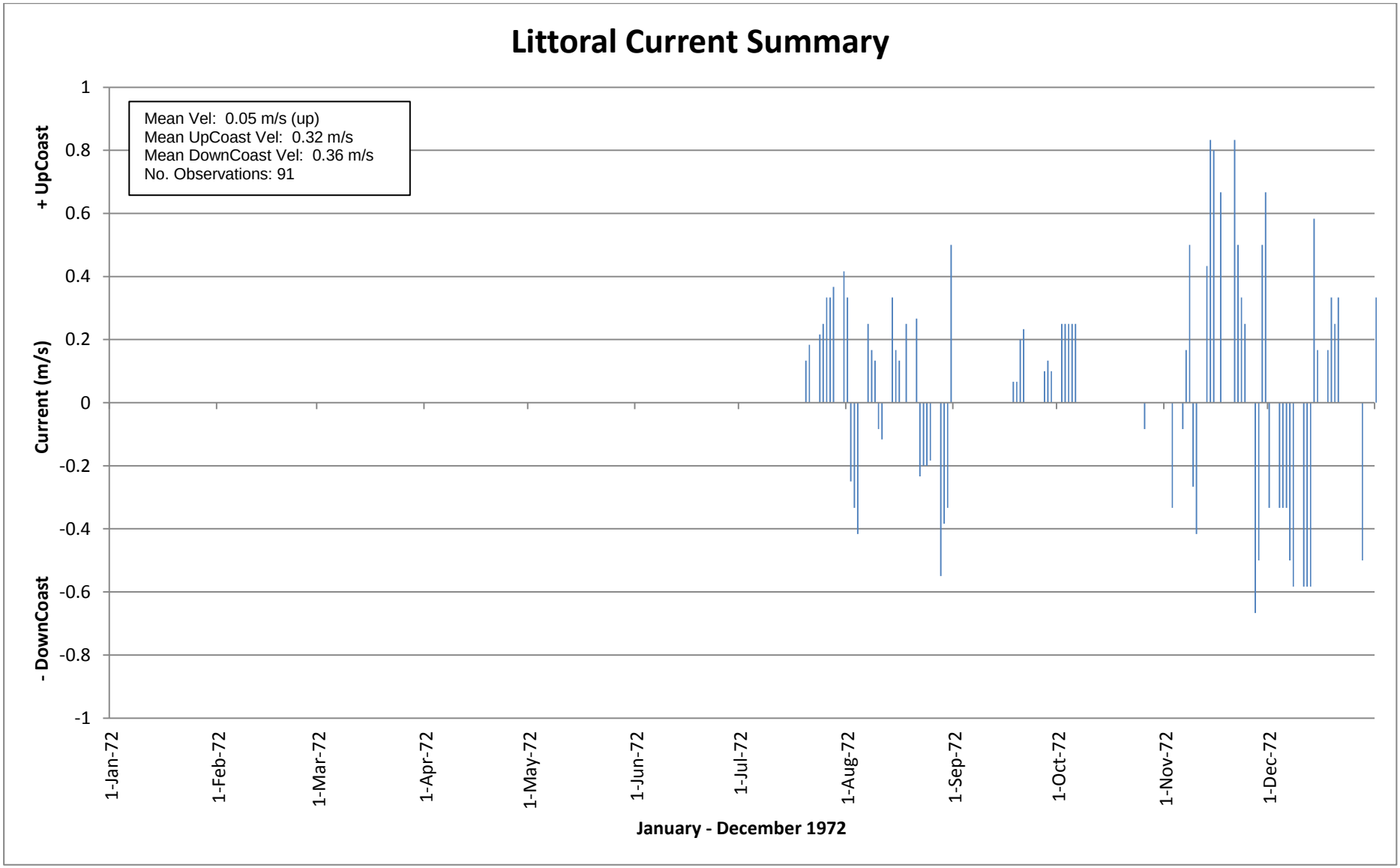
Figure 21



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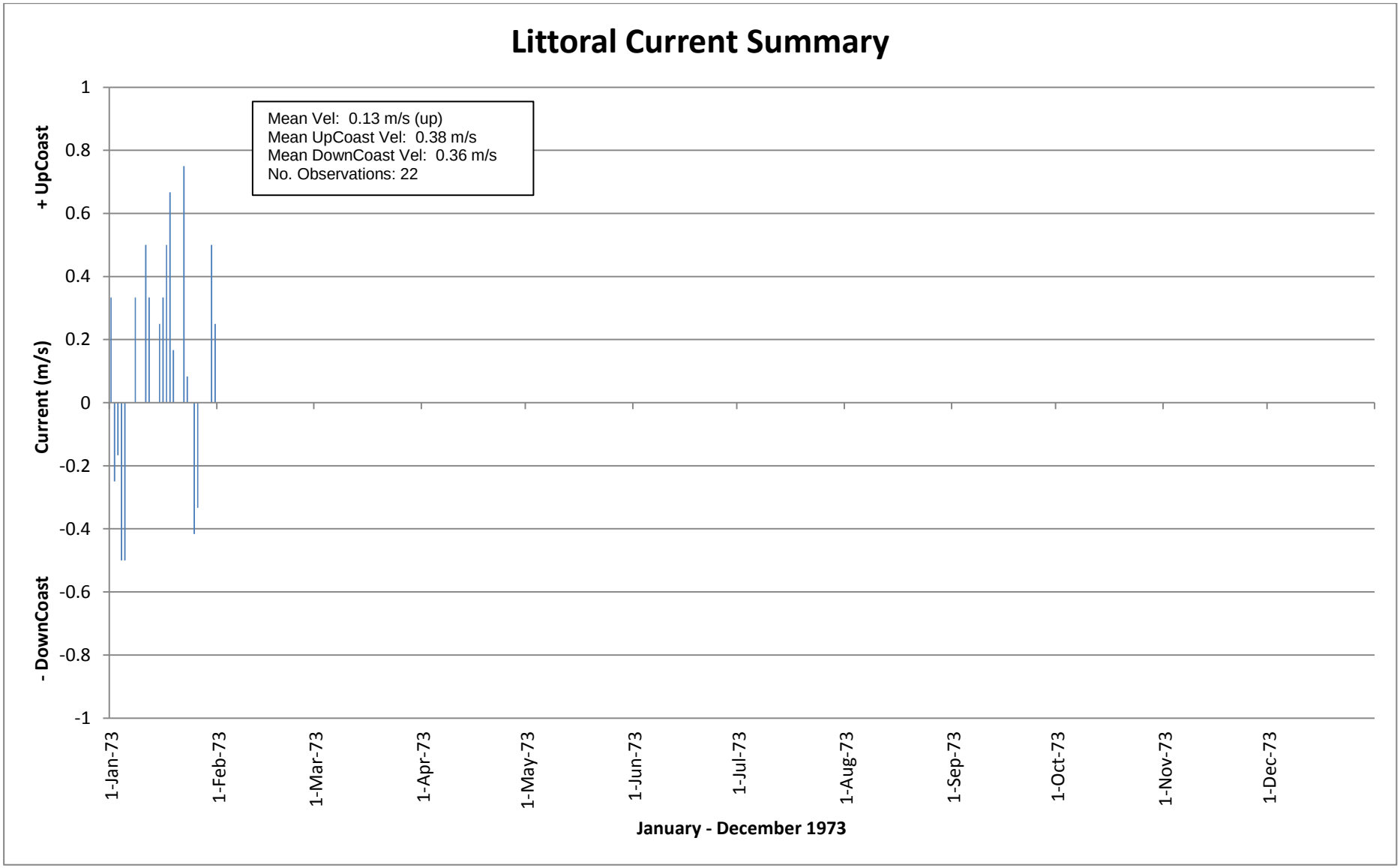
Littoral Current Summary – 1972

Figure 22



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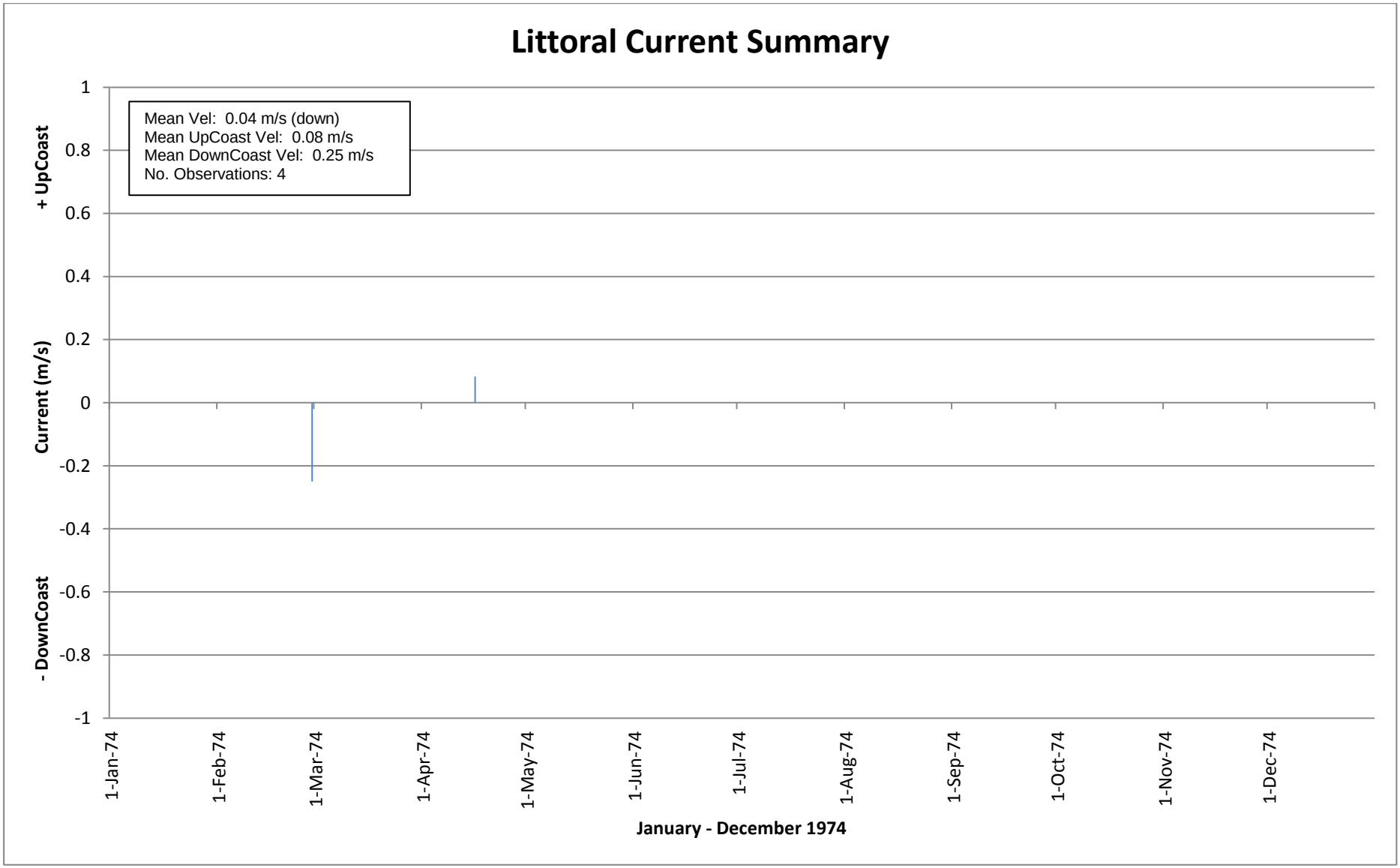
Littoral Current Summary – 1973

Figure 23



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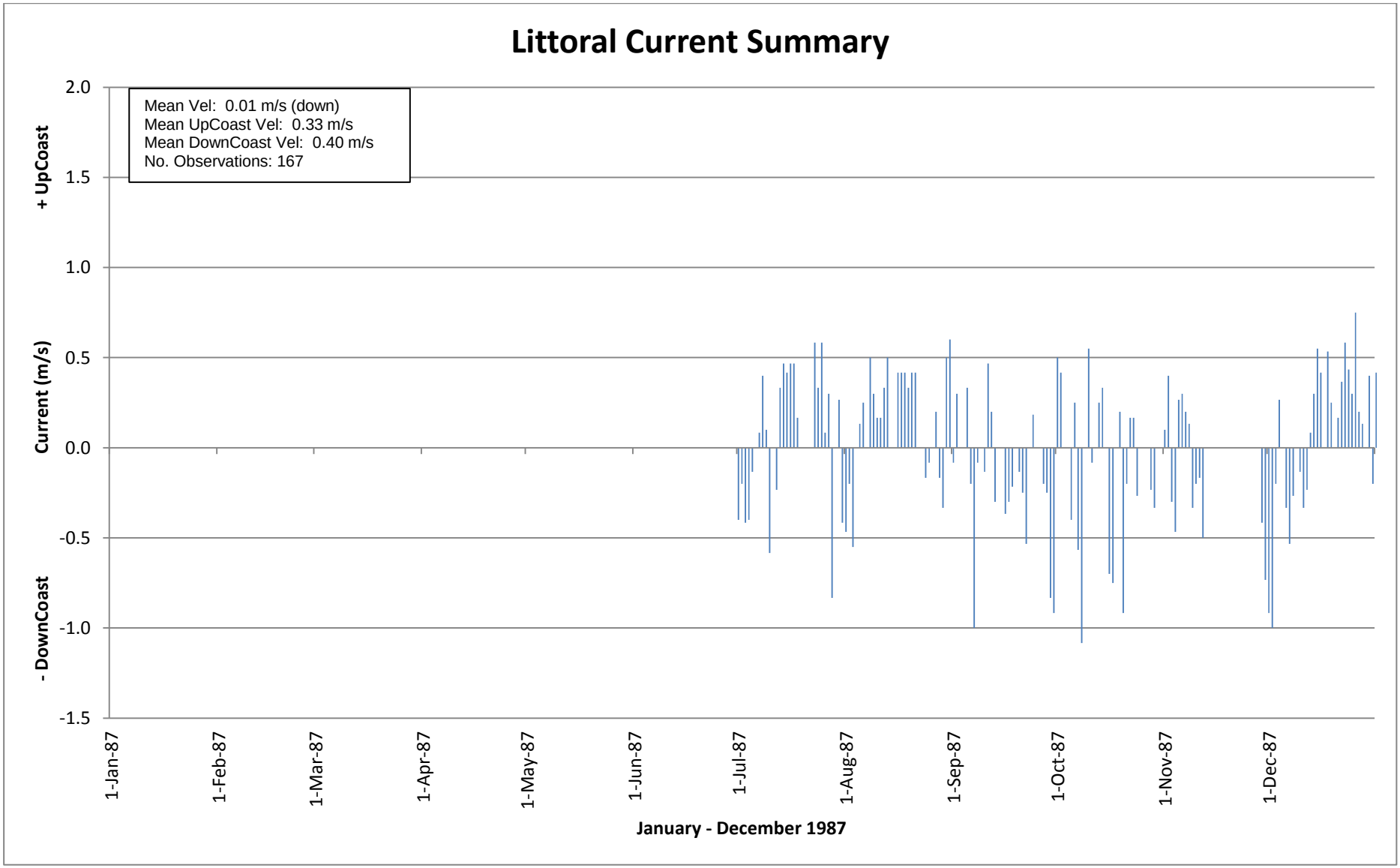
Littoral Current Summary – 1974

Figure 24



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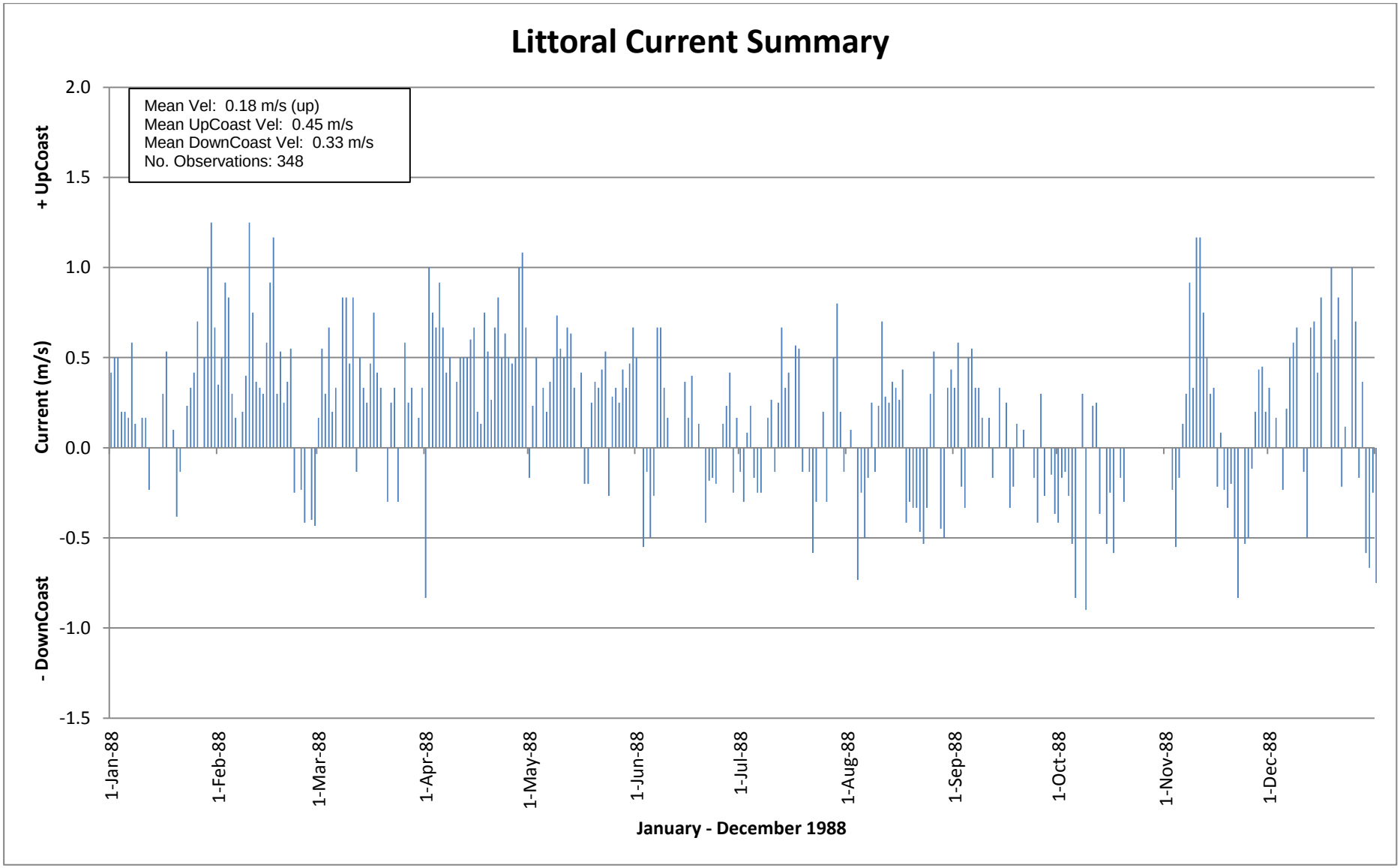
Littoral Current Summary – 1987

Figure 25



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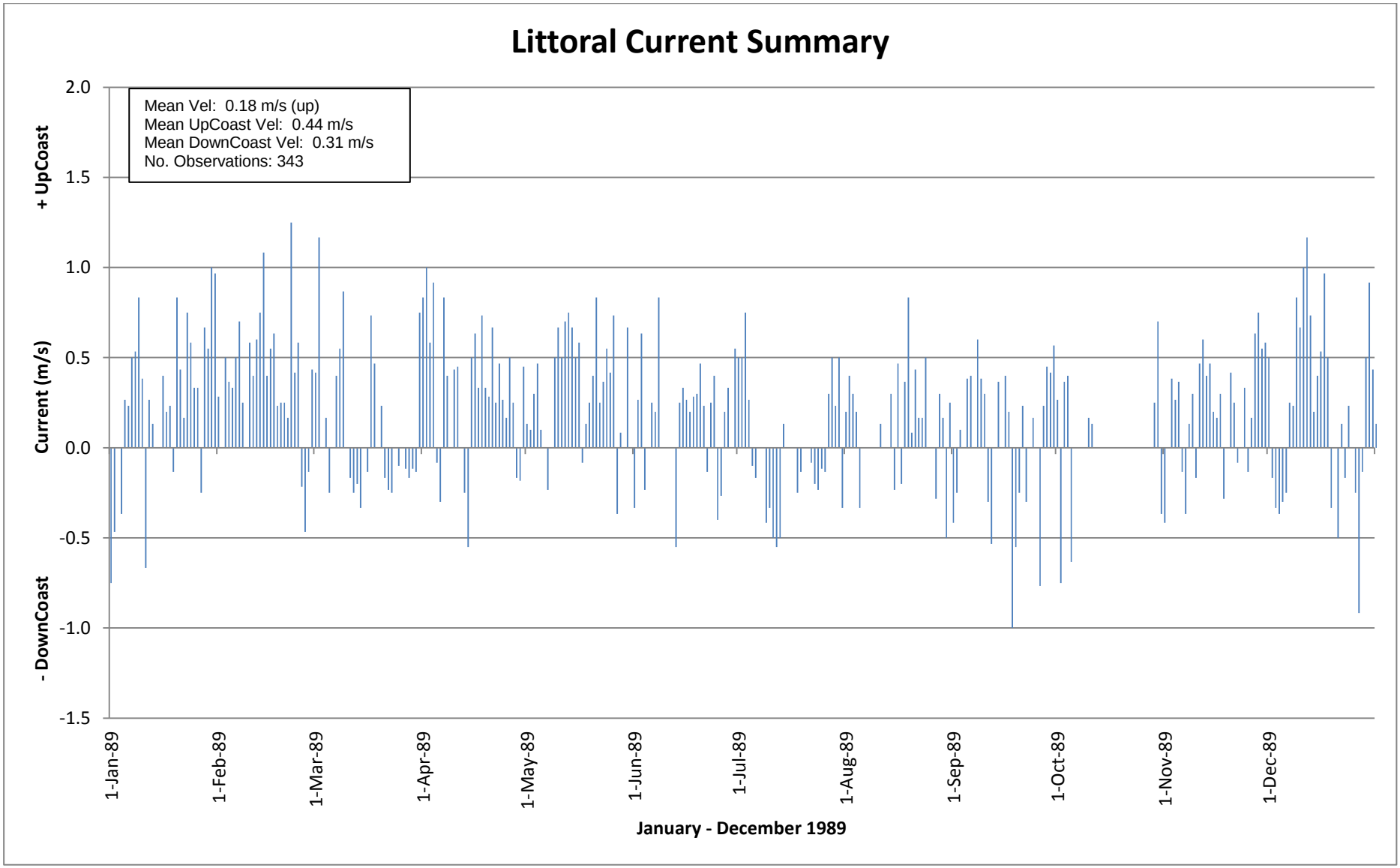
Littoral Current Summary – 1988

Figure 26



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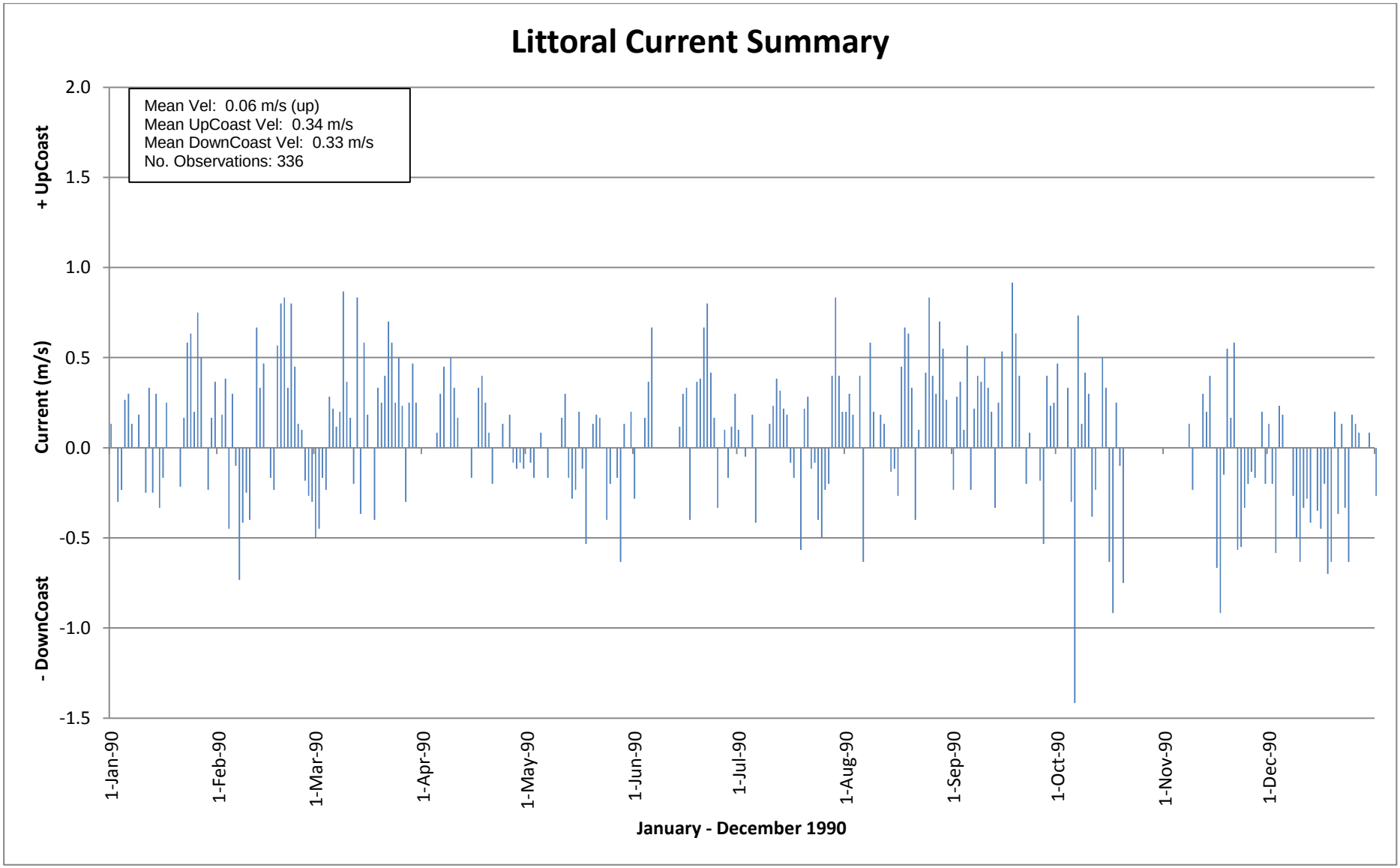
Littoral Current Summary – 1989

