# Wave data recording program
# Brisbane Region
# 1976 - 1994

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Department of
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## Abstract

This report provides summaries of primary analyses of wave data recorded in water depths of 60 metres and greater, offshore near Brisbane in southern Queensland. Data was recorded using a Datawell Waverider buoy, and covers the period 30 October 1976 to 30 June 1994. The data was divided into seasonal groupings for analysis. No estimations of wave direction data have been provided.


This report has been prepared by the Coastal Management Branch, Division of Conservation, Queensland Department of Environment and Heritage on behalf of the Beach Protection Authority.

While reasonable care and attention has been taken in collecting, processing and compiling wave data in this report, the accuracy and reliability of this information is not guaranteed in any way by the Beach Protection Authority. The Authority accepts no responsibility for the use of this information in any way.


August 1994

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## 1.0 Introduction

As part of its long-term data collection program, the Beach Protection Authority has been recording wave characteristics along Queensland's coastline since 1968. This has been done using a series of wave recording stations. This report summarises the primary analyses of wave data collected at the Brisbane station. In addition, brief details of the recording equipment, the method of handling raw data and the type of analyses used are provided.

## 2.0 Recording equipment

All the Beach Protection Authority's wave recording stations use the Waverider system manufactured by Datawell b.v. of the Netherlands. In this system, a waverider buoy is used to determine the sea surface fluctuations at an offshore location. Vertical acceleration of the buoy is measured by an accelerometer mounted on a stabilised platform in the buoy and twice integrated to give displacement. The instantaneous water level data are then transmitted to the shore station as a frequency modulated high frequency radio signal.

In the original configuration of the Brisbane station, first installed on 30 October 1976, the shore station consisted of a WAREP Waverider receiver and a DIMA digitiser/recorder. The WAREP receiver controlled the timing of data recording and provided a paper chart of the water level signal. Wave data were recorded by the DIMA unit in 20-minute bursts and digitised at 0.5 second intervals (2.0Hz). The data were recorded on digital cassettes and, along with the paper charts, transferred to Brisbane office for processing.

On 1 November 1991, the wave recording system was upgraded to a personal computer-based system utilising the Datawell DIWAR Waverider receiver/digitiser. The water level data, digitised at 0.39 second intervals (2.56Hz), are recorded in bursts of 4096 points (approximately 27 minutes) and recorded on the hard disk of the PC. The proprietary software running on the PC controls the timing of data recording and processes the data in 'near real time' to provide a set of standard sea-state parameters which may be accessed remotely via the public switched telephone network. Recorded data and analysis results are downloaded daily to a central computer system in Brisbane for checking and archiving.

Further information on the operation of the Waverider buoy and the recording systems can be obtained from the sources listed in section 7 of this report.

## 3.0 Wave recording and analysis procedures

Over the period 20 February 1987 to 31 October 1991, wave data have generally been recorded four times a day at 0300, 0900, 1500 and 2100 hours (Australian Eastern Standard Time). During storm events the recording frequency might have been manually switched by the operator to record eight times a day. Since 1 November 1991, the PC-based recording system has recorded data at (nominally) hourly intervals.

Recorded wave data are analysed in the time domain by the zero upcrossing method and in the frequency domain by spectral analysis. Spectral analysis of the WAREP/DIMA data was performed by the autocorrelation method providing 50 lags at a spacing of 0.2 Hz. The PC-based analysis uses Fast Fourier Transform techniques to give 128 spectral estimates in bands of 0.01 Hz. The zero upcrossing analysis is equivalent in both systems.

Wave parameters resulting from this processing include the following:

| | |
|---|---|
| S(f) | energy density spectrum |
| Hsig | significant wave height (time domain), the average of the highest one-third of the waves in the record |
| Hmax | highest individual wave in the record |
| Hrms | root mean square of the wave heights in the record (time domain) |
| Tsig | significant wave period (time domain), the average period of the highest one-third of waves in the record |
| Tz | average period of all zero upcrossing waves in the record (time domain) |
| Tpeak | wave period corresponding to the peak of the energy density spectrum |
| Tc | average period of all the waves in the record based on successive crests |

These parameters form the basis for the summary plots and tables attached to this report.