Figure 27



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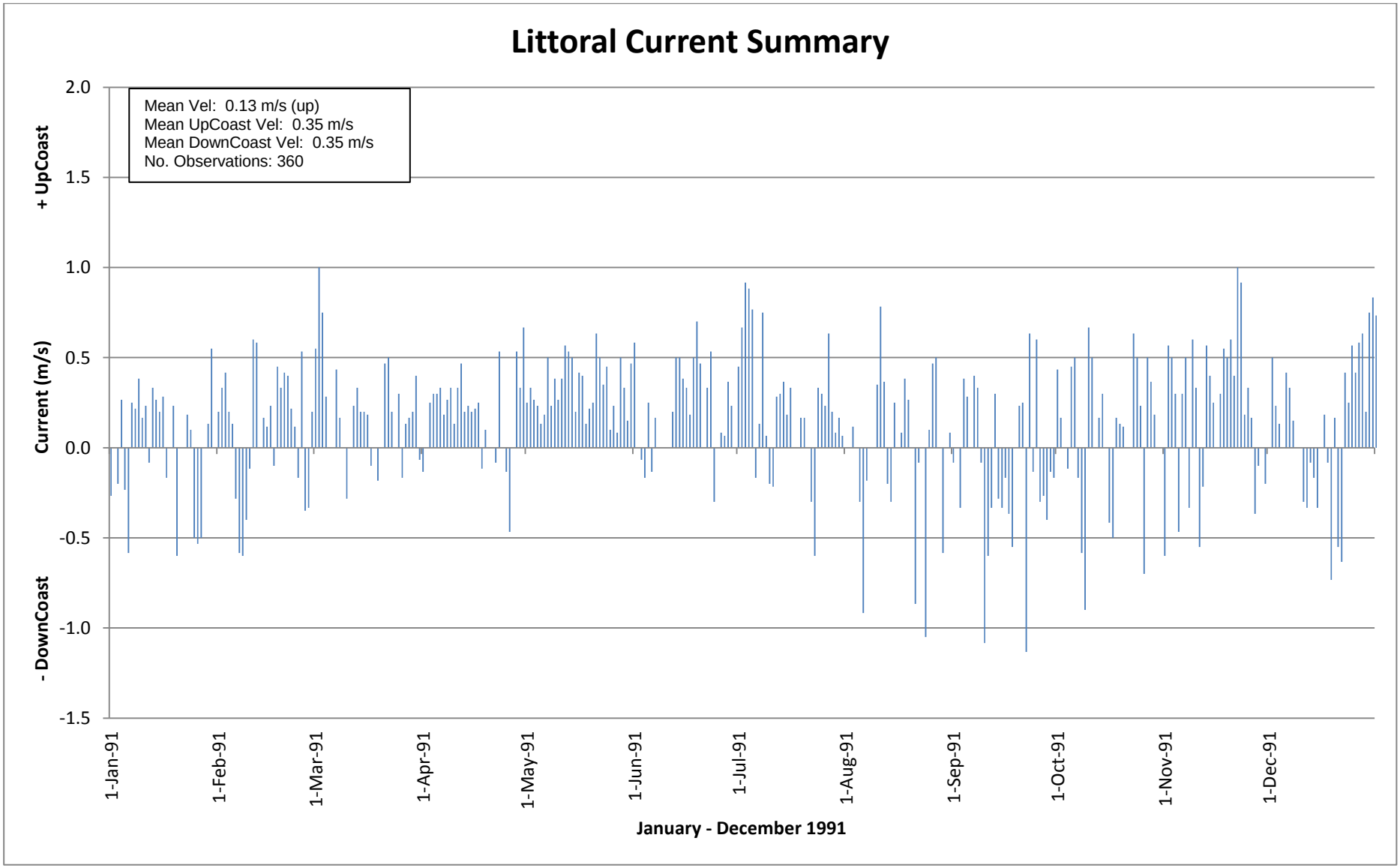
Littoral Current Summary – 1990

Figure 28



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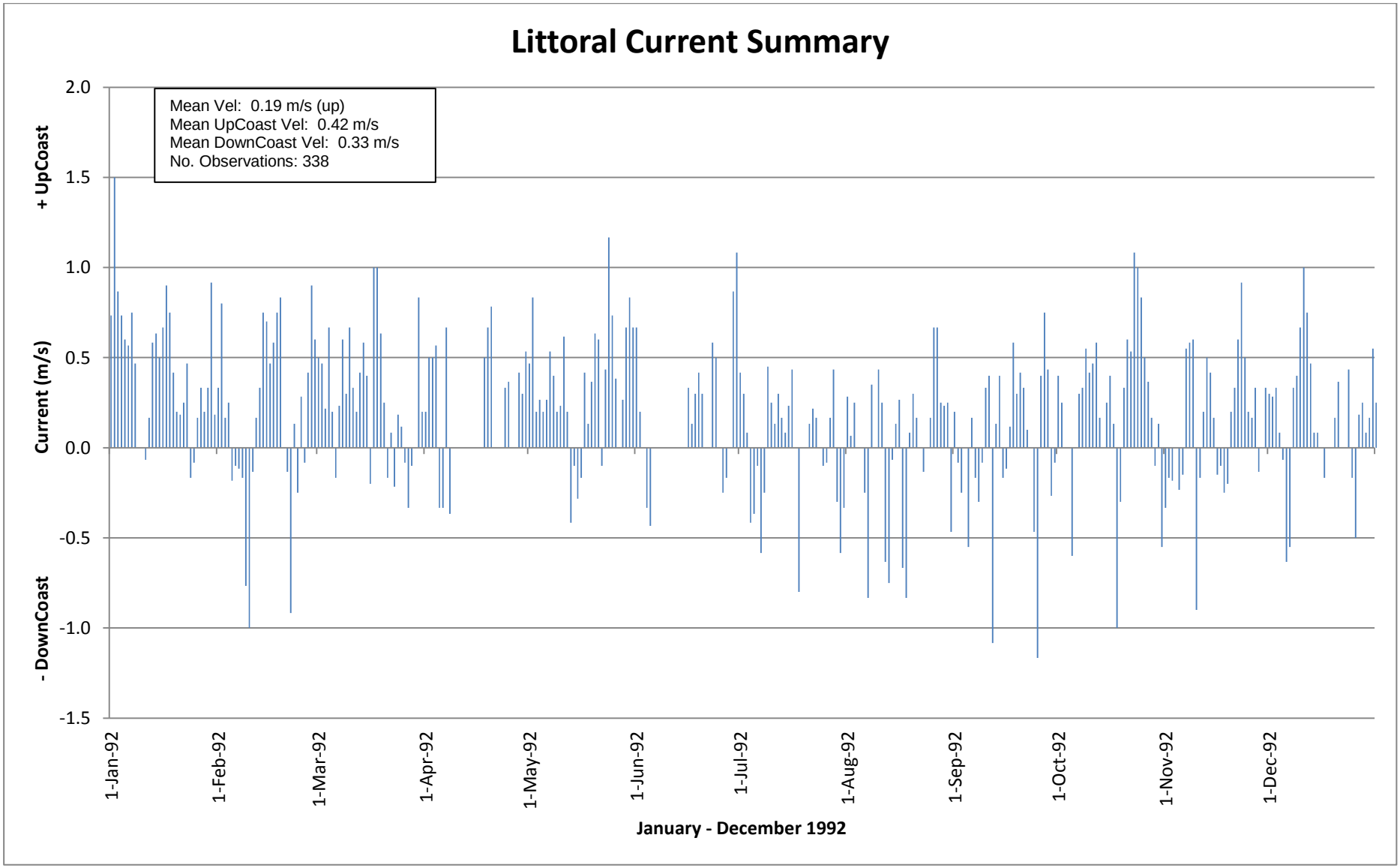
Littoral Current Summary – 1991

Figure 29



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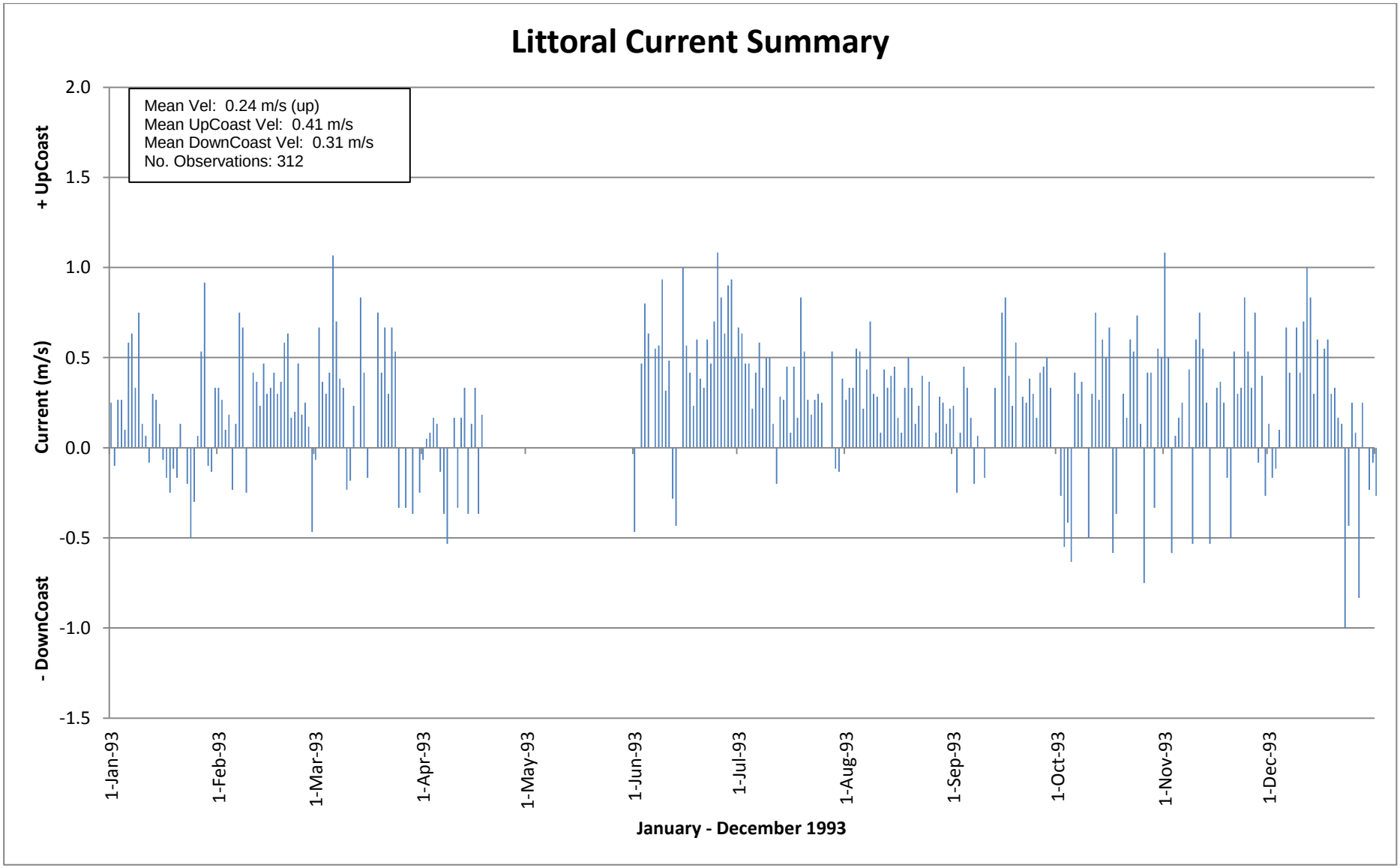
Littoral Current Summary – 1992

Figure 30



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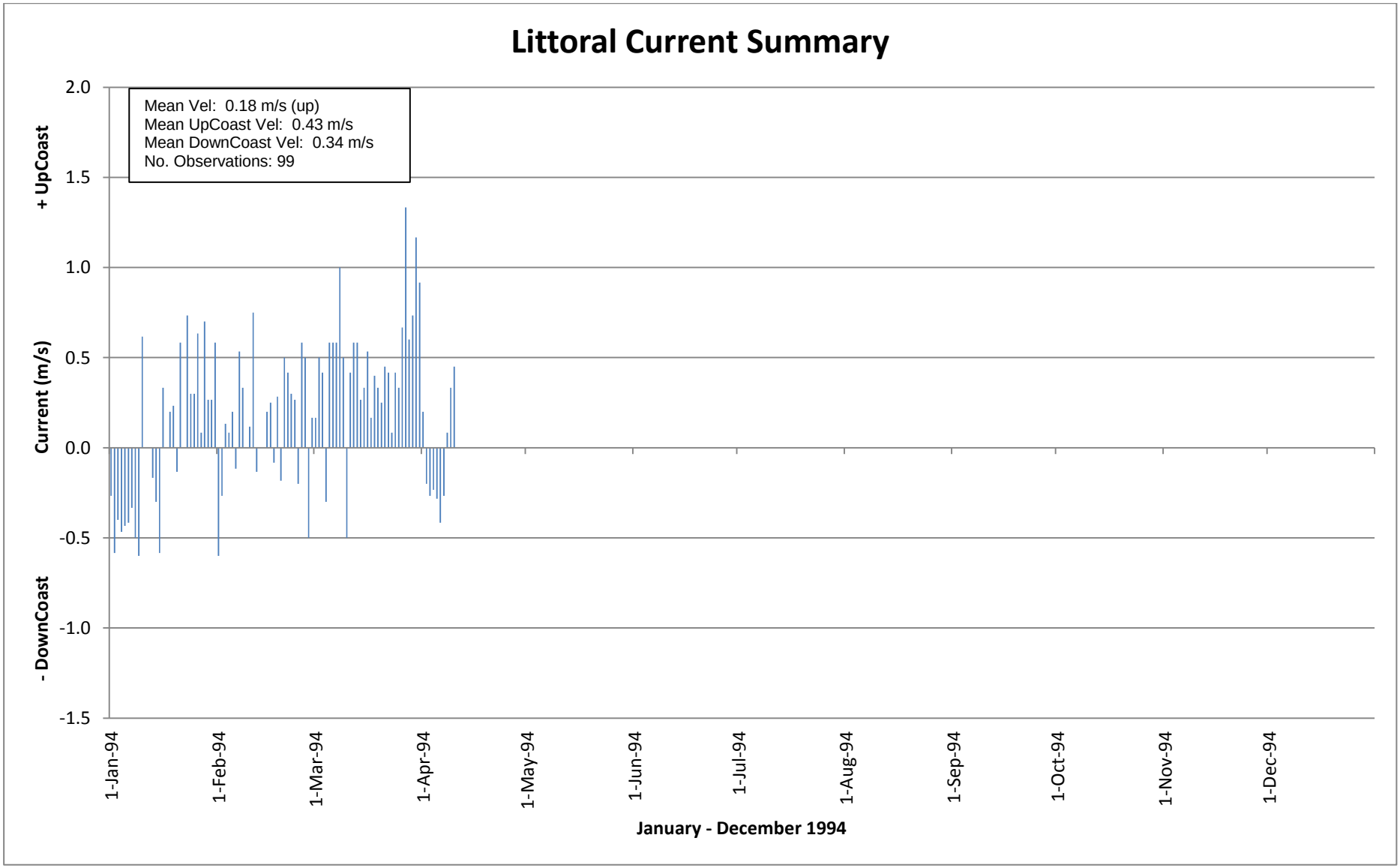
Littoral Current Summary – 1993

Figure 31



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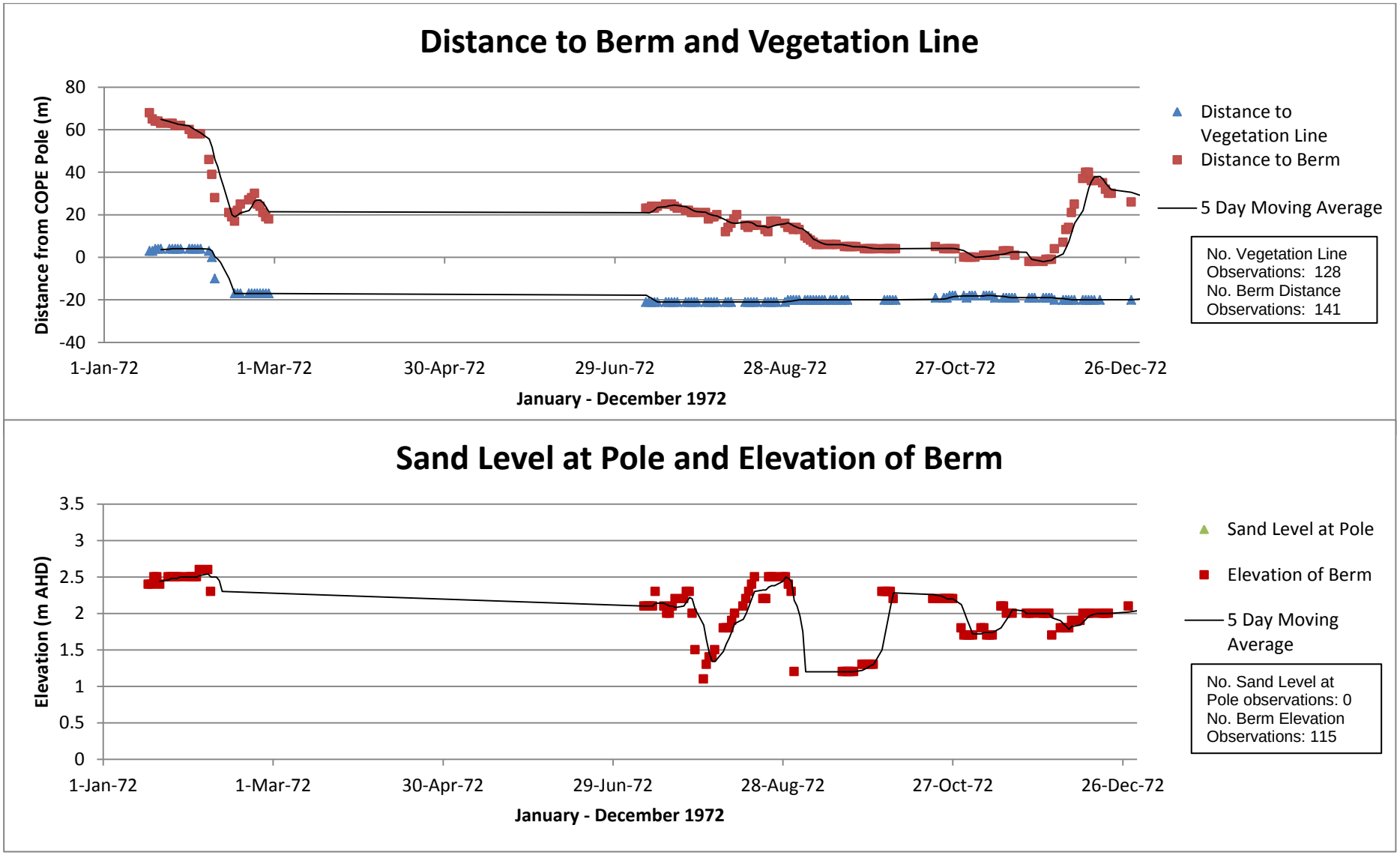
Littoral Current Summary – 1994

Figure 32



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
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Beach Profile Parameters – 1972

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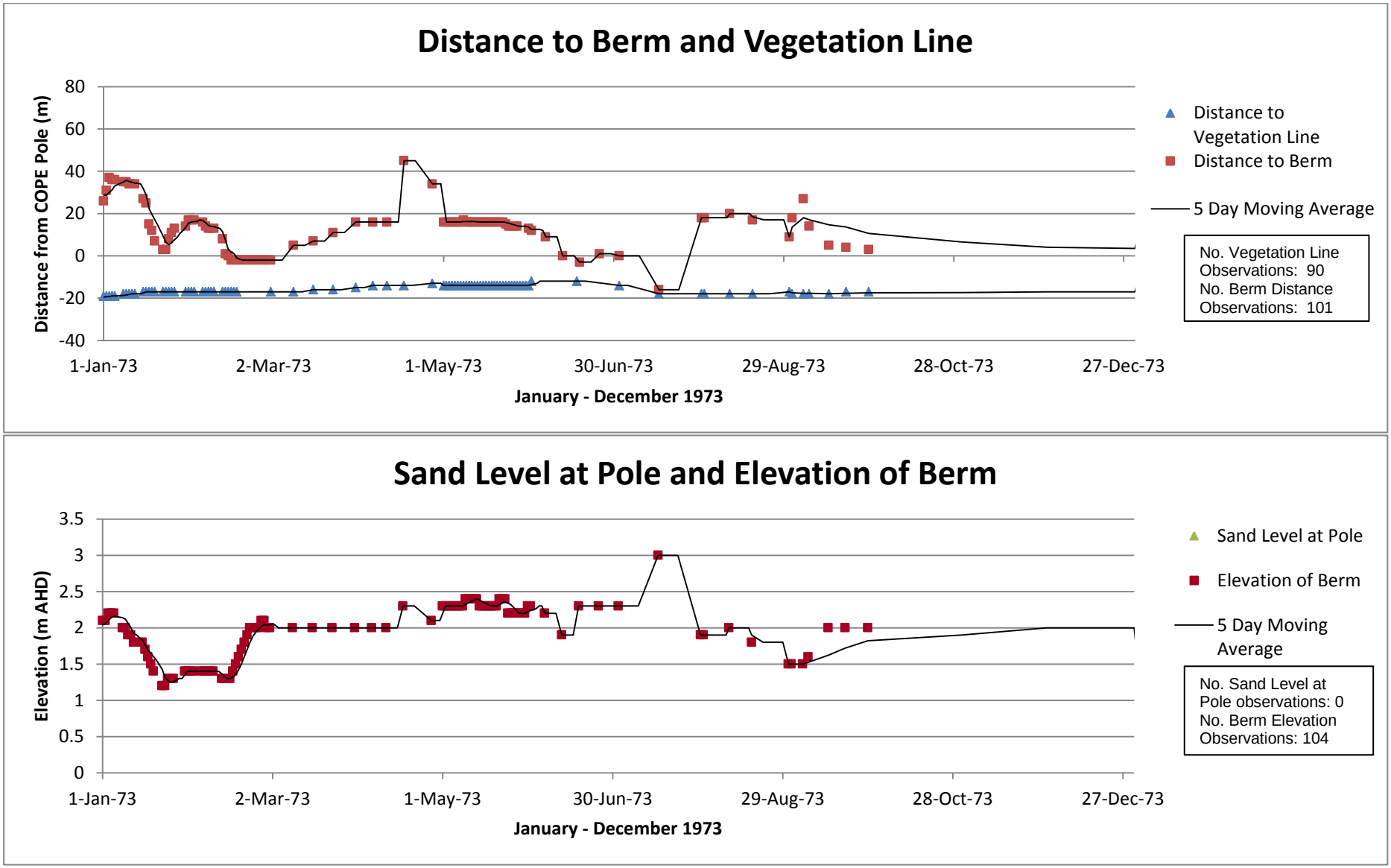
Figure 33



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Beach Profile Parameters – 1973

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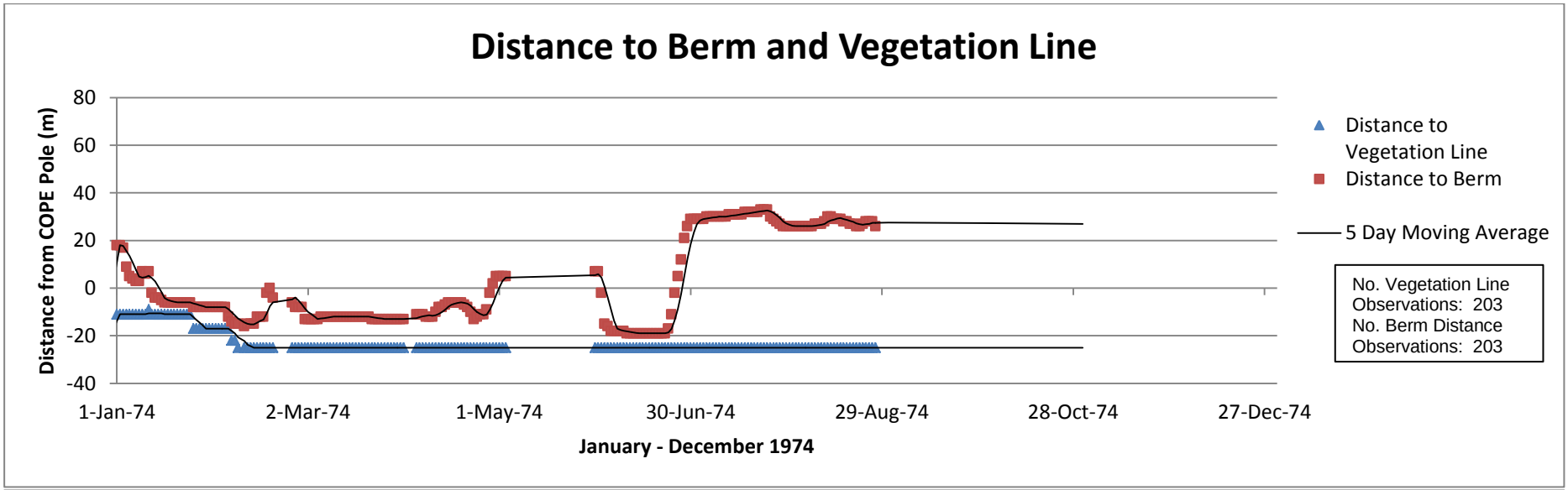
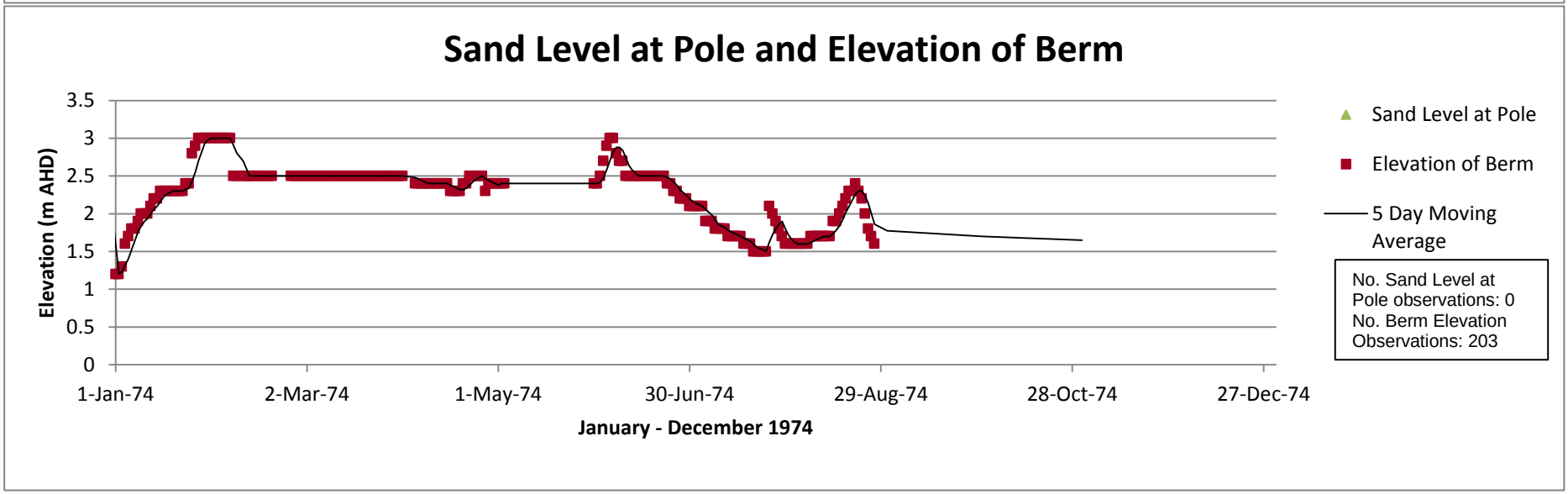
Figure 34





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Beach Profile Parameters – 1974

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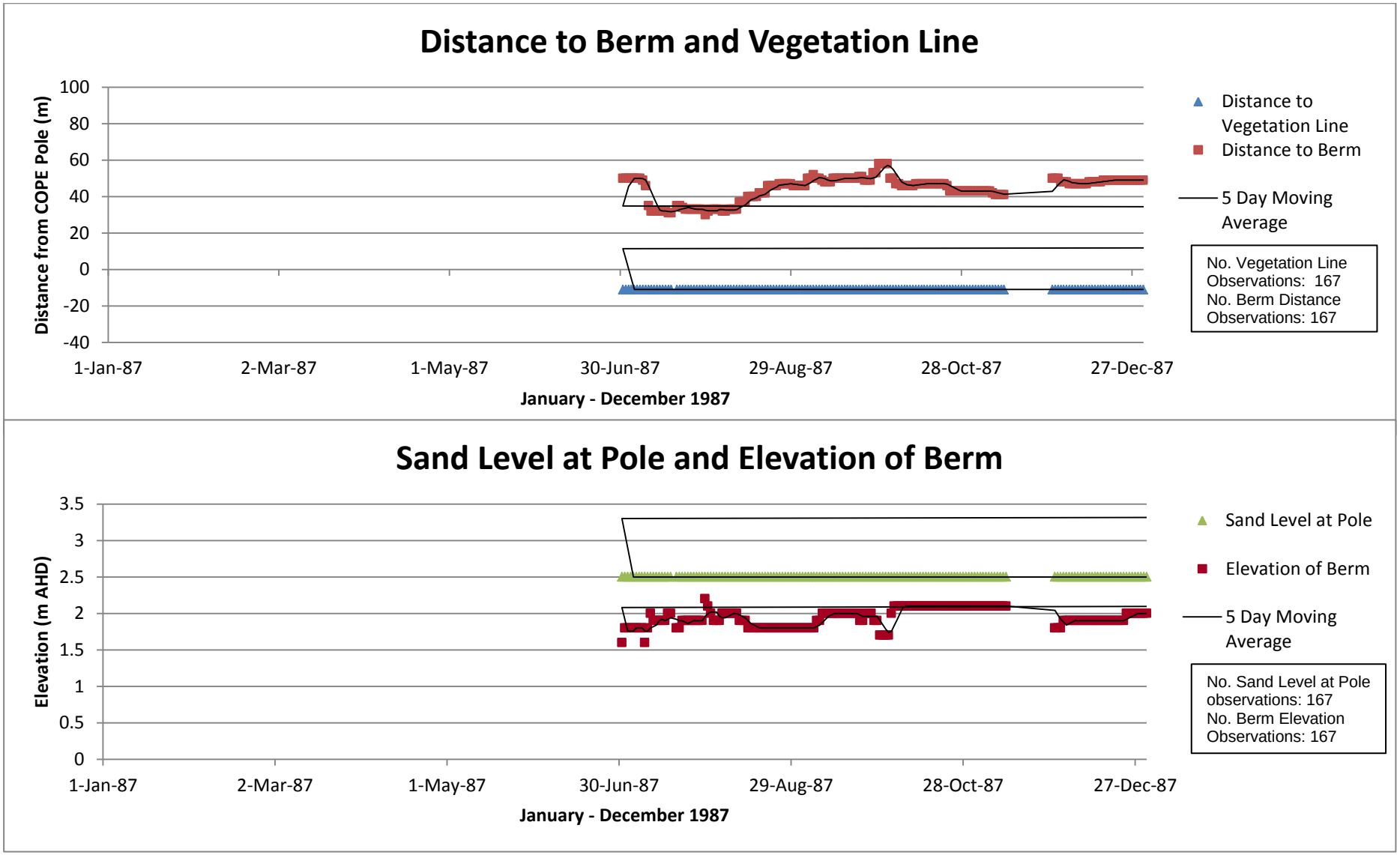
Figure 35



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Beach Profile Parameters – 1987

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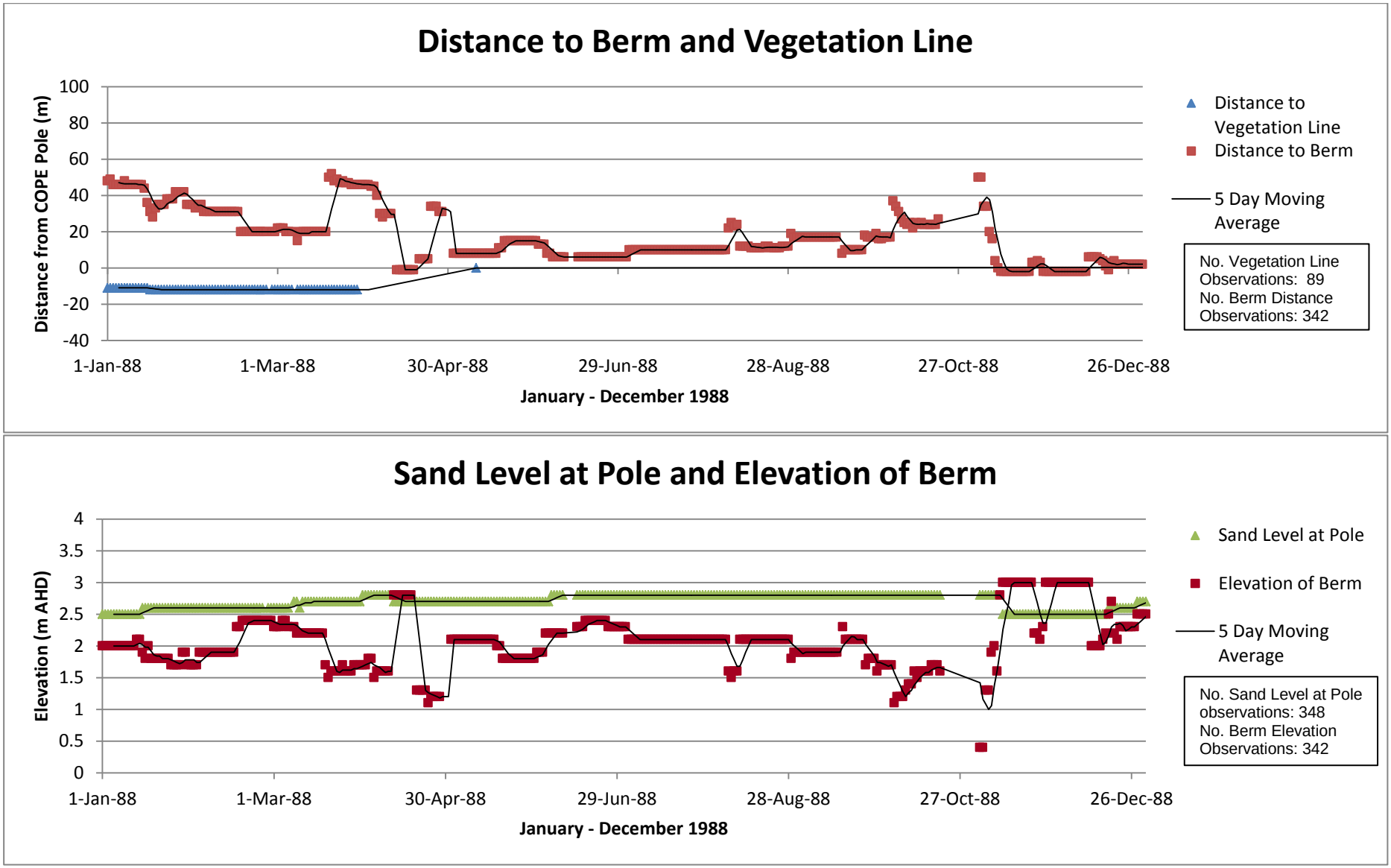
Figure 36



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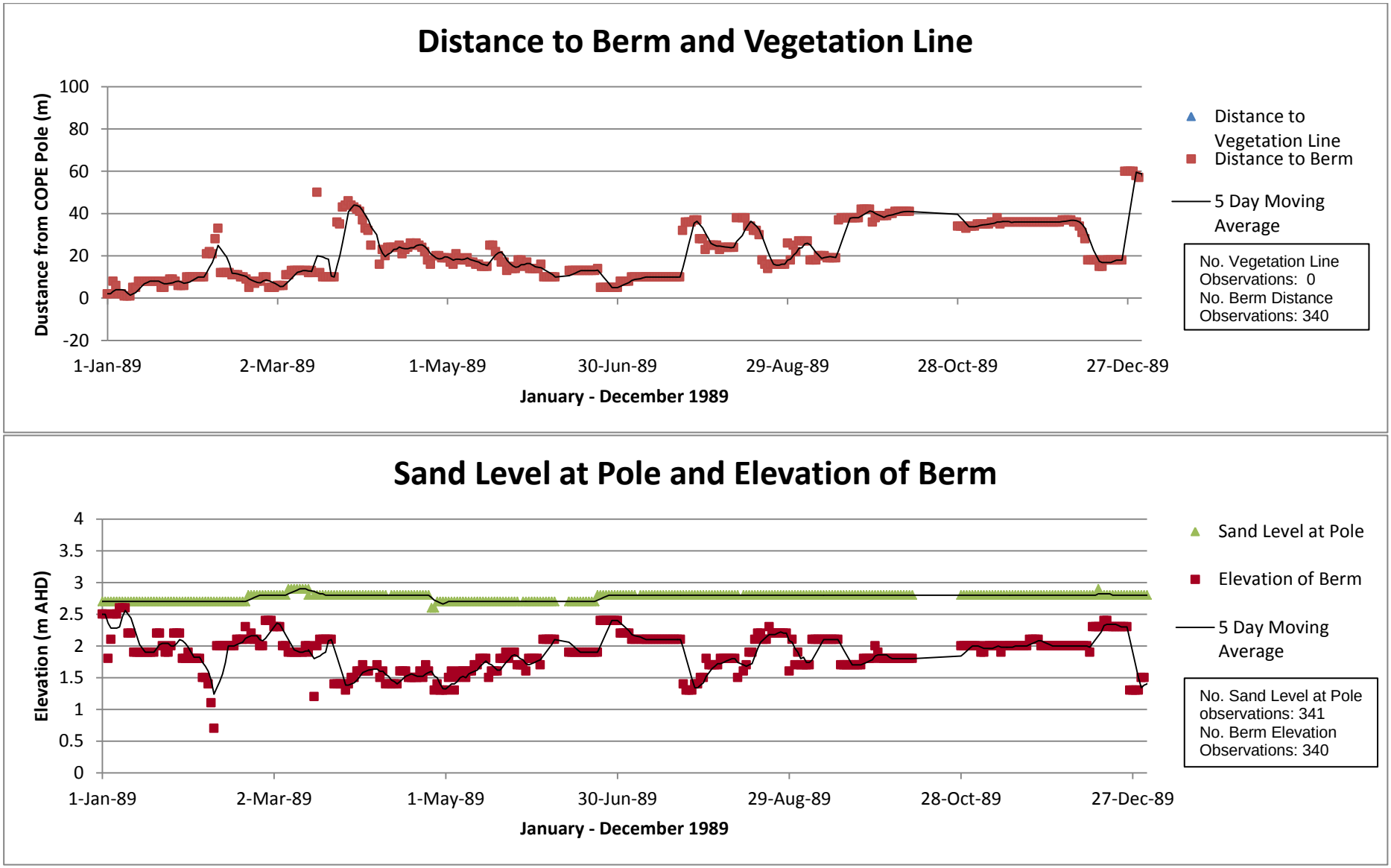
Beach Profile Parameters – 1988

Figure 37



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Beach Profile Parameters – 1989

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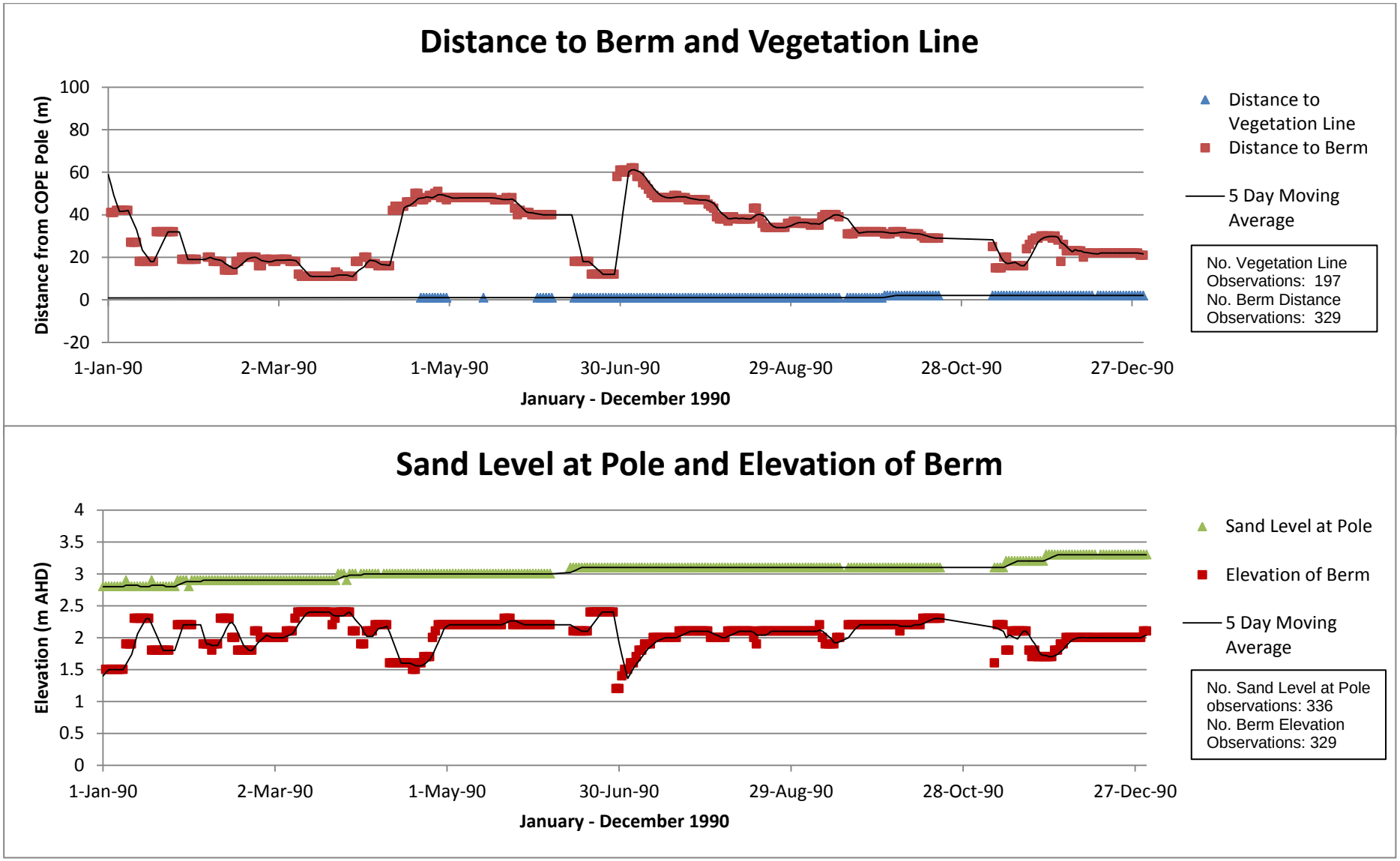
Figure 38



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Beach Profile Parameters – 1990

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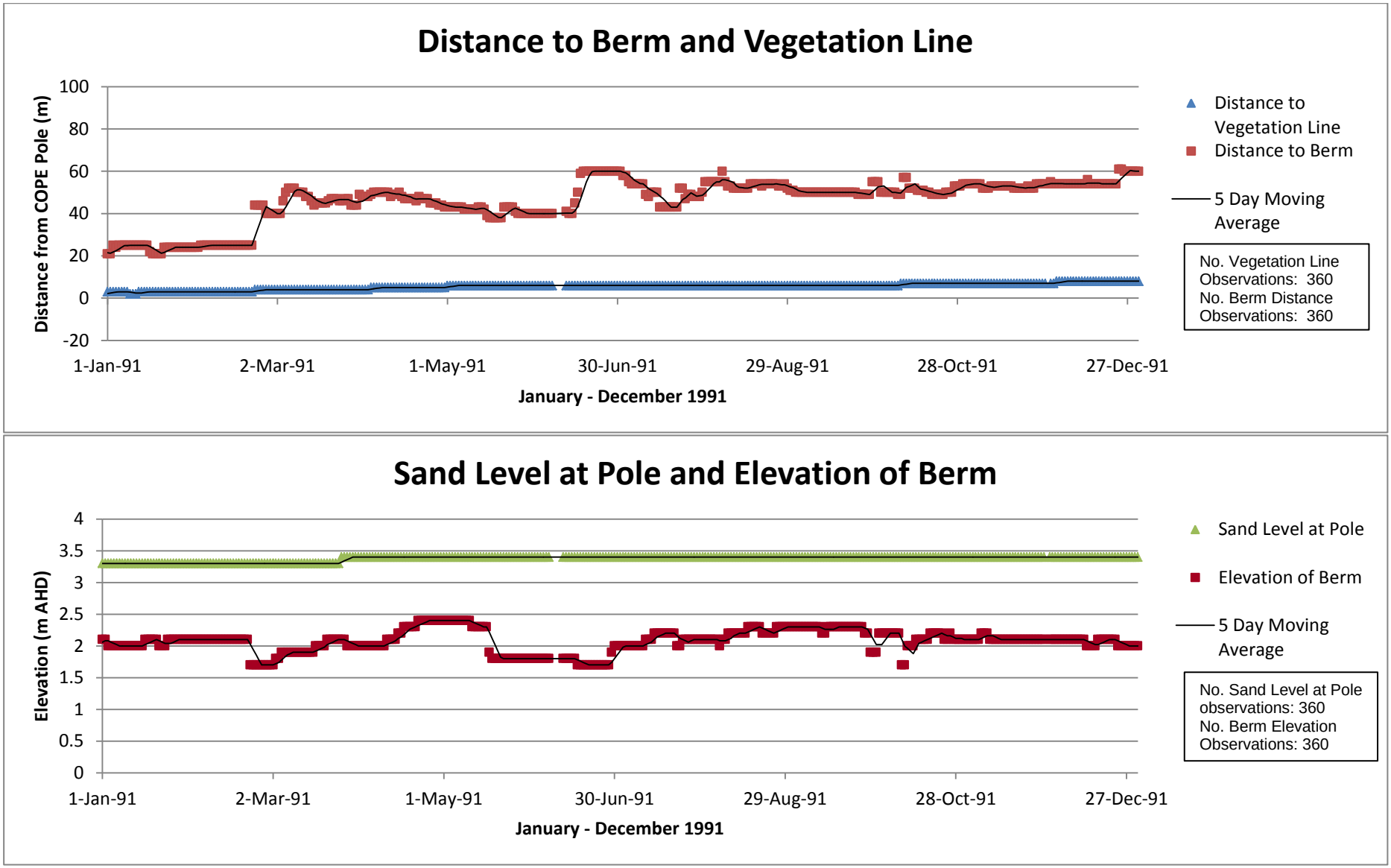
Figure 39



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Beach Profile Parameters – 1991

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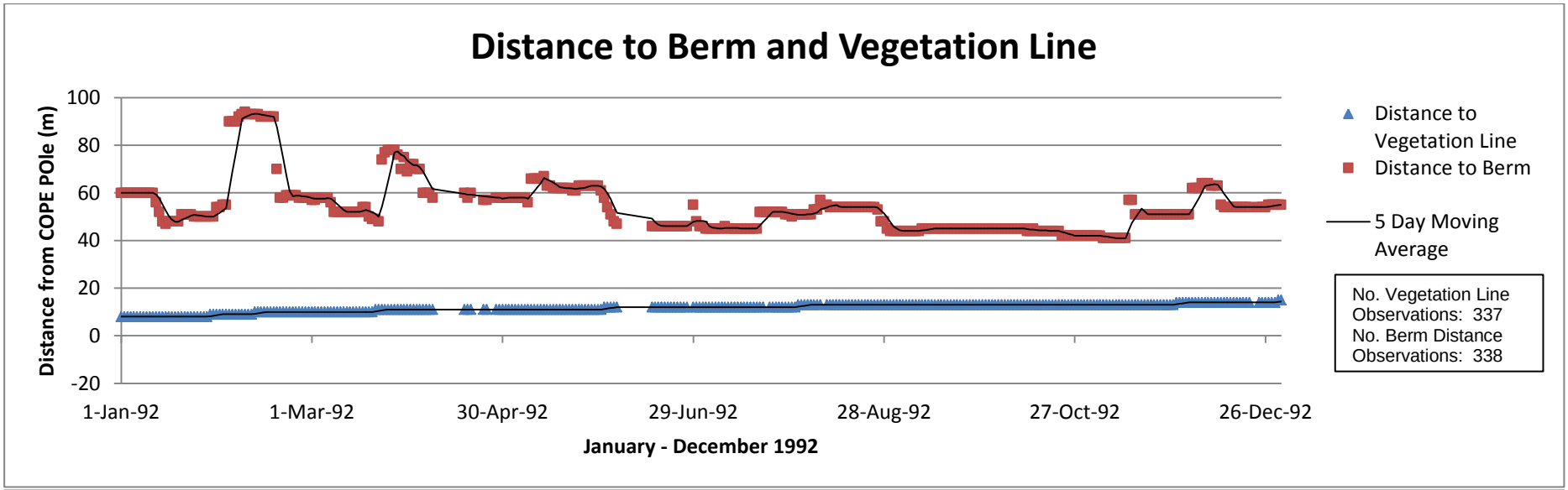
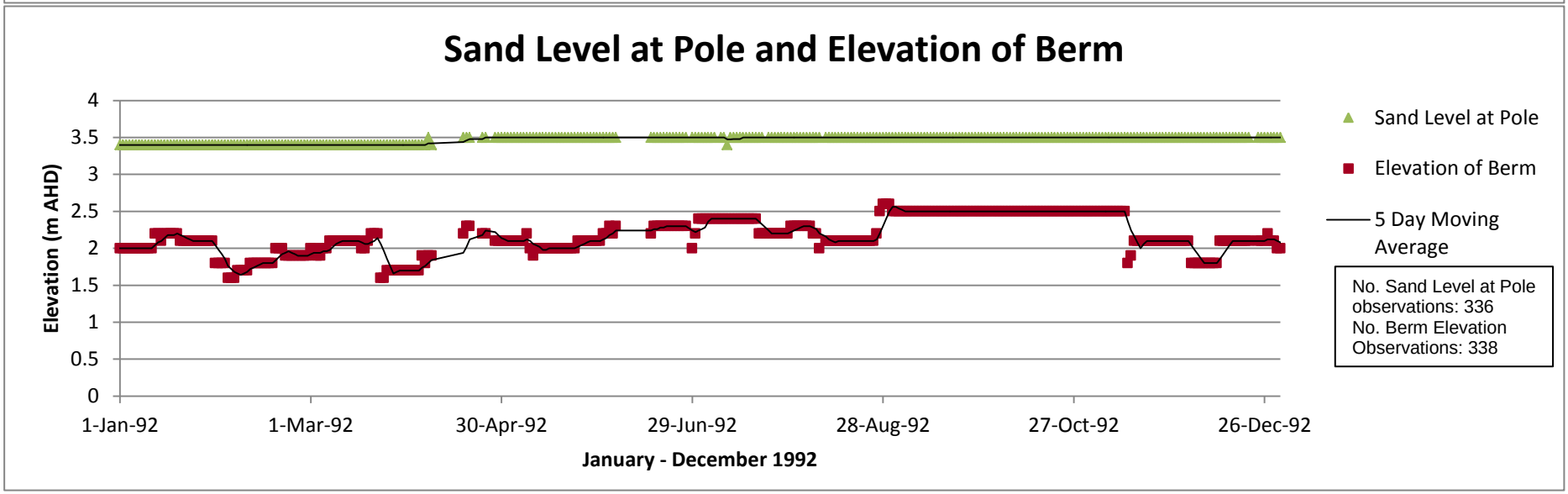
Figure 40





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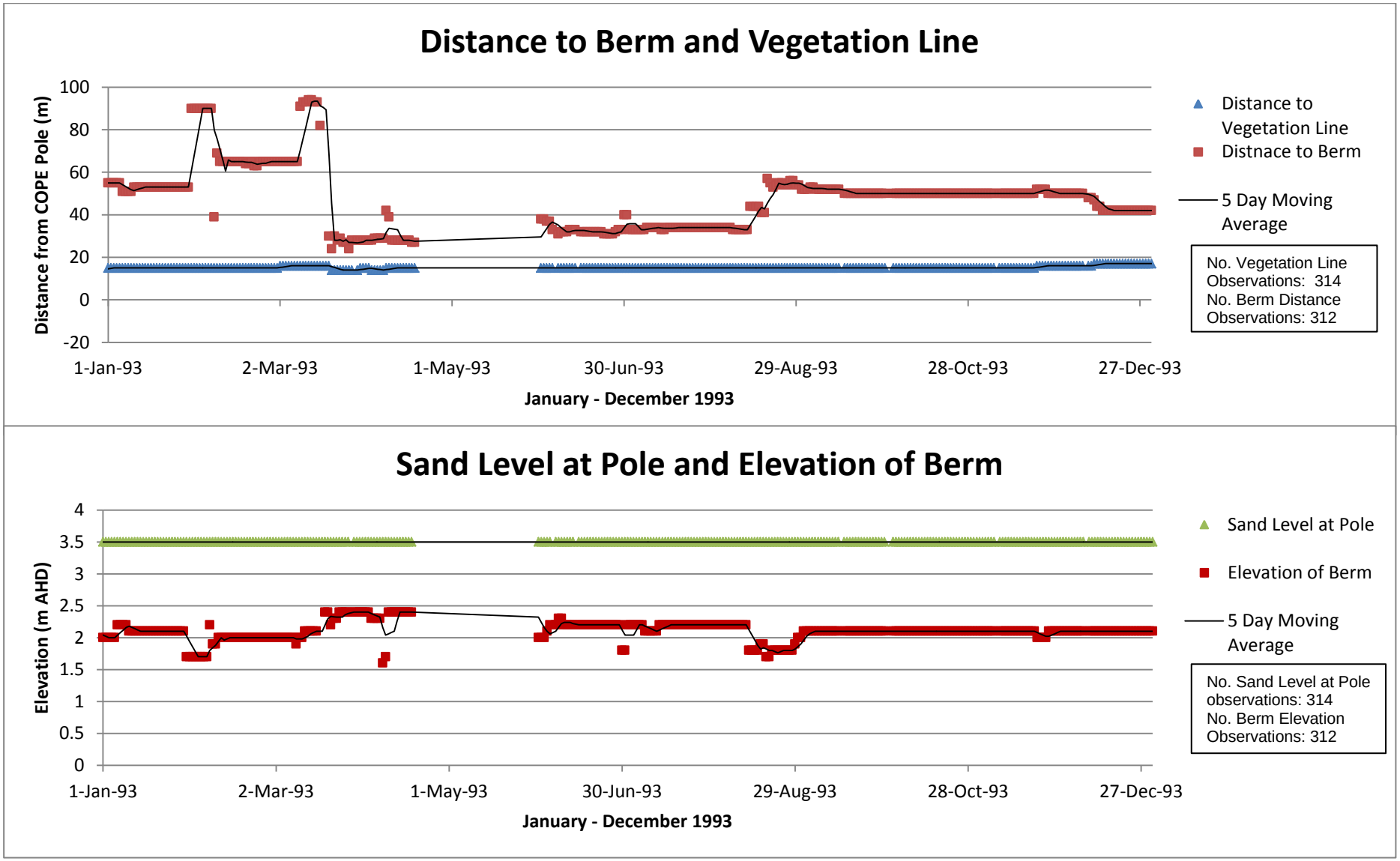
Beach Profile Parameters – 1992