## 4.0 Data losses

Data losses can be divided into two categories — losses due to equipment failure and losses during data processing due to signal corruption. Common causes of data corruption include radio interference and a spurious low frequency component in the water level signal caused by a tilting accelerometer platform in the Waverider buoy.

Analysis of data recorded by the WAREP/DIMA and the PC-based systems include some data rejection checks. In the case of the WAREP/DIMA data, the length of the record can be shortened to exclude corrupt data points. In the PC-based analysis, a small number of spurious data points can be corrected by an interpolation procedure. Otherwise the entire series is rejected.

Details of data losses for the Brisbane wave recording station are included in Appendix 1.

## 5.0 Wave climate

The wave climate presented in this report is based on statistical analyses of the parameters obtained from the recorded wave data. Programs developed by the Authority provide statistical information on percentage of time occurrence and exceedance for wave heights and periods. The results of these analyses are presented in tables 1, 2 and 3 and figs.2, 3 and 4. In addition, similar analyses are carried out on the relationships between the various wave parameters and these are presented in fig.5.

## 6.0 Data presentation

No attempt has been made to interpret the recorded data for design purposes or to apply corrections for refraction, diffraction and shoaling to obtain equivalent deep water waves. Before any use is made of this data, the exact location of the buoy and the water depth in which the buoy was moored should be noted. This information is given in Appendix 1. The data presented does not include any information on wave directions. The Waverider recording system is designed to record only vertical movements of the water surface. Other means must be used to correlate wave directions and wave records.

When major meteorological events such as cyclones occurred during the recording period, these have been noted. They are summarised with the maximum wave heights recorded and other comments in Appendix 2.

For analysis, summer has been taken as the period from 1 November to 30 April of the following year. Winter covers the period 1 May to 31 October in any one year.

## 7.0 References


Datawell, *Operation and service manual for the Waverider - series 6000*

Datawell, *Manual of Waverider receiver type WAREP - mark II*

Datawell, *Manual of the digital Waverider receiver type DIWAR*

Datawell, *Manual of the digital magnetic tape recorder type DIMA - mark II*

Lawson and Treloar Pty Ltd (1991), *Real time wave analysis package*

Bureau of Meteorology, *Monthly weather review*


## Appendices

### Appendix 1 Details of Brisbane Region wave recorder installations

Details of wave recorder installation

Location: 153°37' East, 27°25' South; 9.0 kilometres E of Point Lookout (see fig.1)
Period: 30 October 1976 to 24 November 1988
Water depth at buoy: 70 metres relative to Australian height datum

Location: 153°37' East, 27°29' South, 11.0 kilometres ESE of Point Lookout (see fig.1)
Period: 25 November 1988 to 31 October 1991
Water depth at buoy: 80 metres relative to Australian height datum

These two locations were calculated using radar ranging and compass bearings to prominent landmarks.

Location: 153°37' East, 27°23.88' South, 9.31 kilometres ENE of Point Lookout (see fig.1)
Period: 31 October 1991 to 13 July 1994
Water depth at buoy: 76 metres relative to Australian height datum

This location was measured using GPS fixing procedures. Water depths are accurate to +/- 1 metre.

Note: Between 13 July 1994 and 29 August 1994, the location was 153°37.14' East, 27°24.38' South, 9.22 kilometres ENE of Point Lookout (see fig.1) where the water depth was 80 metres relative to Australian height datum. On 29 August 1994, the buoy was shifted to about 11km ESE of Point Lookout.