Figure 41



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Beach Profile Parameters – 1993

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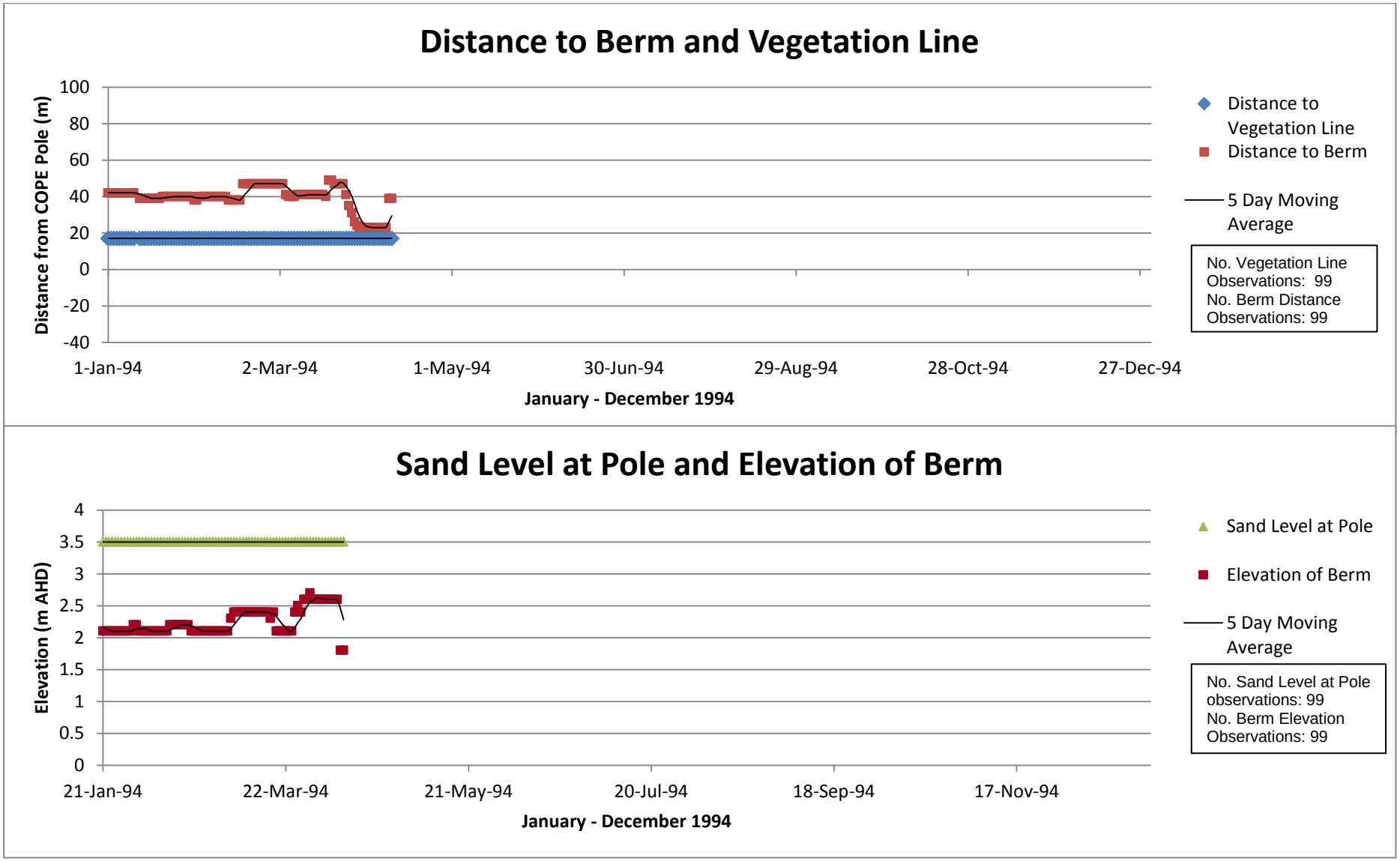
Figure 42



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Beach Profile Parameters – 1994

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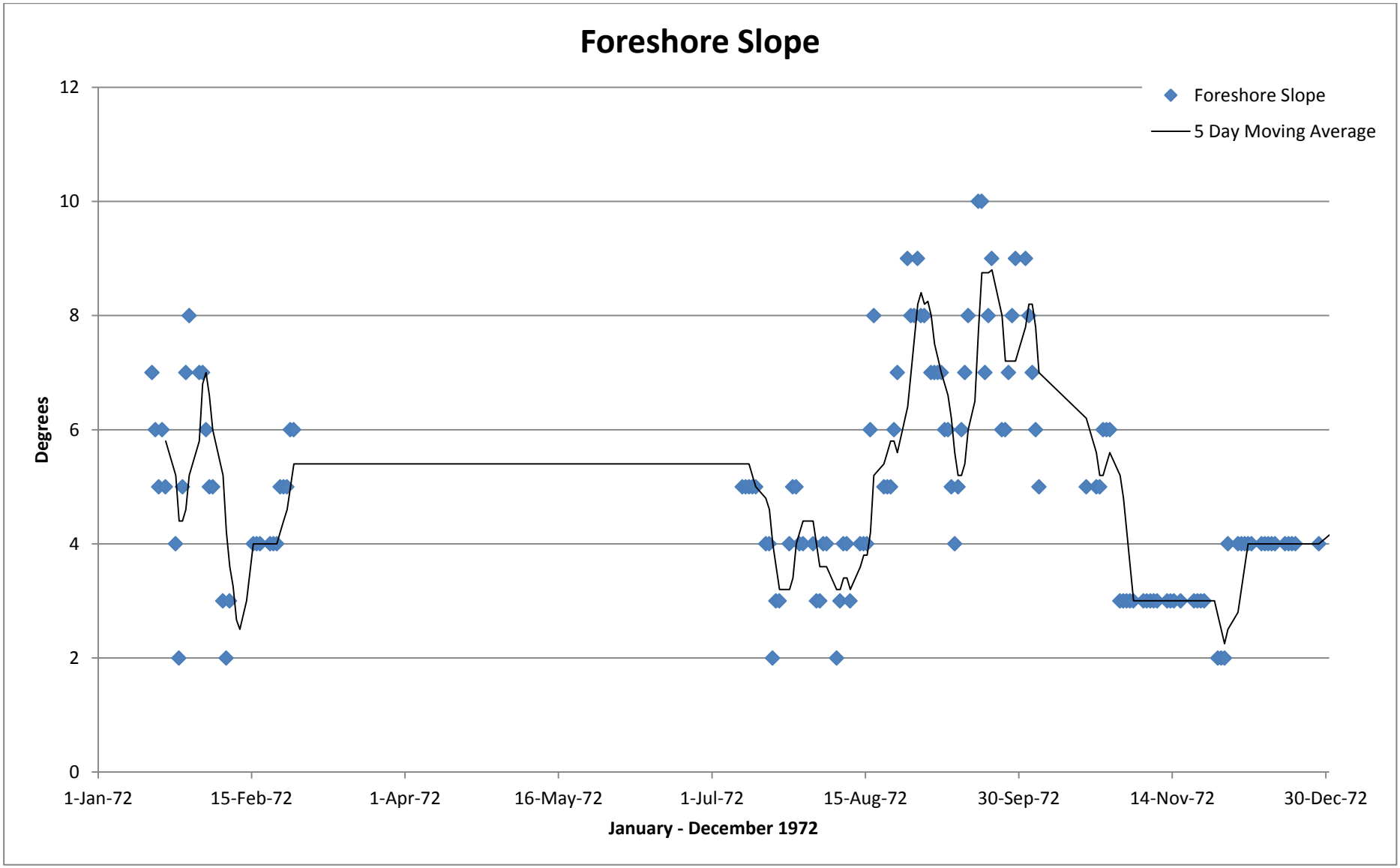
Figure 43



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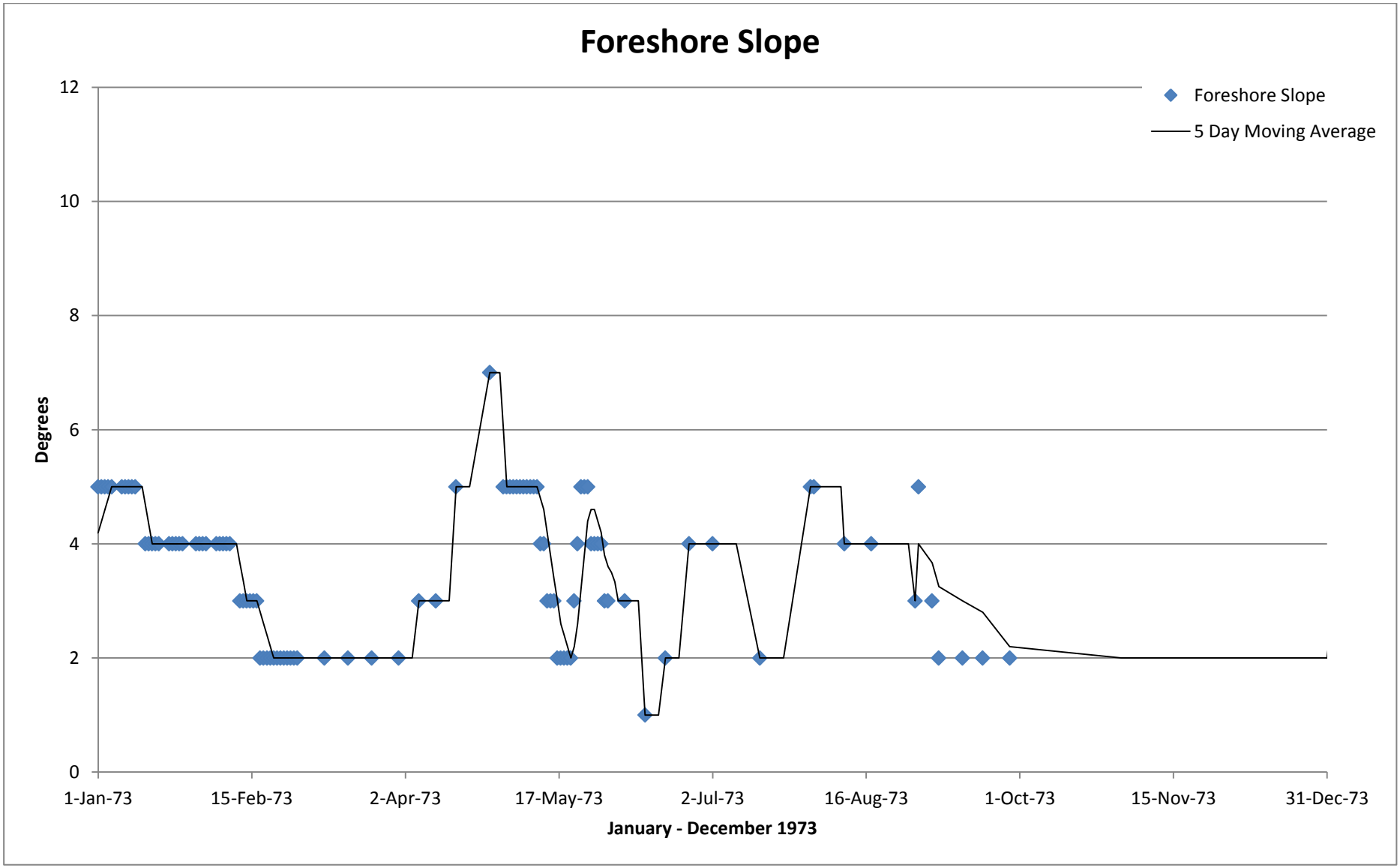
Foreshore Slope – 1972

Figure 44



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Foreshore Slope – 1973

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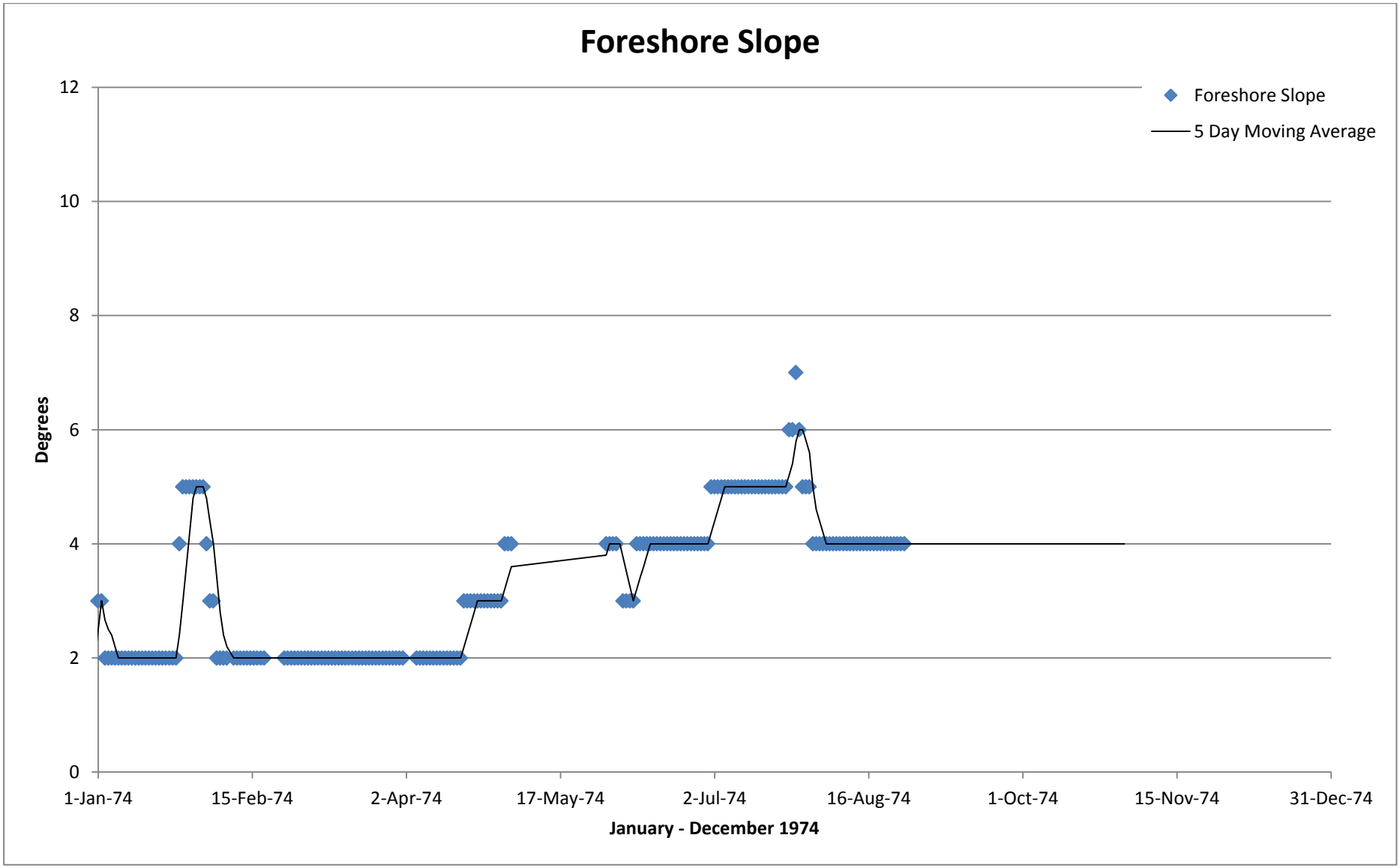
Figure 45



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Foreshore Slope – 1974

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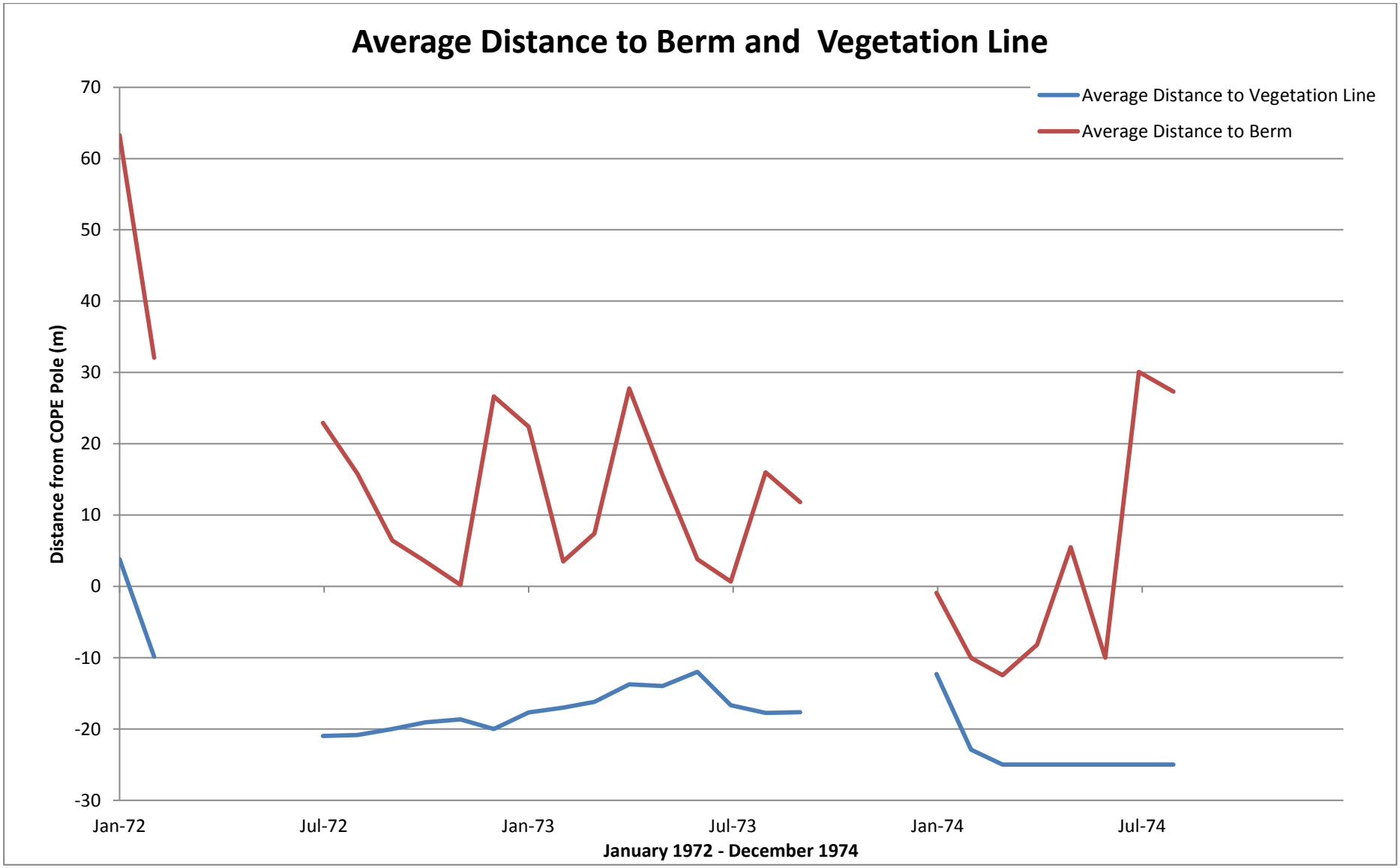
Figure 46



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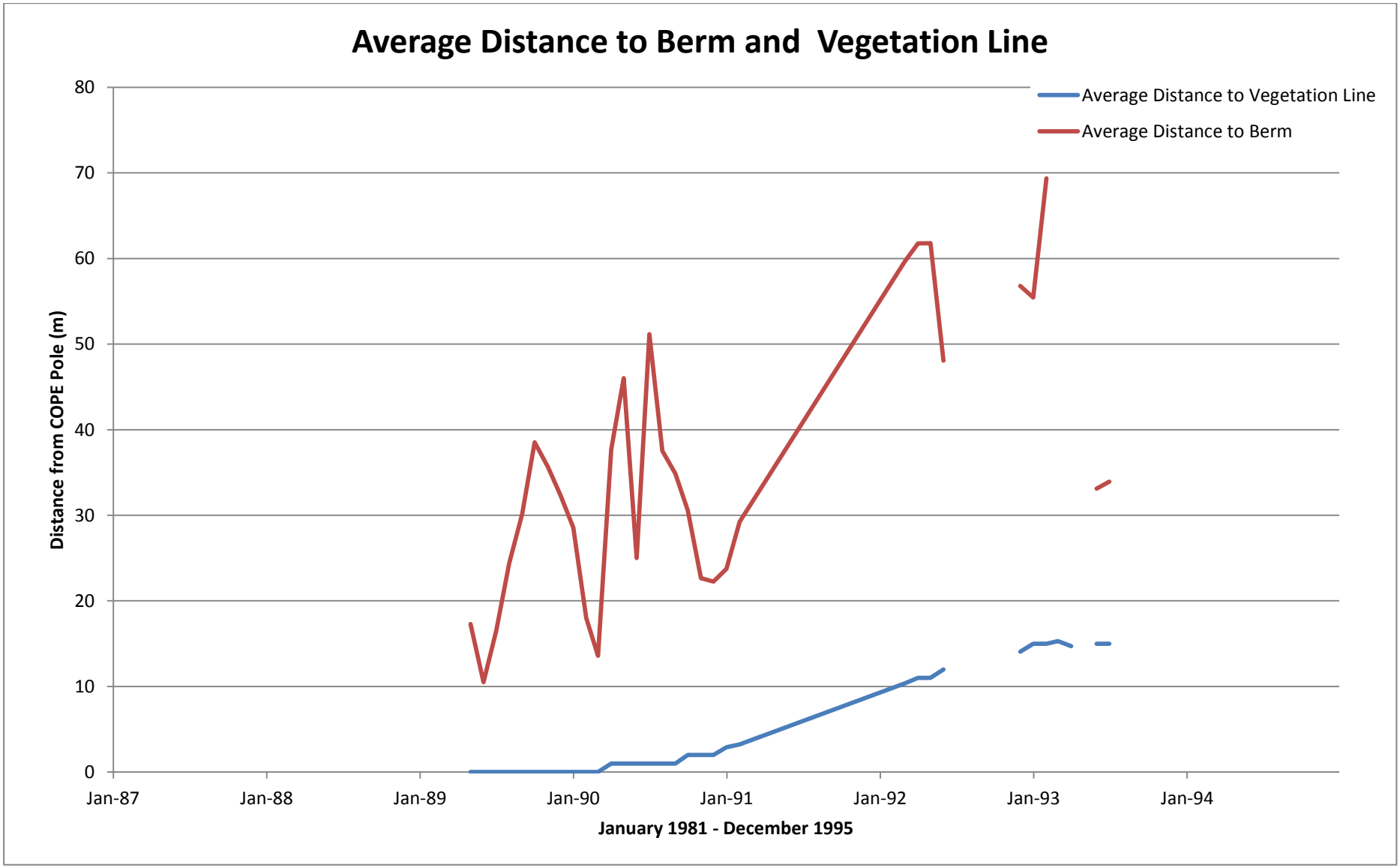
Average Distance to Berm and Vegetation Line

Figure 47



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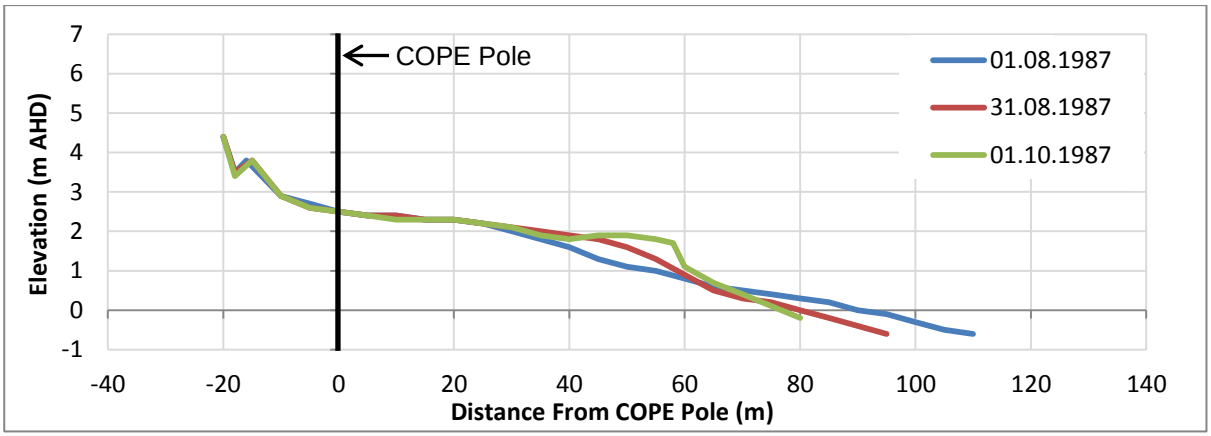
Average Distance to Berm and Vegetation Line

Figure 48



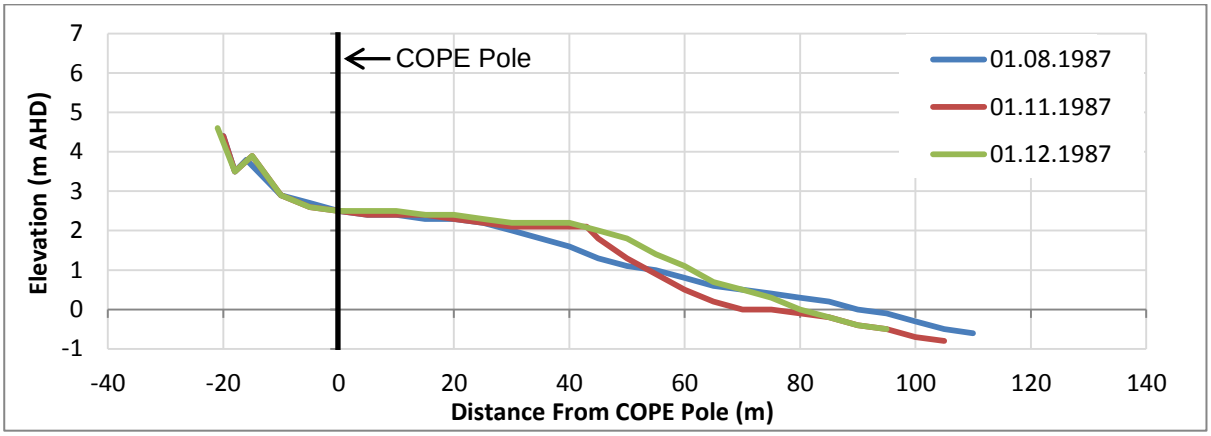


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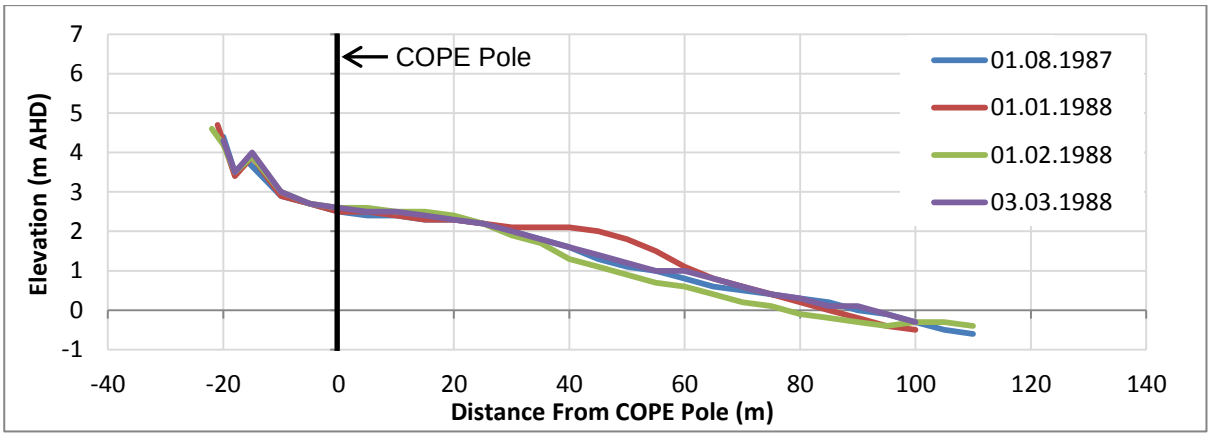
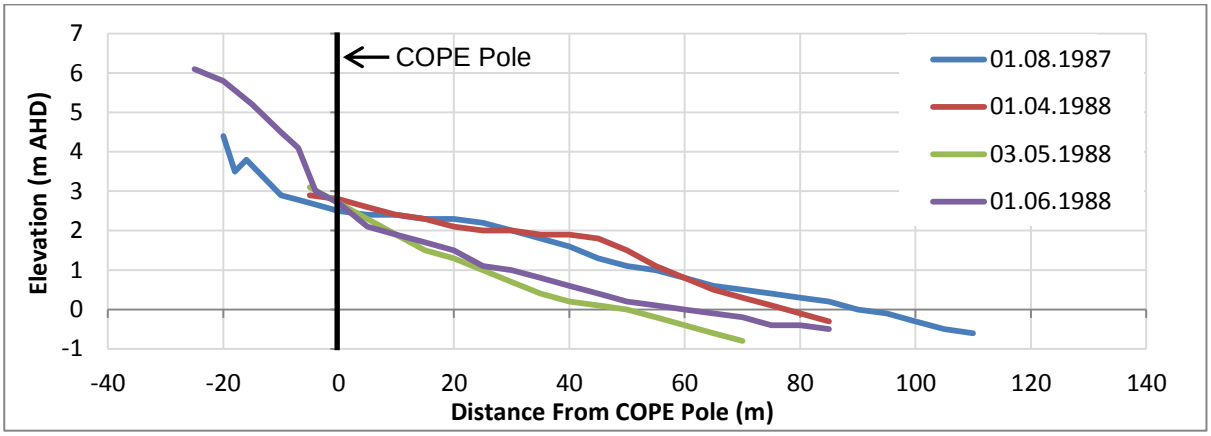
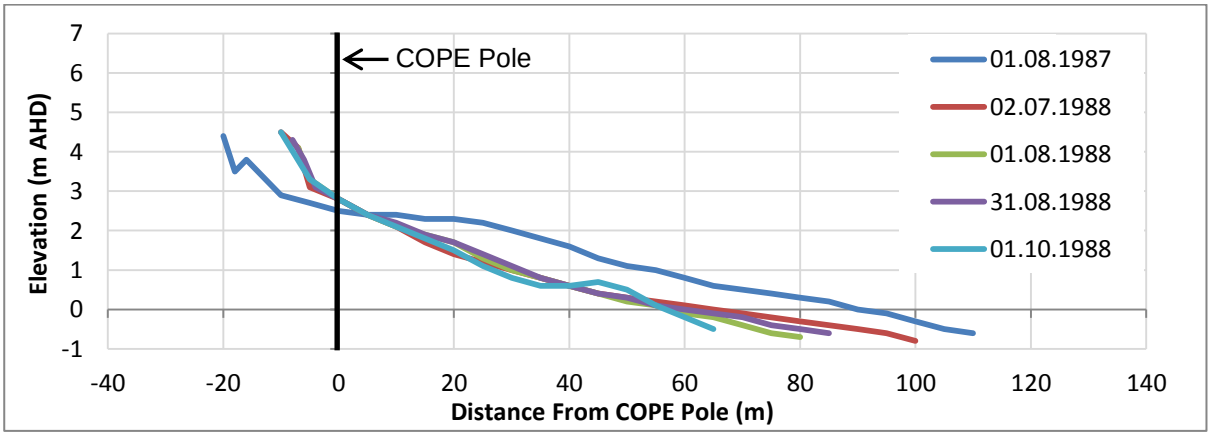
Figure 49

Monthly Beach Profiles – 1987







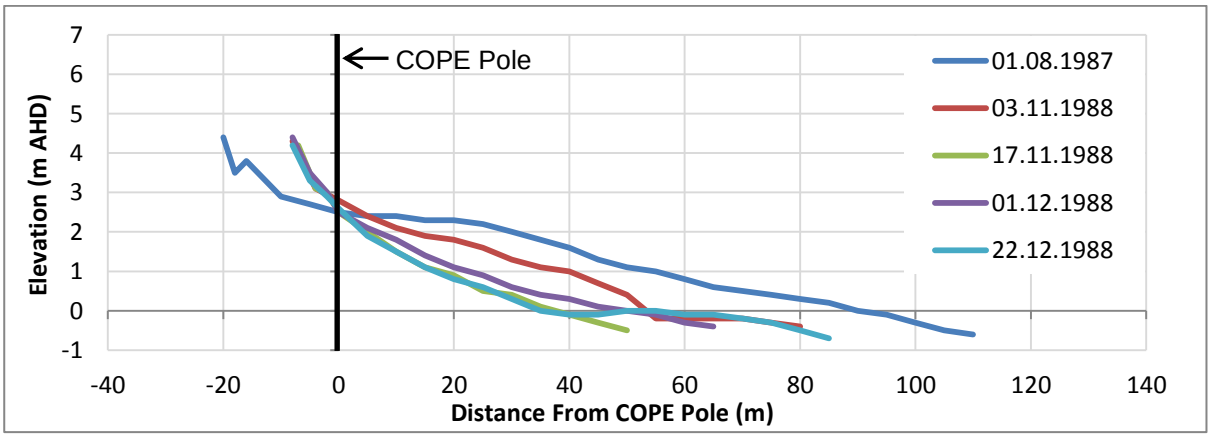


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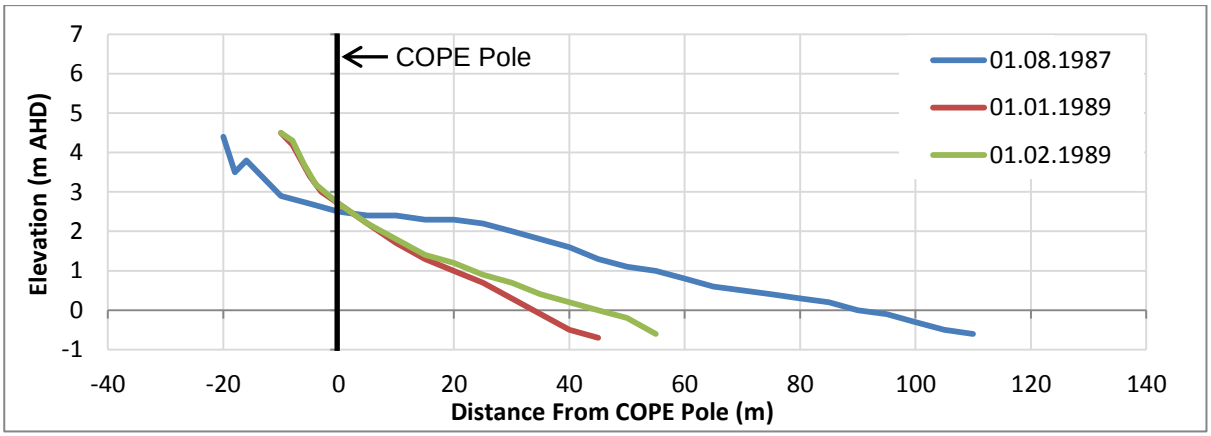
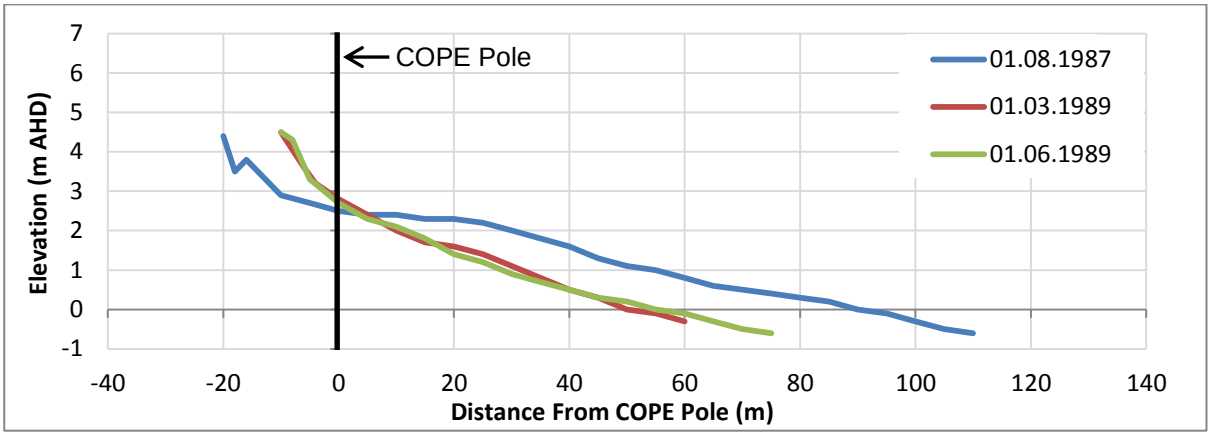
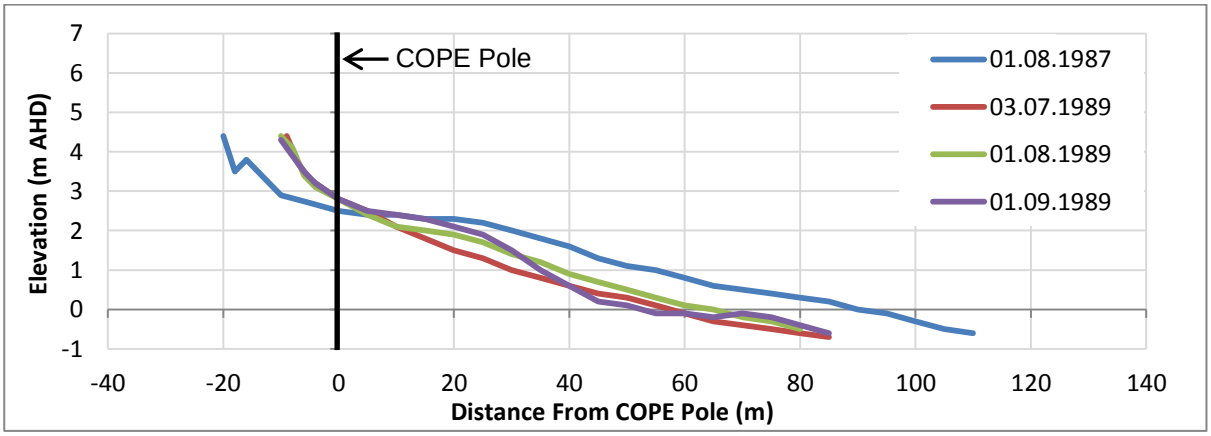
Figure 50

Monthly Beach Profiles – 1988







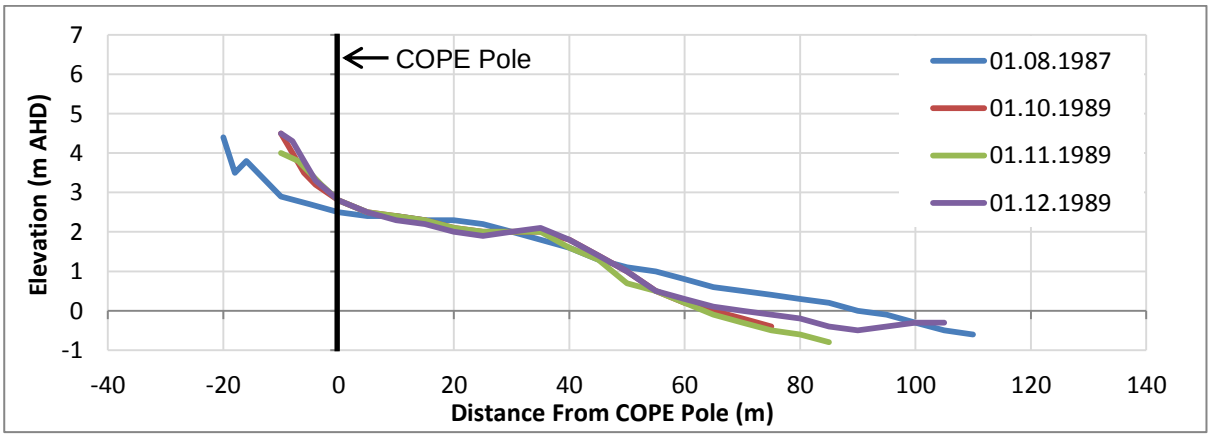


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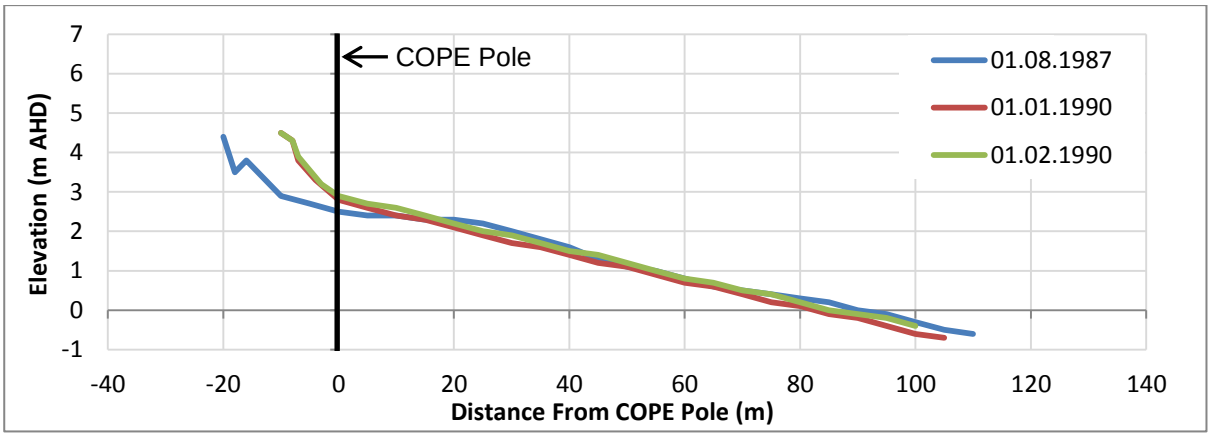
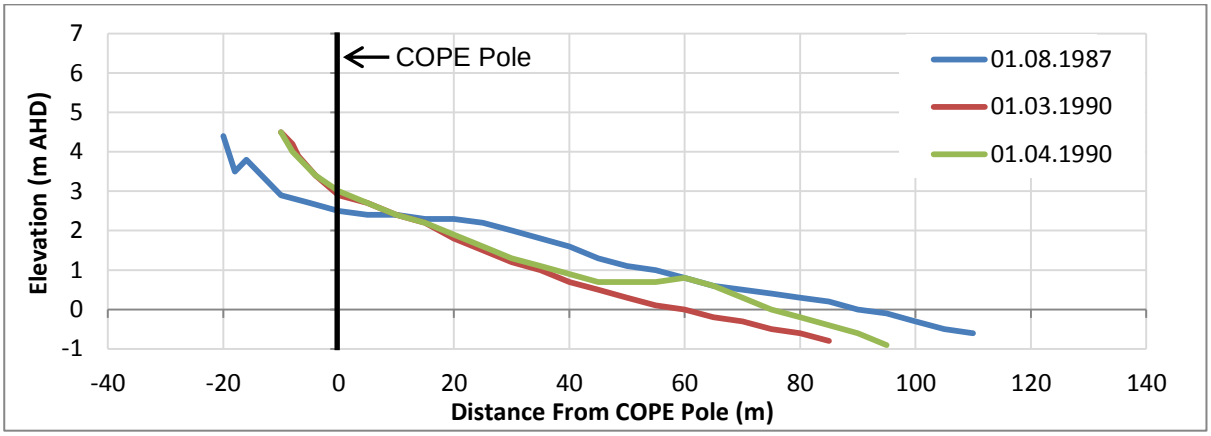
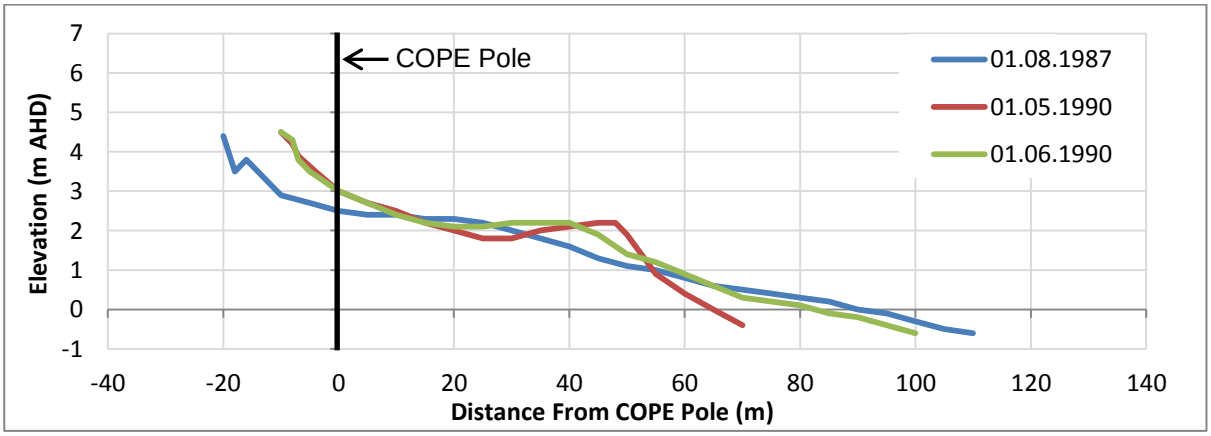
Figure 51

Monthly Beach Profiles – 1989







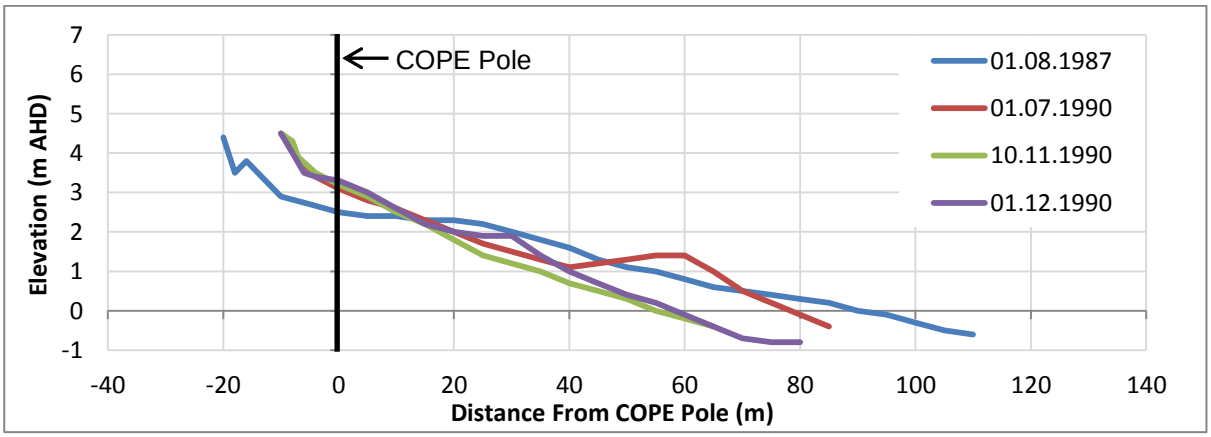


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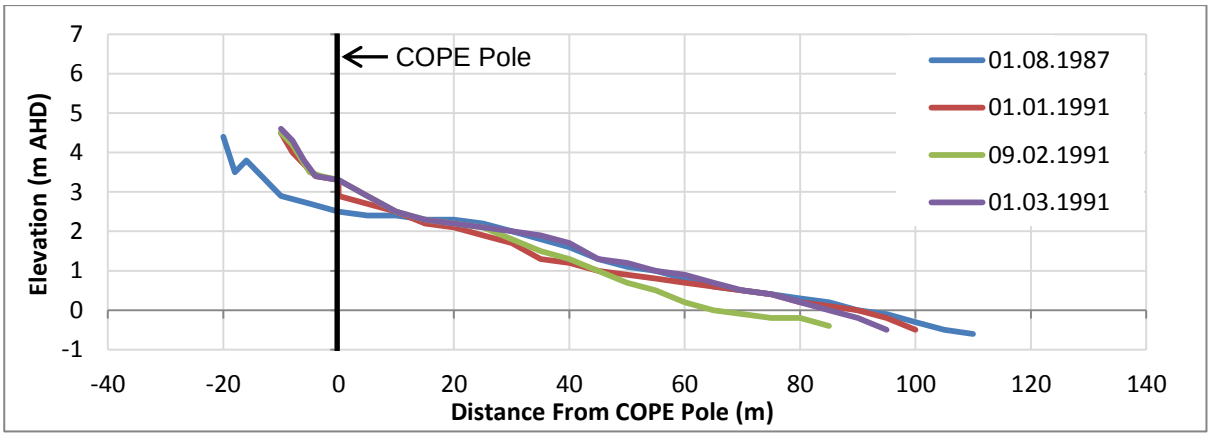
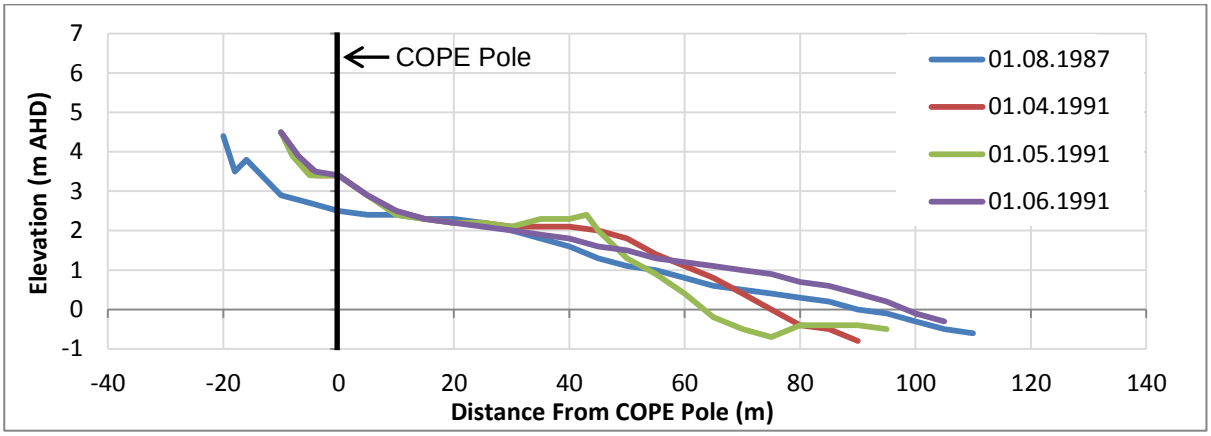
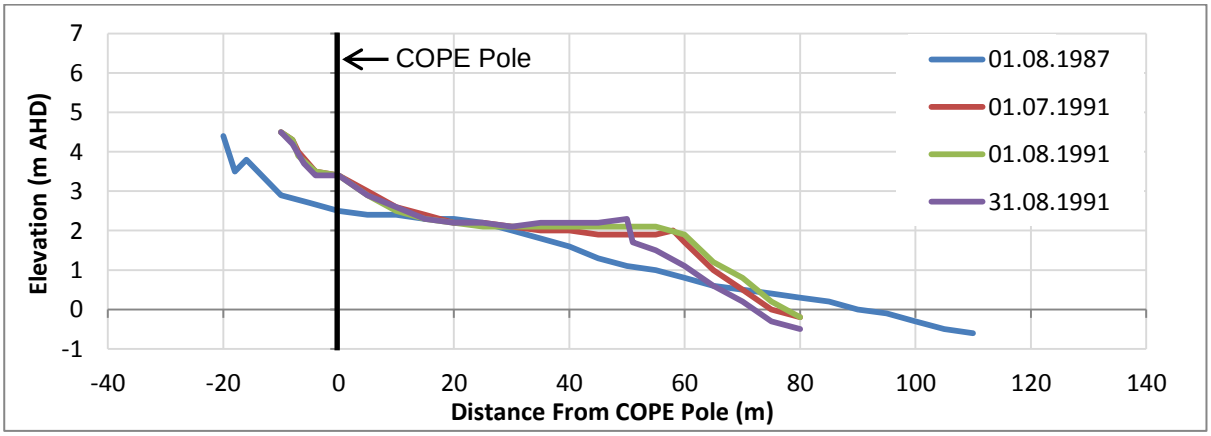
Figure 52