#### Period of data collection

30 October 1976 to 30 June 1994

#### Location of recording stations

30 October 1976 to 1 October 1987, Department of Harbours and Marine
Pinkenba Depot

1 October 1987 to 10 January 1989, Department of Harbours and Marine,
Queensland Government Hydraulics Laboratory, Deagon

11 January 1989 to 23 October 1991, Point Lookout Surf Life Saving Clubhouse

24 October 1991 to present, Poinf Lookout Hotel

#### Recording

Normal recording interval: Two 20-minute records daily at 0300 hours and 1500 hours between 30 October 1976 and 16 June 1982.

Four 20-minute records daily at 0300 hours, 0900 hours, 1500 hours and 2100 hours between 17 June 1982 and 31 October 1991.

From 1 November 1991, one-hourly samples approximately 26 minutes long have been taken giving 4096 water surface elevation figures for that period from which sea state parameters are calculated and recorded.

Number of records analysed: 33 589
Number of days in recording period 30 October 1976 to 30 June 1994: 6452
Number of days of data lost due to equipment failure and signal corruption (see 4.0 above): 1067
Percentage of recordings available for analysis: 83.46%

Periods during which four recordings a day were taken:
6-8 February 1978
20-27 July 1978
10 January 1979
31 January - 25 February 1979
7 January 1980
14-20 February 1981
7-10 April 1981
8-16 April 1982
17 June 1982 to 31 October 1991

Periods during which five recordings a day were taken:
27 January 1982

Periods during which six recordings a day were taken:
2 March 1989

Periods during which eight recordings a day were taken:
27-28 February 1980
22-25 October 1985
13-17 August 1985

## Appendix 2 Major meteorological events

| Meteorological event | Central pressure (HPa) | Date | Estimated position of cyclone relative to buoy (km) | Maximum Hsig recorded (metres) | Maximum Hmax recorded (metres) | Tp (secs) |
|---|---|---|---|---|---|---|
| Low pressure system offshore from Brisbane | 1004 | 19-05-77 | | 4.38 | 6.26 | 12.32 |
| Low pressure system offshore from Brisbane | 1008 | 30-07-79 | | 4.67 | 8.73 | 10.99 |
| Cyclone Paul | 992 | 08-01-80 | 530 ESE | 4.25 | 9.84 | 9.28 |
| Cyclone Ruth | 998 | 14-02-80 | 610 NE | 4.02 | 6.30 | 9.83 |
| Cyclone Sina and high pressure system near Tasmania | 1002 and 1032 | 10-03-80 | 1250 NNE | 3.70 | 5.27 | 8.41 |
| Low pressure system offshore from Brisbane | 1008 | 08-05-80 | | 5.21 | 8.06 | 11.73 |
| Cyclone Cliff | 994 | 15-02-81 | 220 NNE | 4.33 | 7.16 | 9.64 |
| Low pressure system offshore near Fraser Is | 1012 | 22-05-81 | | 3.75 | 5.21 | 8.54 |
| Cyclone Abigail | 984 | 27-01-82 | 790 E | 4.00 | 5.37 | 9.73 |
| High pressure system in Tasman Sea | 1040 | 04-06-83 | | 5.27 | 10.04 | 11.02 |
| Low pressure system offshore from Brisbane | 1008 | 22-06-83 | | 3.81 | 5.78 | 8.75 |
| High pressure system over Tasman Sea and low pressure system off south-east Queensland | 1032 and 1000 | 08-04-84 | | 5.22 | 7.31 | 10.58 |
| High pressure system over Tasman Sea | 1036 | 20-05-84 | | 4.13 | 6.78 | 11.24 |
| Low pressure system offshore from Brisbane | 1004 | 09-07-85 | | 3.93 | 6.79 | 9.08 |
| High pressure system over Tasman Sea | 1032 | 27-10-85 | | 3.87 | 4.98 | 10.16 |
| High pressure system over Southern Ocean and low pressure system off south-east Queensland | 1024 and 996 | 25-01-86 | | 3.77 | 6.79 | 10.51 |
| Low pressure system off south-east Queensland | 1008 | 17-06-86 | | 3.99 | 6.90 | 12.44 |