Monthly Beach Profiles – 1990







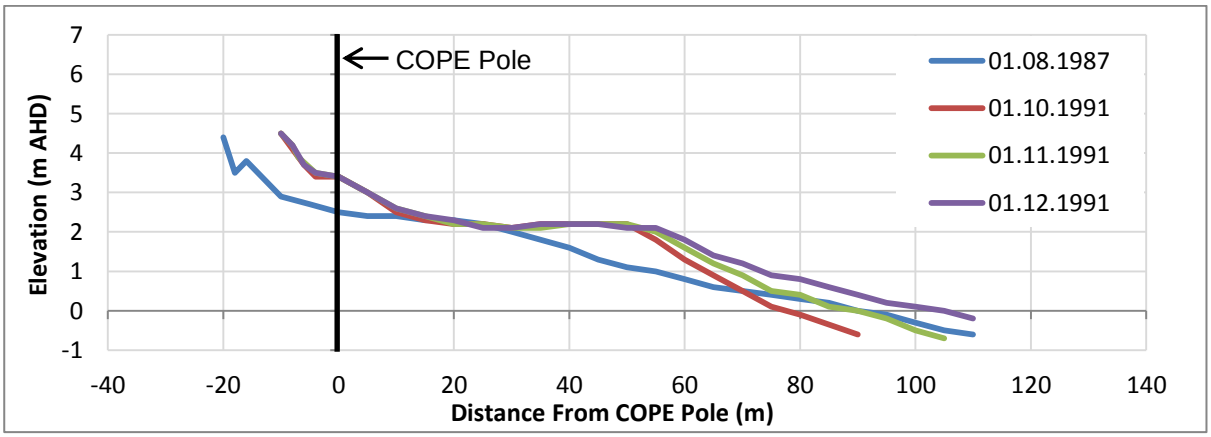


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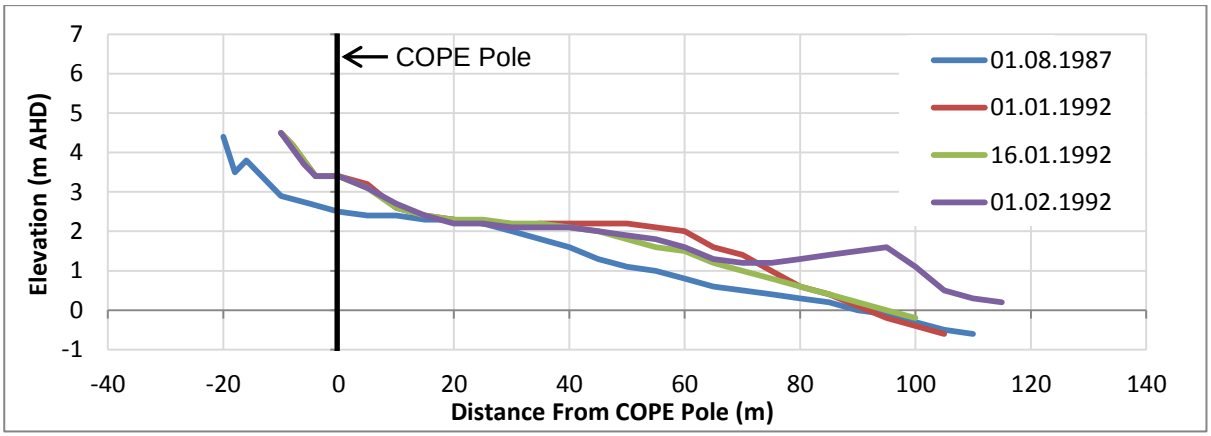
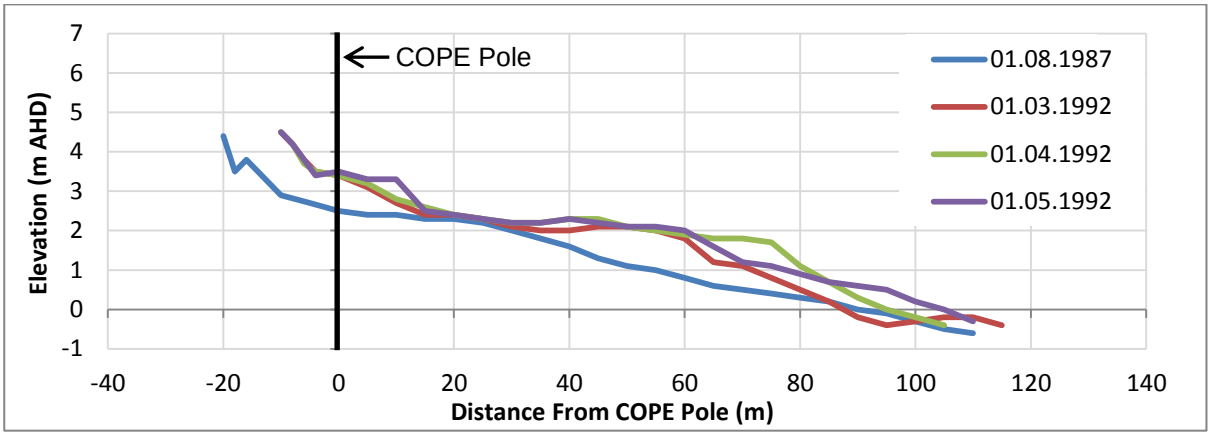
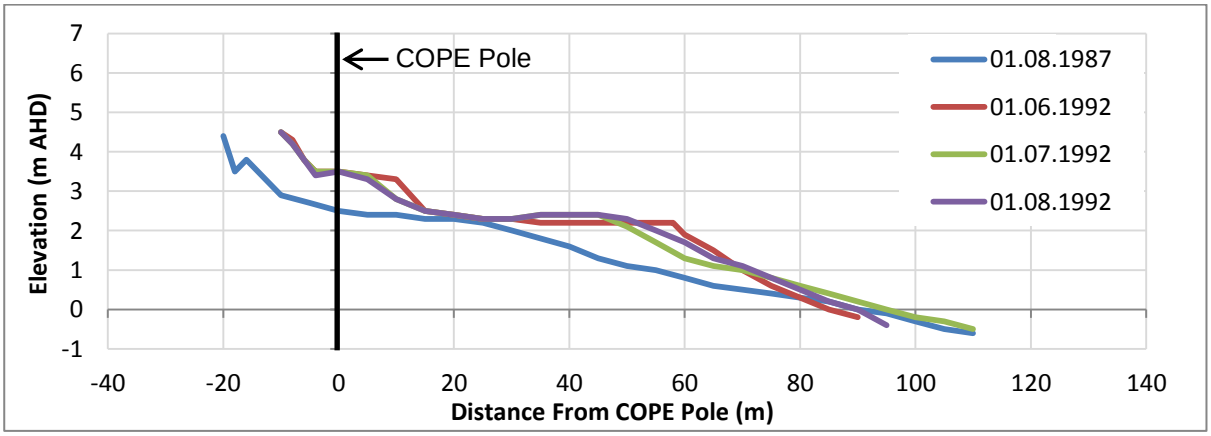
Figure 53

Monthly Beach Profiles – 1991







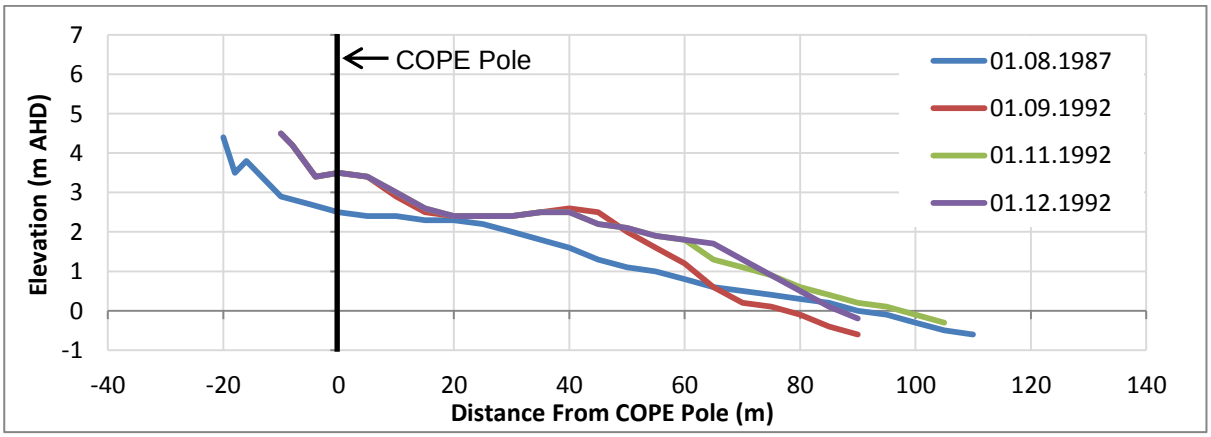


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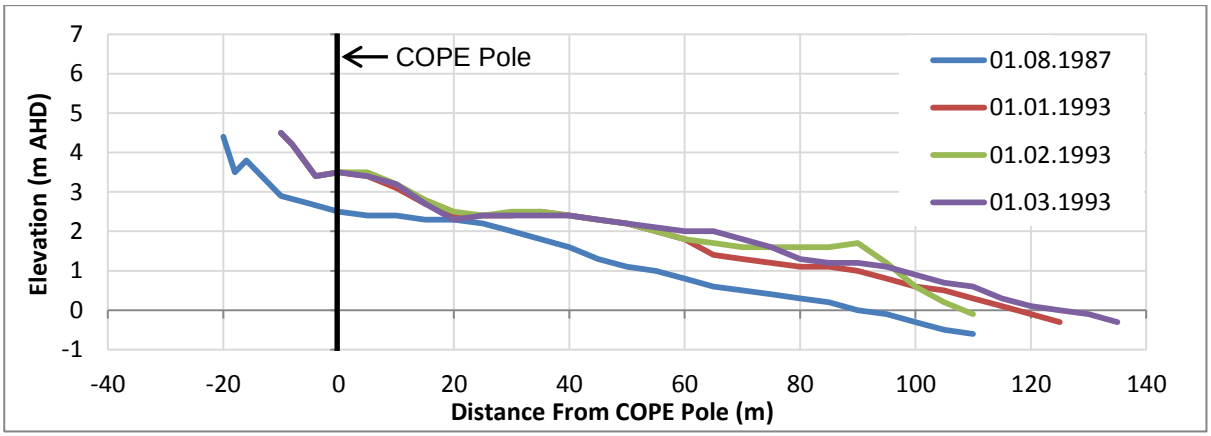
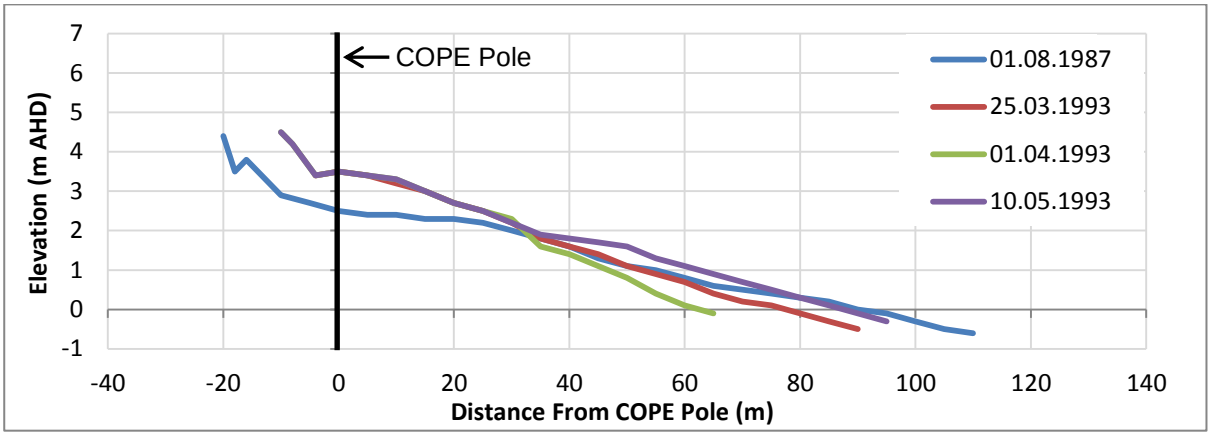
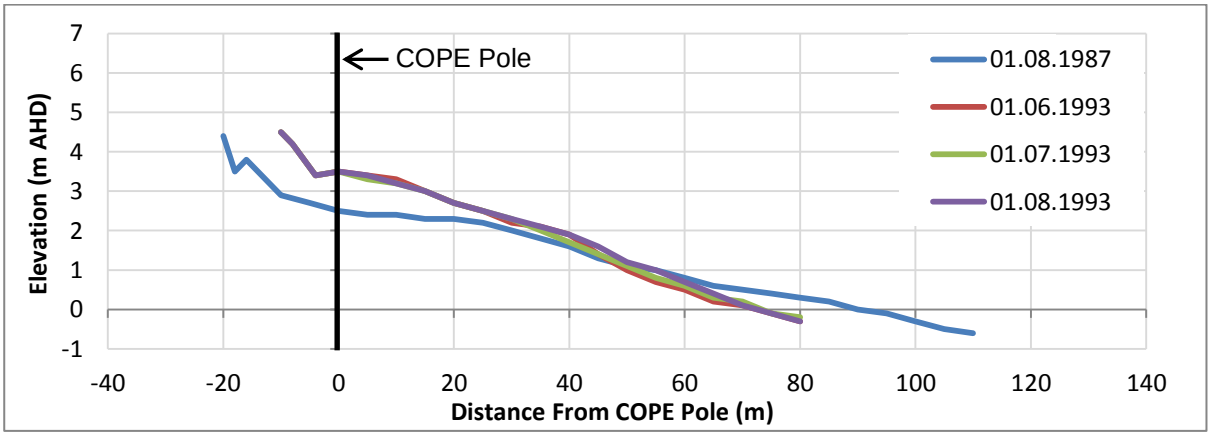
Figure 54

Monthly Beach Profiles – 1992







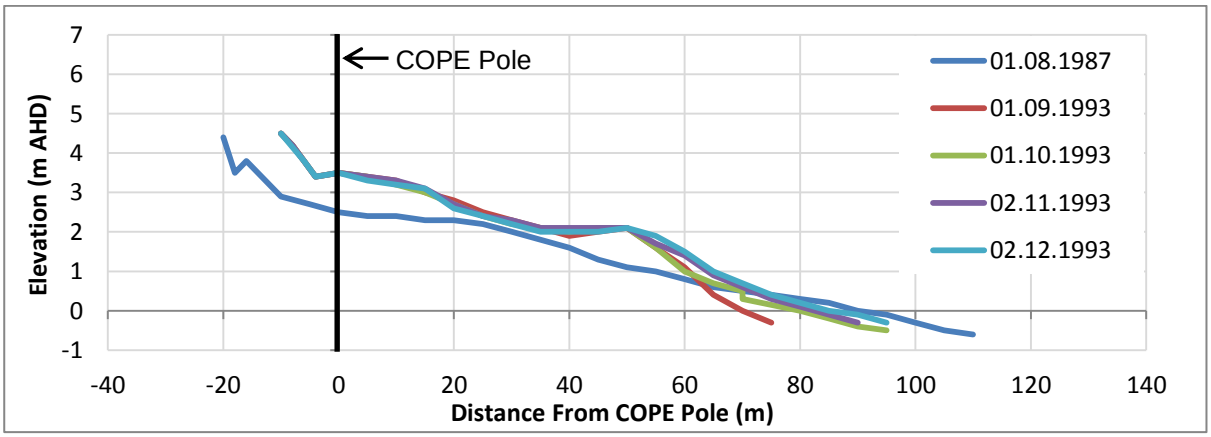


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Figure 55

Monthly Beach Profiles – 1993

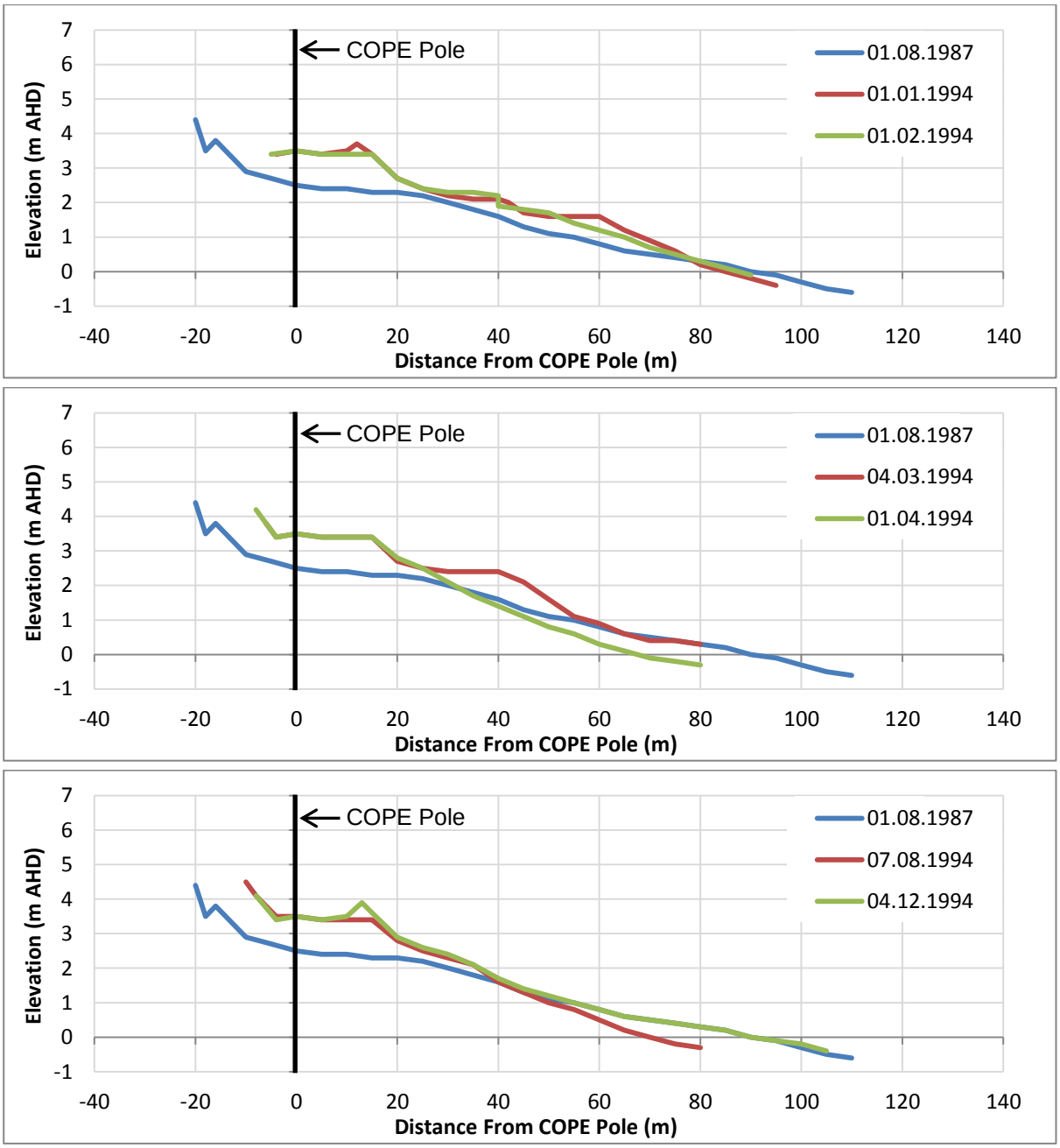

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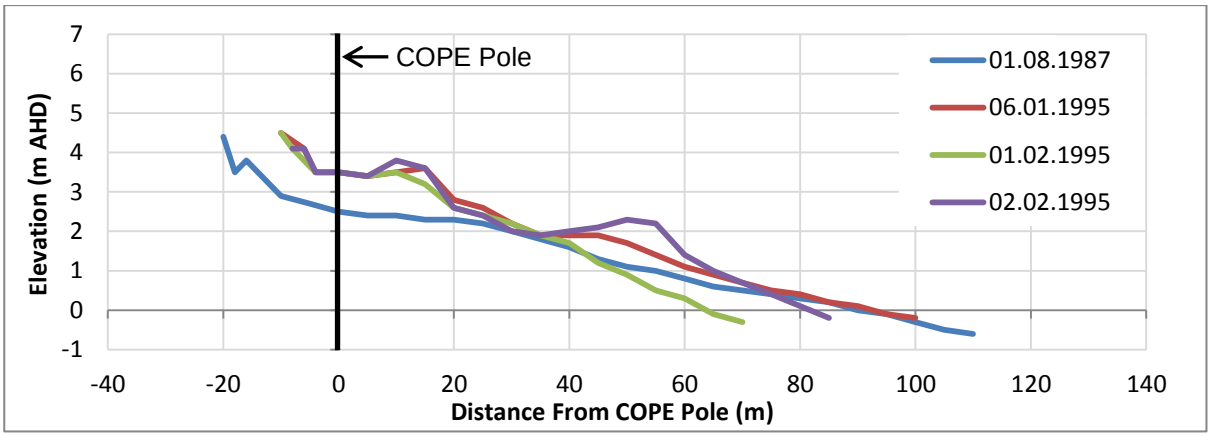
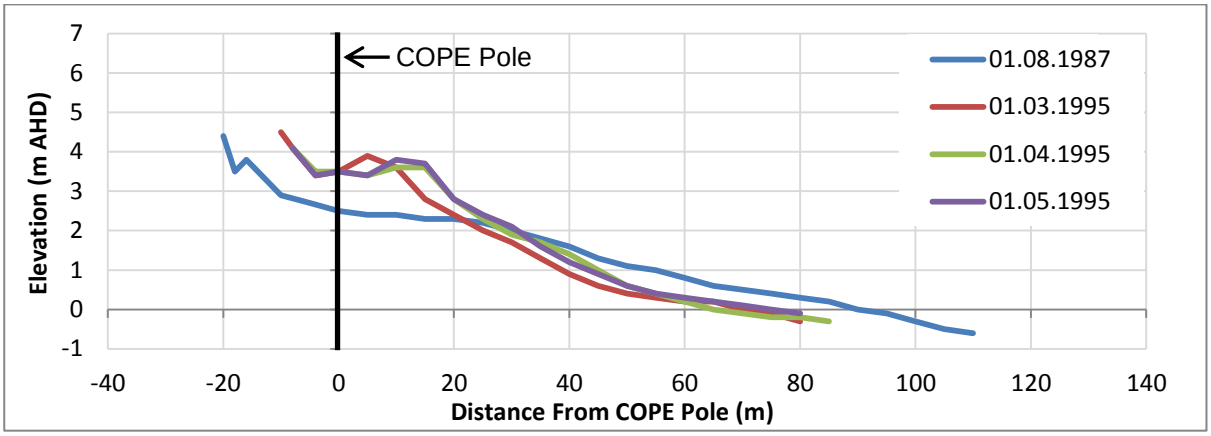
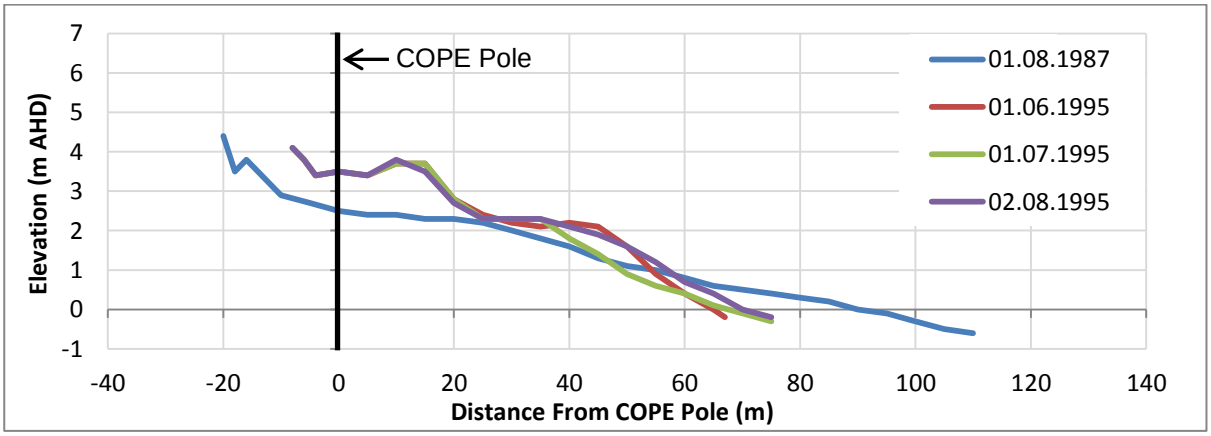
Figure 56

Monthly Beach Profiles – 1994







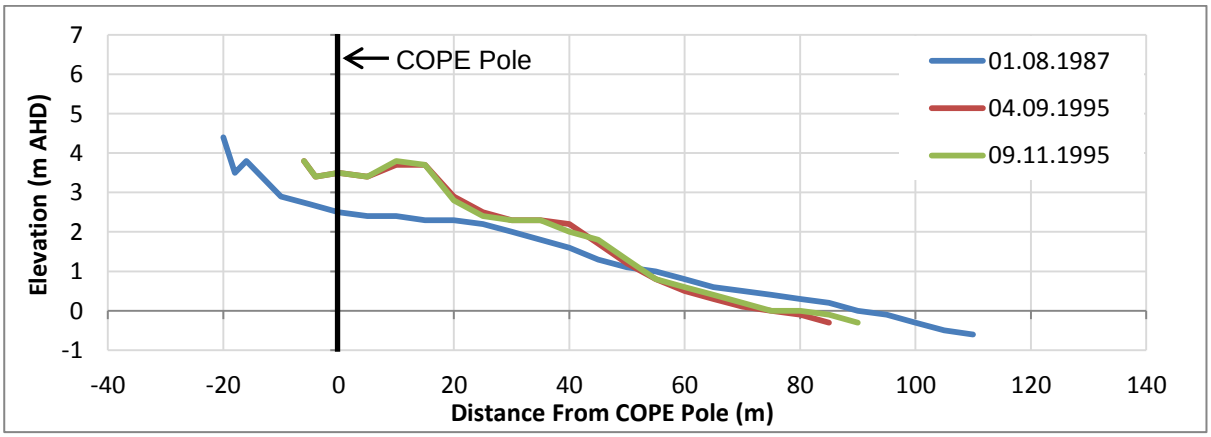


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Figure 57

Monthly Beach Profiles – 1995

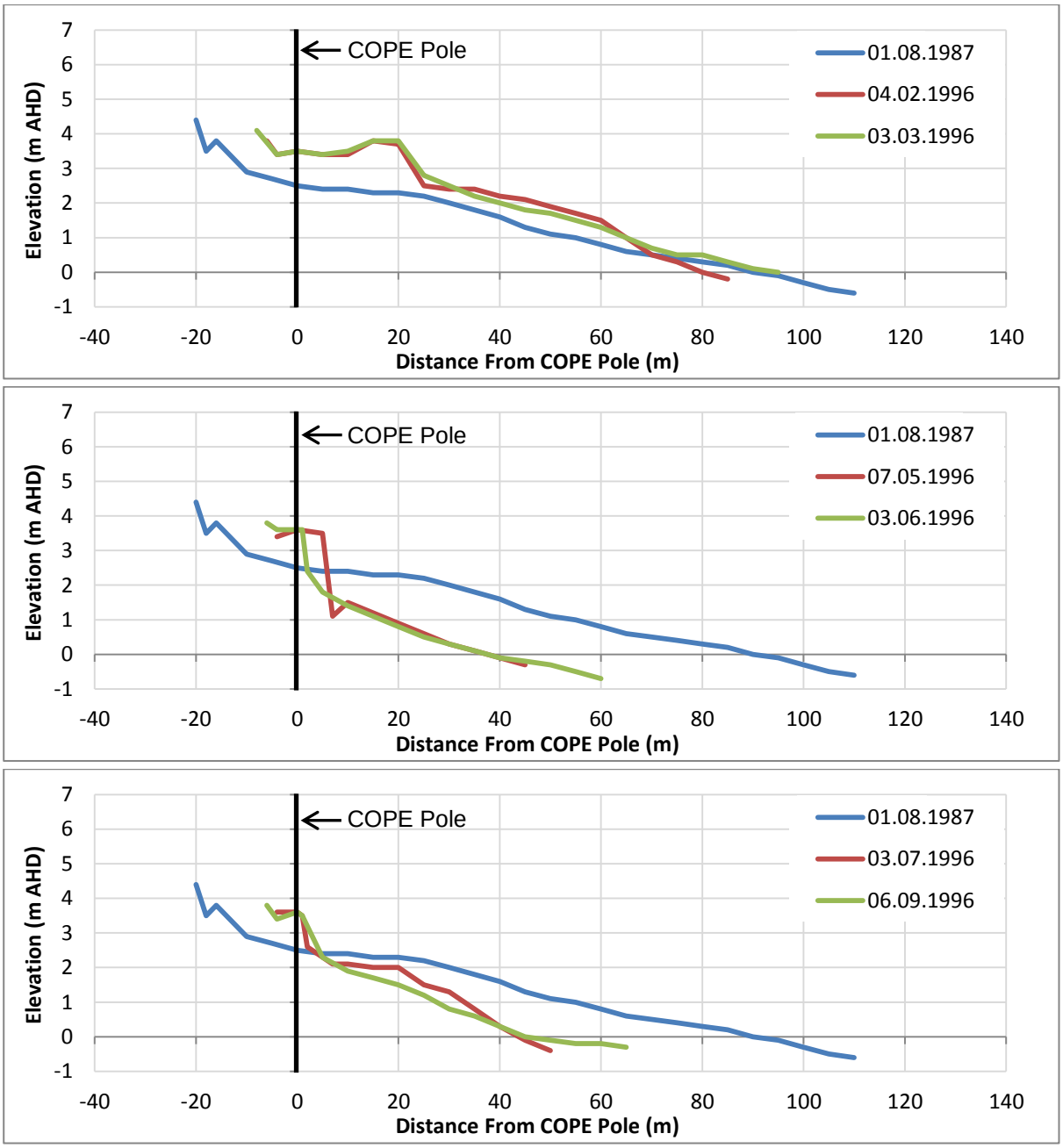

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Figure 58

Monthly Beach Profiles – 1996

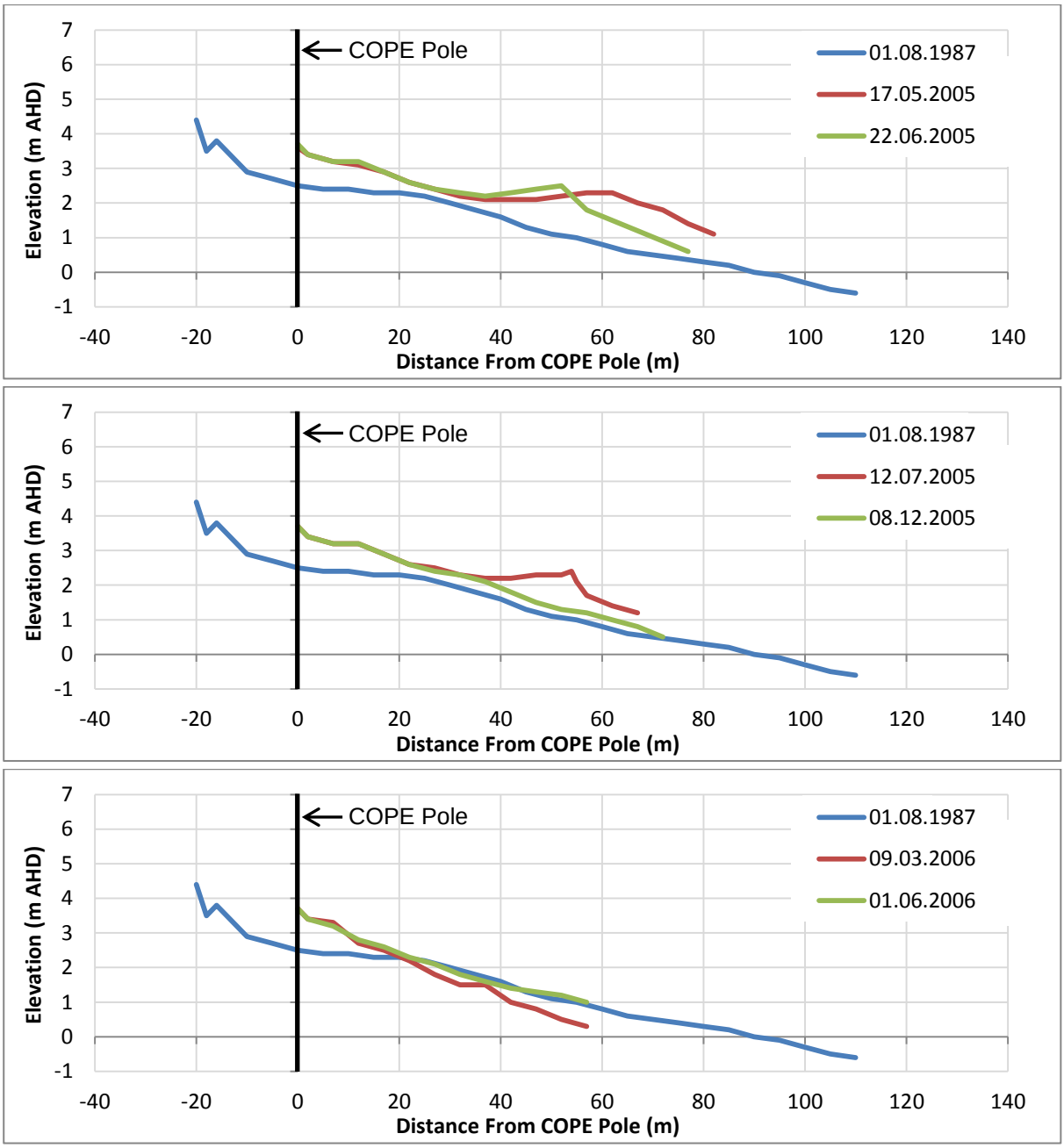

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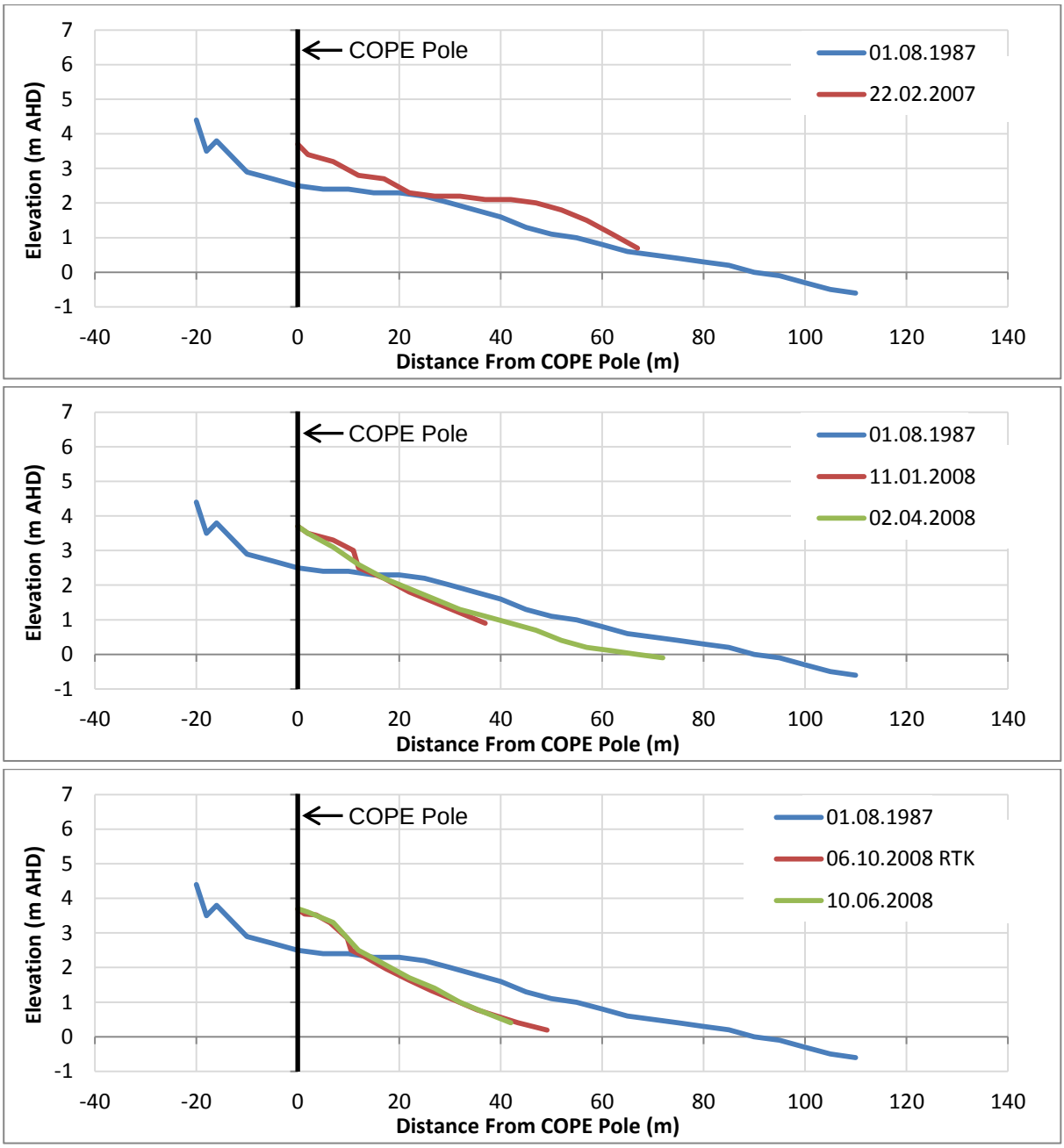
Figure 59

Monthly Beach Profiles – 2005 – 2006



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Burleigh Heads COPE Data Compilation

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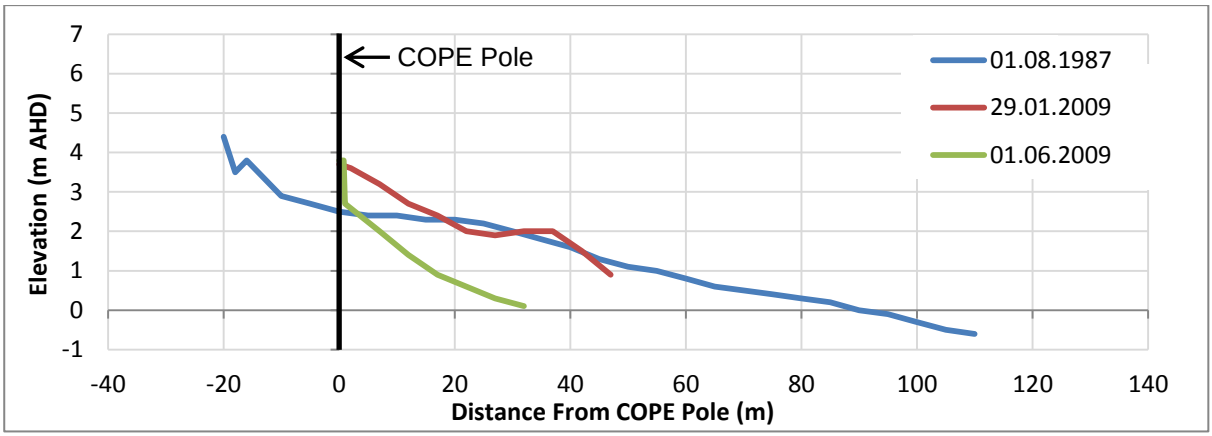
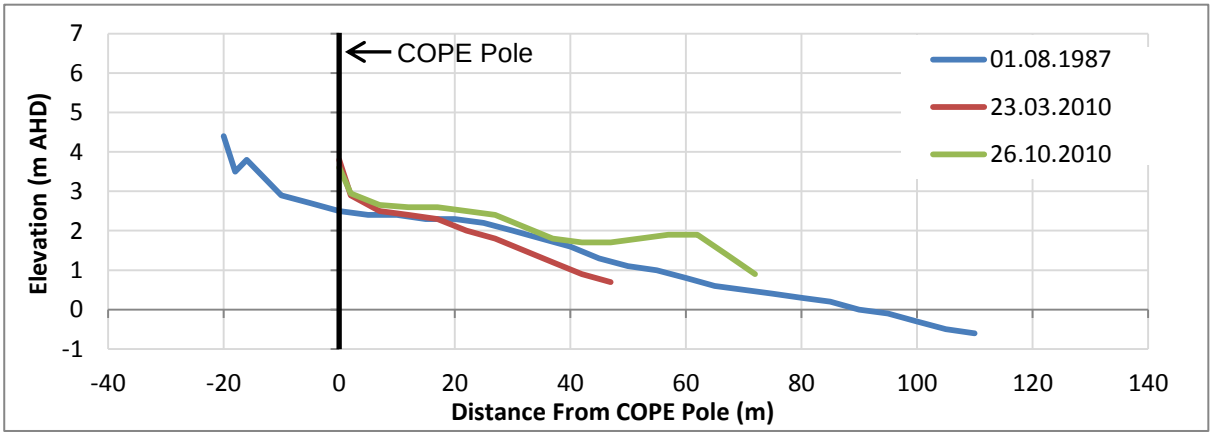
Figure 60

Monthly Beach Profiles – 2007 – 2008





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Burleigh Heads COPE Data Compilation

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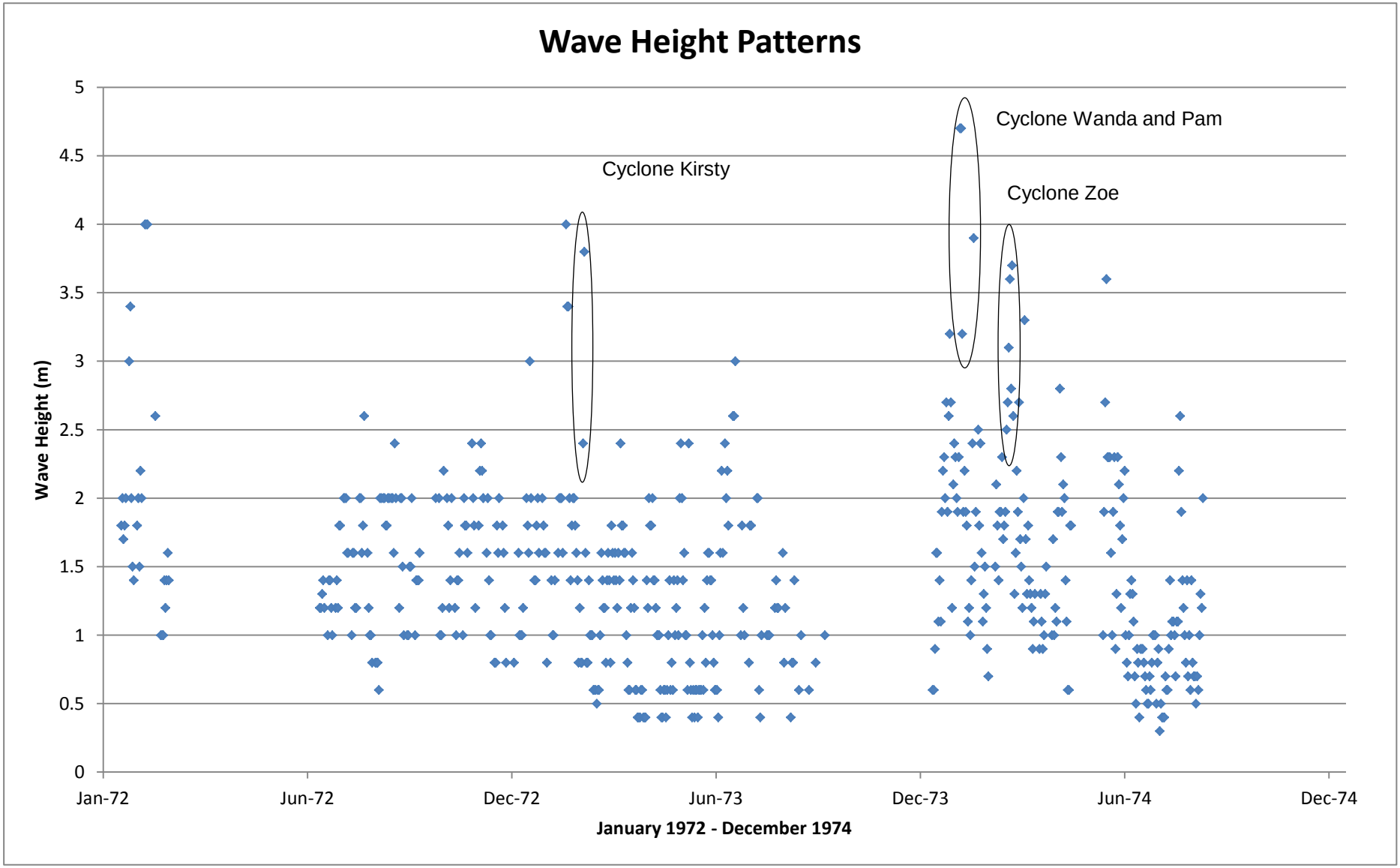
Figure 61

Monthly Beach Profiles – 2009 – 2010



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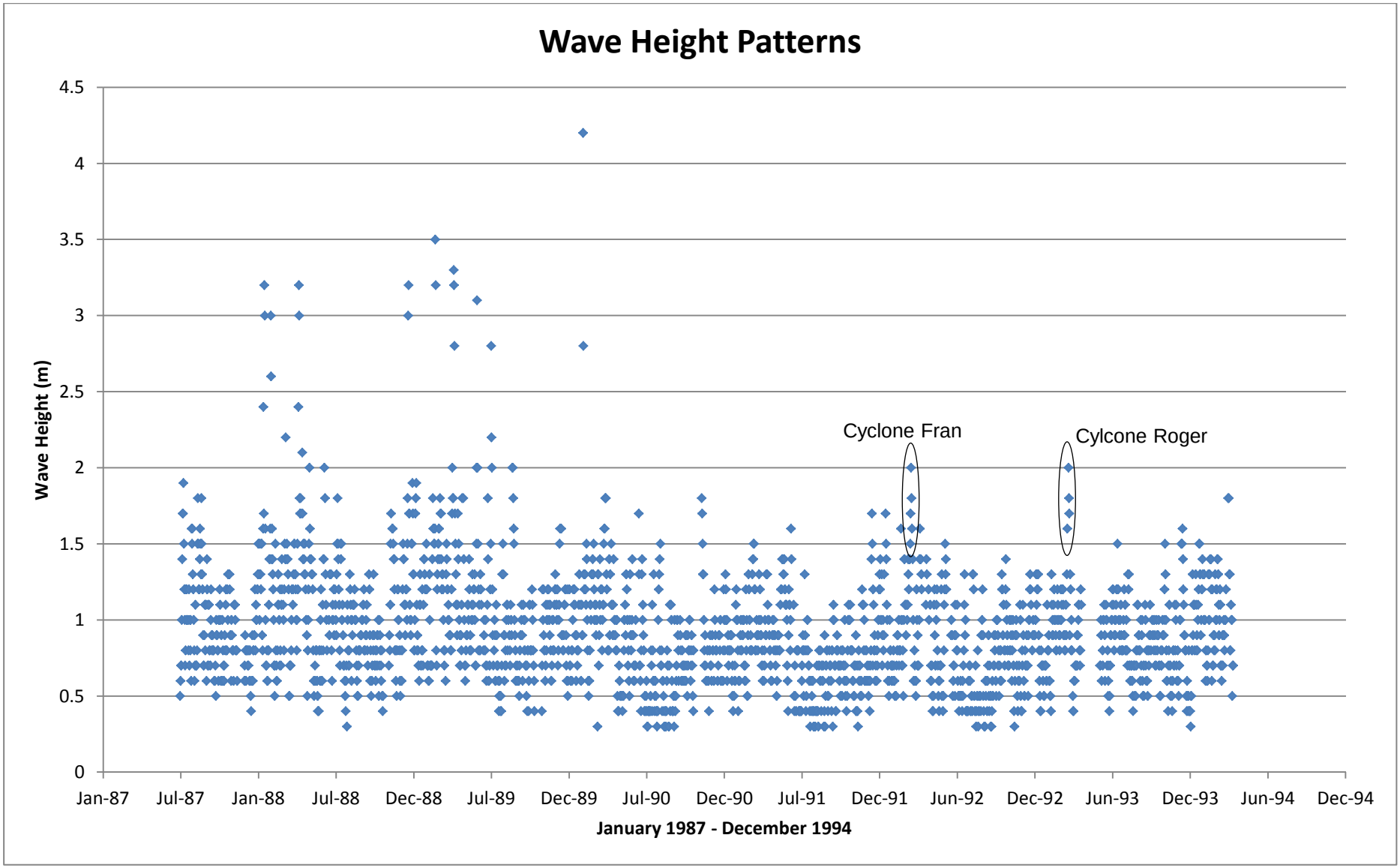
North Burleigh COPE Data Compilation

Job Number	41-27255
Revision	A
Date	29 Jan 2014

Wave Heights and Cyclone Influence

Figure 62

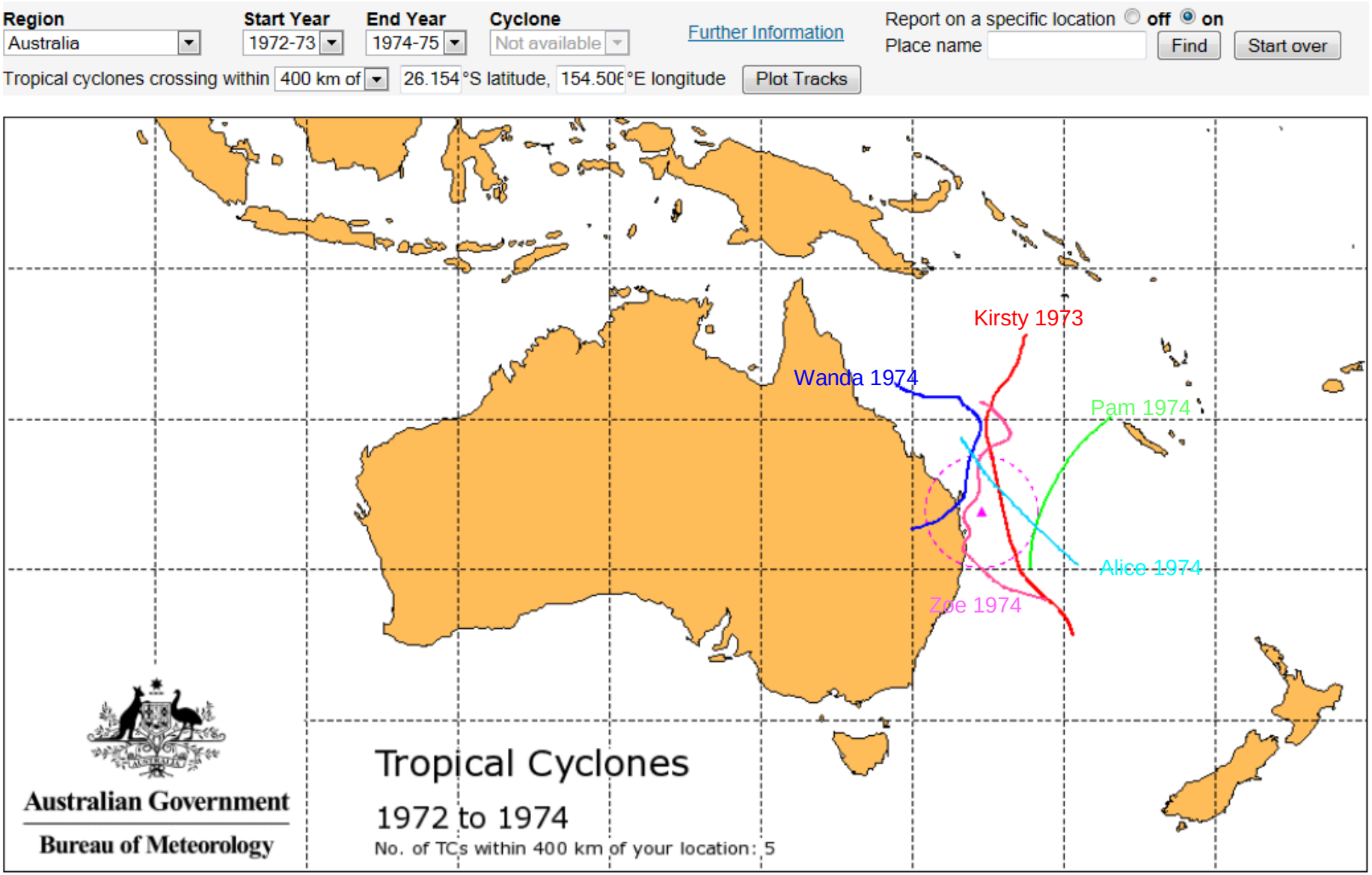


Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Burleigh Heads COPE Data Compilation

Job Number	41-27255
Revision	A
Date	31 Jan 2014

Wave Heights and Cyclone Influence

Figure 63

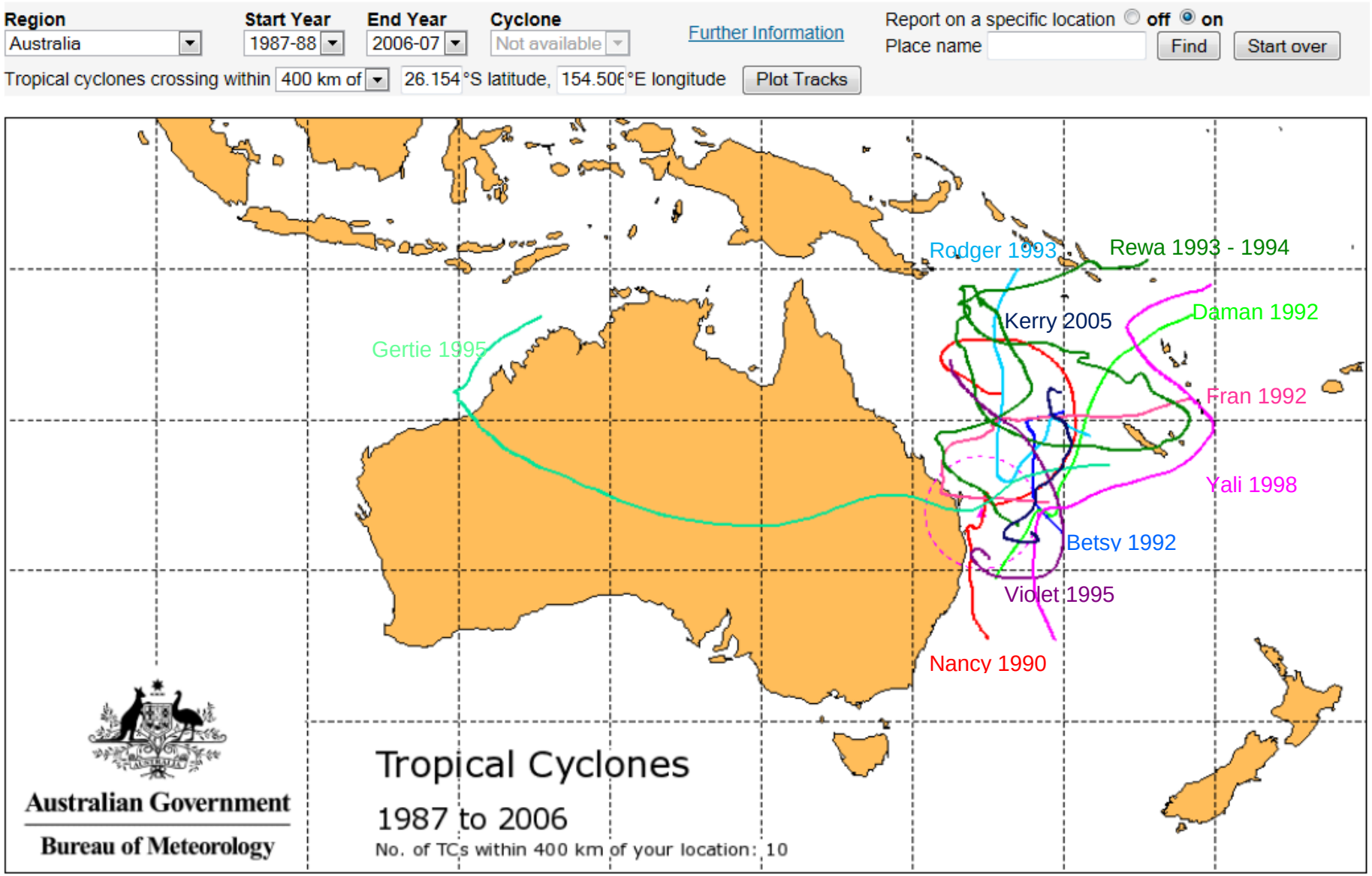


Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
North Burleigh COPE Data Compilation

Job Number	41-27255
Revision	A
Date	29 Jan 2014

Cyclone Tracks January 1972 – December 1974

Figure 64



Coastal Impacts Unit - Department of Science, Information Technology, Innovation and the Arts
Burleigh Heads COPE Data Compilation

Job Number	41-27255
Revision	A
Date	23 Jan 2014

Cyclone Tracks January 1987 – December 2006

Figure 65

Table 14: Amendments to Data (Burleigh Heads)

Date	Parameter	Changed From	Changed To	Justification
7/05/1990	Surf Zone Width	0	5	Surrounding data is in the range of 5 - 40 s, new value was averaged from waves with similar parameters

Note: No amendments were made to the North Burleigh data set.

Note: On the new recording sheet, surf zone widths (m) were recorded as the time (s) it takes for an average wave to transgress the surf zone. Using the following equation from Patterson & Blair 1983, the value was converted into metres:

$$Surf\ Zone\ Width\ (metres) = 0.86 \times g^{\frac{1}{2}} \times H_{obs}^{\frac{1}{2}} \times t_w$$

where:

$g = acceleration\ due\ to\ gravity = 9.81 m/s^2$

$H_{obs} = observed\ wave\ height\ (m)$

$t_w = elapsed\ time\ for\ a\ wave\ of\ average\ height\ to\ transgress\ the\ surf\ zone\ from\ the\ break\ point\ to\ the\ final\ runup\ position\ on\ the\ beach\ (s)$

Where a correction to the surf zone width was required, a value was estimated by using a surf zone parameter for a wave with a similar height and period. This value was then converted from seconds to metres using the above formula.

Appendix A – COPE Instructions

The following text is an extract from the BPA newsletter – Beach Conservation No. 69 in which the COPE program was the feature article. The extract describes how the recordings were performed for the **new format** recording sheet, which was introduced in March 1986.

OBSERVATIONS

The data is recorded on special forms which are suitable for computer processing. An example is shown in Figure 2. The wave parameters recorded are:

(i) estimate of wave heights (average and maximum):

(ii) wave period (average time interval between waves);

(iii) wave direction (as a compass bearing);

(iv) surf zone width (traverse time of surf zone by average wave).

The beach parameters recorded, using the installed reference pole are:

(i) elevation of the fixed contour or beach berm;

(ii) distance to the fixed contour or beach berm;

(iii) distance to the average vegetation line;

(iv) sand level at the pole.

Wind speed and compass direction are determined by the use of a hand held wind meter.

The longshore current in the surf zone causes the transportation of sand along the beach, and it is important that this current is measured. This is done by introducing a harmless dye into the water and measuring the distance that the dye patch travels along the beach in one minute. Wave action soon dissipates the dye.

The survey of a monthly beach profile, using the installed reference pole, provides information on beach movements. During periods of change, such as cyclonic wave attack, profiles are usually taken before and after the event. All reference poles are surveyed at the time of installation to allow replacement in the same position if they are destroyed or are washed out by erosion.

The average sand grain size is an element to be considered in the assessment of longshore sand transport rates. Therefore, a monthly sample is taken from a specified beach level and analysed to reveal any seasonal or long term changes.

The following document details the instructions on how to fill out the **old format** recording sheet which was discontinued in March 1986.

FORM No. BE3

BEACH PROTECTION AUTHORITY - QUEENSLAND

Instructions for filling out COPE recording form

COASTAL OBSERVATION PROGRAMME - ENGINEERING

(COPE)

STATION IDENTIFICATION:

Each site for COPE has been assigned a numerical code consisting of five digits. The first two digits define the Shire or City in which the site is located, and the remaining three digits define the particular beach and reference mark position within a particular Local Authority area. A space is provided to write in the name of the beach at which the observation is made.

DATE:

Record the year, month and day in the spaces provided on each page of the recording sheet.

TIME: (Column 2)

Record the time to the nearest quarter-hour **in Eastern Standard Time** (E.S.T.) at which the observation is made. (e.g. 10.00 a.m. Daylight Saving Time is 0900 E.S.T.). The 24-hour clock system of recording time is used to avoid any confusion between a.m. and p.m. (e.g. 0900 is 9.00 a.m. and 1500 is 3.00 p.m.).

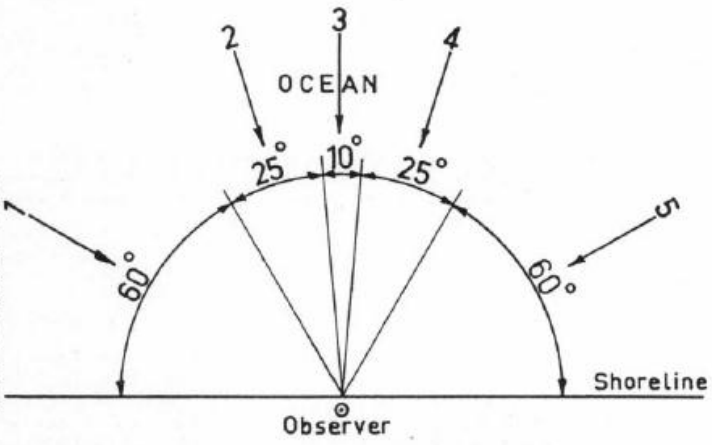
Daily observations should be made as close as possible to 0900 hours, and twice-daily observations should be made once in the morning and once in the afternoon and as close as possible to 0900 and 1500 hours. Observations should be made at the **same** time every day.

WAVE OBSERVATIONS:
(These observations are to be made twice daily.)

(a) **Wave Period:** (Column 3). Record the time in seconds for eleven wave "crests" to pass a stationary point. Eleven "crests" will include ten complete waves (crests and trough). Crest 1 is zero-time, crest 11 is cut time.

(b) **Wave Height:** (Column 4). This observation is based solely on the judgement of the observer. The observer's best estimate will be sufficient. Record the breaking wave height to the nearest one-fifth metre. If wave height is less than one-fifth metre (0.2), the wave height is "O". If no waves exist at all, mark "O" for **both** WAVE HEIGHT and WAVE PERIOD columns.

Fig. 1 WAVE DIRECTION CODE



(c) **Wave Direction:** (Column 5). Darken the space which best describes the direction of the approaching waves according to Fig. 1 above. If no waves exist at all, write the direction as "O".

(d) **Type of Breaking Waves:** (Column 6). If no waves exist, leave the item blank, otherwise choose only **ONE** of the following four types of waves:

Spilling – Spilling occurs when the wave crest becomes unstable at the top and the crest flows down the front face of the wave, producing an irregular, foamy water surface. This wave is sometimes referred to as a "roller" (see Fig. 2 below). Mark "SP" for spilling.

Plunging – Plunging occurs when the wave crest curls over the front face of the wave and falls into the base of the wave, producing a high splash and much foam. This wave is sometimes referred to as a "dumper" (see Fig. 3 below). Mark "PL" for plunging.

Plunging/Spilling – Darken this space only when there is a combination of spilling and plunging waves. Mark "PS" for plunging/spilling.

Surging – Surging occurs when the wave crest remains unbroken while the base of the front of the wave advances up the beach (see Fig. 4 below). Mark "S" for surging.

(e) **Surf Zone Width:** (Column 7). This observation is based on the judgement of the observer. The observer's best estimate is sufficient. Record the distance, to the nearest whole metre, from the water line at the time of observation to the line of the most seaward row of breakers, at the time of observation. If no waves exist at all, mark "O". If two or more breaker zones exist, record the distance to the most seaward row of breakers of the most seaward breaker zone.

(f) **Offshore Bar:** (Column 8). Record whether or not a significant offshore bar exists. This may be determined as "yes" if there is a distinct gutter between the initial breakpoint and the beach, allowing the wave to reform; and "no" if the wave continues in a broken state from the initial breakpoint to the beach (see Fig. 5).

Fig. 2

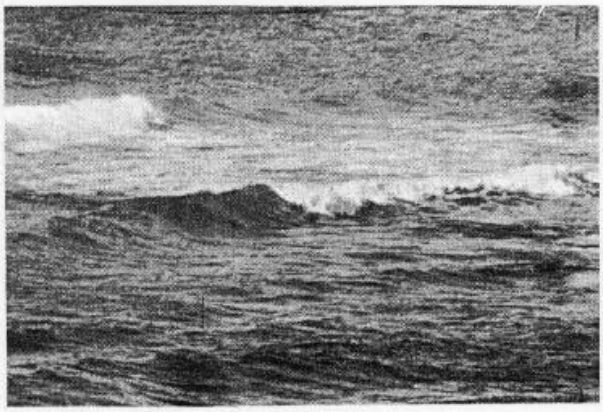


Fig. 3

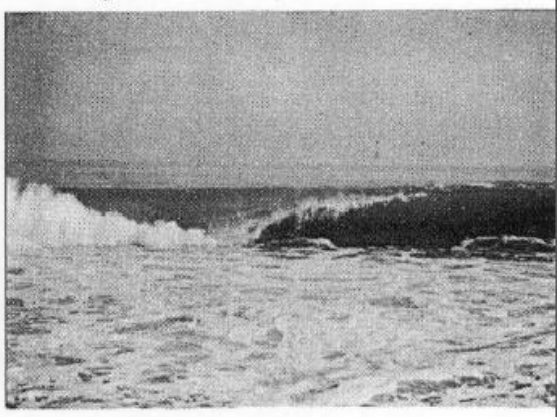


Fig. 4

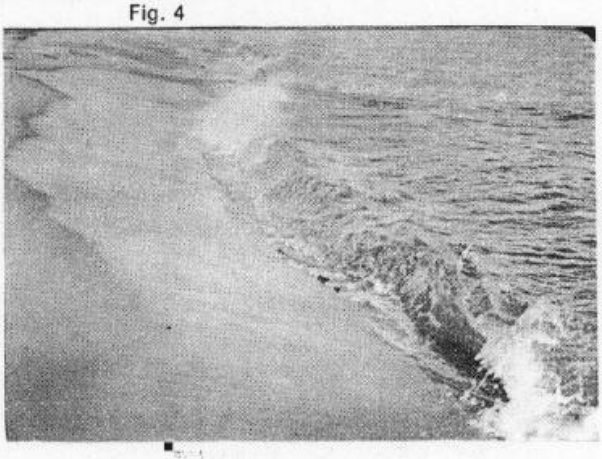
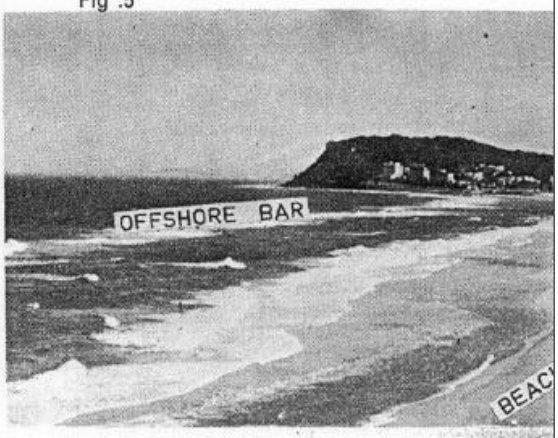


Fig .5



WIND OBSERVATIONS: (These observations are to be made twice daily).

(a) **Wind Velocity:** (Column 9). A wind meter is provided for each observer. The instructions provided with the meter should be followed to obtain wind velocity measurements.

(b) **Wind Direction:** (Column 10). Determine the orientation of the beach with respect to the compass directions, and record the direction **from which** the wind is coming. The direction of true north should be indicated on the reference mark or nearby.

STATE OF TIDE: (Column 11). (This observation is to be made twice daily).

Indicate the relative state of tide by marking one of the ranges: low tide "O/4", quarter tide "1/4", half tide "2/4", three-quarter tide "3/4", full tide "4/4", and mark whether the tide is rising "R", falling "F", or stationary "S" at the time of observation.

BEACH OBSERVATIONS: (These observations are to be made once daily.)

(a) **Elevation of the most seaward beach berm crest:** (Column 12). To obtain this, a graduated reference pole has been installed on the beach and the observer has been provided with a hand level. The observer should also have a 1.5 m-long support for the level. To use the Clinometer as a level, set the bubble lever to zero and sight through the instrument to the reference pole so that the bubble is centred on the cross hair. To obtain this measurement, the observer must place himself on the most seaward berm crest and take a reading of the reference pole (see Fig. 6 below). This reading minus 1.5 metres (length of support) is recorded on the form. If no berm can be easily recognised mark "NB" for no berm.

(b) **Distance to the most seaward berm crest from the reference pole:** (Column 13). Record the distance (to the nearest whole metre) between where the level reading is taken and the reference pole (see Fig. 6 below). If no berm exists, leave the distance **blank: DO NOT** mark the "O". If the distance is measured landward from the reference pole, the distance is a minus value. After erosion the berm may be at the erosion scarp.

(c) **Distance to the vegetation line from the reference pole:** (Column 14). Record the distance to the nearest whole metre between the reference pole and a line along the average seaward extent of the existing perennial vegetation. If the distance is measured landward from the reference pole, the distance is a minus value.

(d) **Angle of Foreshore Slope:** (Column 15). This observation can be made by placing the support pole for the level on the foreshore slope and laying the level on the support, as shown in Fig. 7 below. The foreshore is the uniform sloped section of the beach between H.W.M. and L.W.M. Next, adjust the bubble level so as to centre the bubble in the bubble tube, and then note reading on the DEGREE scale.

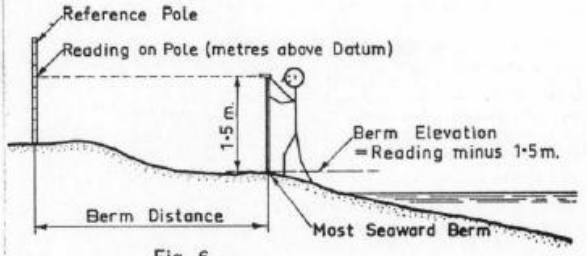


Fig. 6

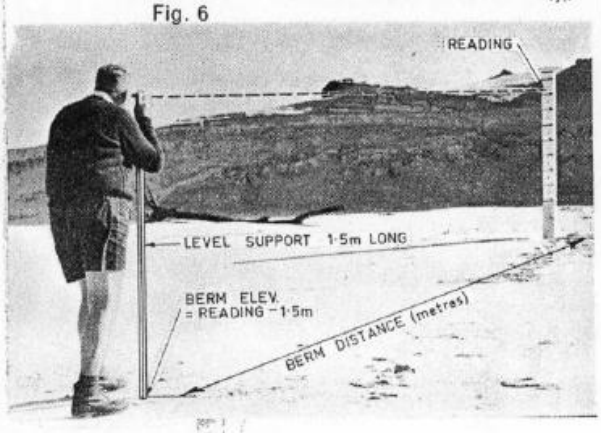


Fig. 7

Continued overleaf

LITTORAL CURRENT OBSERVATIONS: (These observations are to be made once daily.)

(a) **Current Velocity:** (Column 16). For this measurement the observer is provided with dye. The dye is **very** powerful, and care must be observed when handling it so as not to allow any dye to accidentally spill. The dye should be thrown as near as possible to the midpoint of the surf zone. The observer will note the position of the dye at entry to the breaker zone and the position of the dye after an elapsed time of one minute. The distance between these two positions is entered in the spaces provided on the form. If no current is evident, darken the "O" marks.

(b) **Current Direction:** (Column 17). If no current is evident, mark "C" for "calm". Otherwise indicate whether the dye patch moves downcoast or upcoast. In general, current that flows to the north is considered upcoast, and that which flows to the south is considered downcoast.

SAND SAMPLES:

Sand samples should be collected once a month in the special plastic bags provided. The sample should be obtained from the foreshore slope of the beach at about half tide level. Identify the sample with the name and code number of the beach, and record the date and time the sample was collected. Write this information directly on the outside of the specially provided padded envelope.

PHOTOGRAPHS: (Optional)

Photographs are to be taken once a month, preferably early each month and at low tide. General panoramic views of the beach in the up and down coast directions are desired. Photographs should be taken from the same location each time and view the same area with a recognisable landmark in the background. Each photo must be identified with the name and code number of the beach, and the date and time and tide level when it was taken.

COMMENTS:

Note any remarks or sketches or unusual events (e.g. erosion scarps, cyclone damage, surge etc.) in the comments column of the recording form.

Remember: There are about 50 COPE stations in Queensland.

Remember: To mark **all** recording sheets, sand samples and photographs with your code number, and time and date.

Issued by

BEACH PROTECTION AUTHORITY
OF QUEENSLAND

Department of Harbours and Marine
Edward Street, Brisbane 4000
(G.P.O. Box 2195, Brisbane 4001)

Appendix B – Beach Conservation Extracts

Extracts from Beach Conservation newsletters that are related to the Burleigh COPE station site are reproduced below.

Beach Conservation No 44 July 1981

New COPE Stations

Seven new recording stations have been established as part of the Authority's Coastal Observation Program – Engineering (COPE). These are –

Oak Beach – located in Douglas Shire 40 kilometres north of Cairns. Local residents Gordon Cooke and Bruno Riedwig commenced observations on October 9, 1980, and are now assisted by Mr. and Mrs. Fred Britcher.

Woolanmarroo South – located at the mouth of the Russell River in Mulgrave Shire, 50 kilometres south of Cairns. Retired local resident Chas. Lock commenced observations also on October 9, 1980.

Noosa Woods – located on Noosa Beach 150 kilometres north of Brisbane. Roger Little and Lance Cairns commenced observations on September 9, 1980 at a site near Noosa Woods.

Slade Point – located 10 kilometres north of Mackay in Pioneer Shire. Boris Smolakous commenced observations during a visit by COPE Field Officer, Bob Blair on November 10, 1980, and will be assisted by Mr. and Mrs. Alf. Rowe.

Burleigh Heads – located at Gold Coast City some 9 kilometres south of the existing Surfers Paradise station. Nearby resident Bill Patterson commenced observations on December 1, 1980.

Bramston Beach – located in Mulgrave Shire 20 kilometres north of Innisfail. Local residents Mr. and Mrs. Ken Eaton assisted by Gus Feldman commenced observations on February 19, 1981.

Etty Bay – located 10 kilometres south of Innisfail in Johnstone Shire. Mr. and Mrs. Vic Sultana commenced observations also on February 19, 1981.

Various established COPE stations are now operated by observers who have recently entered the program. These are Baffle Creek (Kevin Leeson), Blacks Beach (Greg Long and Ian Woodyard), Burrum Heads (Harold Farmer), Sarina Beach (Bill Smith and Keith Neill), Seaforth (Mr. and Mrs. Allan Patson), West Queens Beach (Max Irving), and Woodgate (Peter Mortimer).

In addition, five temporary wave and current observation sites operated at Noosa from September 1980 to Janurary 1981 as part of the Authority's continuing monitoring of the beach. Information from these sites was provided by Noosa Shire Council employees Adrian Williams and Jim Diener together with local residents Gerry Helton and Alf Wiemann. It is being used to assess sand movements along the beach.

Three new COPE data publications have recently been produced. These are:–
C.02.1 Baffle Creek – Miriam Vale Shire. C.03.1 Flying Fish Point – Johnstone Shire. C.04.1 Woodgate – Isis Shire.

Beach Conservation No 64 November 1986

BEACH PROFILES

Burleigh Heads Beach

by
P.M. Coughlan, Engineer

Burleigh Heads Beach which is situated in the centre of the Gold Coast, a premier tourist resort region for south east Queensland, forms part of a large natural sandy embayment.

This embayment extends north from Point Danger on the Queensland border to Point Lookout, a distance of about 80 kilometres. A characteristic of this embayment is its broad sandy beaches with a dominant sand movement to the north under the influence of ocean waves and currents. Along the embayment beach alignment is influenced by the presence of several rocky headlands and a few man-made structures. The beaches exhibit cyclic erosion/accretion behaviour with beach sand moving offshore under the influence of storm waves but returning to the beach under quieter conditions. The natural sand dunes which originally formed landward of the embayment's beaches act as buffers to slow down beach recession during storm wave attack. The retention of these dunes is particularly important if the sandy beaches are to be preserved.

Burleigh Heads Beach is located centrally on this embayment and bounded at its extremities by rocky headlands – Burleigh Headland to the south and South Nobby Headland to the north. The beach itself is approximately 2 kilometres long. However, development has encroached onto the original frontal dune behind the beach and a public park about 35 metres wide located immediately landward of the beach is virtually all that remains to accommodate natural coastline movements.

Part of the original dune system at Burleigh Heads was mined for heavy minerals during the 1940's and the 1950's and was subsequently levelled to form this public park.

Up until recent times, the park has acted as an adequate buffer to accommodate coastline movements and at the same time has proved to be one of the popular attributes of Burleigh Beach. Consistently good beach conditions, attractive nearby headlands and the park have all combined to make this beach one of the most popular on the Gold Coast.

Recent Behaviour of Burleigh Heads Beach

The construction of a series of groynes at Palm Beach and at the mouth of Tallebudgera Creek to the south of Burleigh Headland in the 1970's has interrupted the dominant northward movement of sand along the coast at these locations. This has resulted in a reduction in the natural supply of sand to Burleigh Heads Beach and a reduction in the quantity of sand in the associated beach system. The beach therefore, became more vulnerable to storm wave attack. Erosion occurred as a result of a storm in June 1983 leaving a 3 metre high erosion scarp just seaward of the park. Had a severe cyclone then occurred the erosion scarp could have been pushed well back into the park.

1985 Beach Nourishment Scheme

Following the erosion in June 1983, the Gold Coast City Council decided that action was needed to prevent erosion of the park at Burleigh Heads. Two options were available – the construction of a boulder wall along an extensive section of Burleigh Heads shoreline which would damage the beach, or the implementation of a beach nourishment scheme which would provide protection for both the park and beach.

Council chose beach nourishment. A total of 200,000 cubic metres of sand was deposited onshore whilst a further 100,000 cubic metres of sand was placed in the nearshore zone. The cost was approximately $900,000 with substantial cost savings being achieved by placing sand in the nearshore zone rather than pumping all the sand onshore. The aim of this onshore/nearshore nourishment scheme was to create a restored beach profile which was

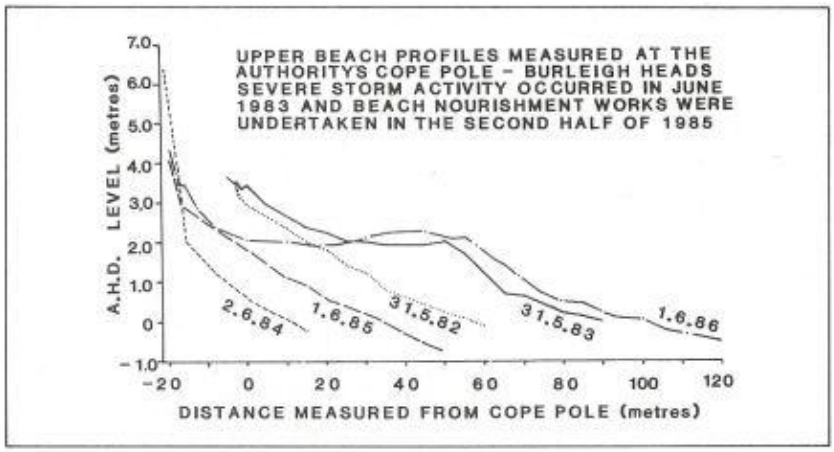
The dredge Vlaanderen XX is shown here pumping sand onto Burleigh Beach. The dredge was under contract to the Gold Coast City Council and discharged 200 000 m^3 of sand onto the beach and a further 100 000 m^3 in the nearshore zone at Burleigh.

View of Burleigh Heads Beach looking south towards Burleigh Headland following the recent beach nourishment works. South Nobby Headland is in the foreground while the public park along the foreshore can also be seen.

closer to the natural beach condition than would have been the case if the sand had been pumped to the upper beach only. Sand for this nourishment scheme was obtained from outside the active beach system about 1.5 km offshore in water depths of 18 to 25 metres.

The Authority determined in 1973 that Burleigh Heads Beach required an initial sand restoration quantity of 605,000 cubic metres to protect it against cyclone attack. The recent nourishment scheme represents approximately 50% of this total requirement.

Between 1976 and 1981, Gold Coast City Council undertook smaller beach nourishment schemes at Burleigh Heads using sand recovered from Tallebudgera Creek. Such schemes were only of short term benefit to Burleigh as sand was obtained from within the active beach system and no nett gain to the volume of sand in the active beach system resulted.



Conclusion

The Gold Coast's economy relies heavily on the continued existence of wide, sandy beaches for the enjoyment of tourists and local residents. The importance of the beaches has been clearly recognized by the Gold Coast City Council in its decision to undertake the recent beach nourishment works at Burleigh Heads and several other beaches on the Gold Coast. The beach nourishment scheme undertaken at Burleigh Heads will protect the recreational amenity of this beach, thereby maintaining the reputation of Burleigh Heads as one of the most popular beach resort areas in south-east Queensland. The performance of this beach nourishment scheme and others recently undertaken on the Gold Coast is being jointly monitored by Council and the Authority to provide information for planning future nourishment projects.

Appendix C – Historical Photographs North Burleigh