| Meteorological event | Central pressue (HPa) | Date | Estimated position of cyclone relative to buoy (km) | Maximum Hsig recorded (metres) | Maximum Hmax recorded (metres) | Tp (secs) |
|---|---|---|---|---|---|---|
| Low pressure system off Queensland | 1012 | 05-03-87 | | 4.65 | 9.08 | 9.52 |
| High pressure system over Tasman Sea | 1028 | 09-04-87 | | 3.87 | 5.82 | 9.51 |
| High pressure system over Tasman Sea | 1036 | 09-05-87 | | 3.63 | 6.33 | 9.65 |
| High pressure system over Great Australian Bight | 1036 | 01-10-87 | | 3.60 | 5.05 | 9.11 |
| Low pressure system off south-east Queensland | 1004 | 15-01-88 | | 4.29 | 6.81 | 10.36 |
| Low pressure system over New South Wales | 996 | 10-02-88 | | 3.92 | 6.39 | 12.73 |
| Low pressure system off northern Queensland and high pressure system over Tasman Sea | 1004 and 1024 | 16-02-88 | | 3.94 | 6.12 | 9.26 |
| High pressure system over Great Australian Bight | 1028 | 06-03-88 | | 4.02 | 6.59 | 14.94 |
| Low pressure system over Brisbane | 1008 | 11-04-88 | | 4.10 | 6.28 | 11.29 |
| High pressure system over Tasman Sea | 1032 | 30-05-88 | | 3.75 | 6.38 | 9.87 |
| Low pressure system off Victorian coast | 1000 | 05-06-88 | | 4.48 | 7.19 | 9.71 |
| Low pressure system over Queensland and high pressure system over Tasman Sea | 1012 and 1032 | 05-07-88 | | 3.97 | 6.71 | 8.78 |
| High pressure system over Victoria | 1032 | 12-07-88 | | 4.48 | 9.16 | 9.24 |
| Low pressure system off Brisbane | 1000 | 15-09-88 | | 4.62 | 7.05 | 9.43 |
| High pressure system over Tasman Sea and low pressure system in Coral Sea | 1024 and 1004 | 06-11-88 | | 4.19 | 7.24 | 9.53 |

| Meteorological event | Central pressure (HPa) | Date | Estimated position of cyclone relative to buoy (km) | Maximum Hsig recorded (metres) | Maximum Hmax recorded (metres) | Tp (secs) |
|---|---|---|---|---|---|---|
| Cyclone Aivu | 995 | 05-04-89 | 800 NNE | 3.94 | 6.42 | 10.33 |
| Low pressure system off south-east Queensland and high pressure system off southern central NSW | 1000 and 1028 | 25-04-89 | | 6.11 | 9.11 | 10.62 |
| Low pressure system off south-east Queensland | 1004 | 29-05-89 | | 4.76 | 7.37 | 10.33 |
| Low pressure system off south-east Queensland | 1004 | 19-08-89 | | 4.74 | 6.76 | 10.03 |
| High pressure system over Tasman Sea | 1024 | 07-09-89 | | 4.09 | 5.81 | 9.43 |
| Cyclone Nancy | 975 | 01-02-90 | 375 NE | ** | ** | ** |
| High pressure system over Tasman Sea and low pressure system off central Queensland | 1032 and 1008 | 09-06-90 | | 4.49 | 7.57 | 10.32 |
| Low pressure system off Brisbane | 1008 | 07-11-90 | | 3.98 | 6.61 | 10.02 |
| High pressure system off central NSW | 1020 | 13-01-91 | | 1.92 | 2.53 | 7.65 |
| Low pressure system off south-east Queensland coast | 1006 | 11-05-91 | | 3.00 | 5.25 | 9.9 |
| Passage of front through south-east Queensland with a high pressure system over central Queensland | 1020 | 24-06-91 | | 2.90 | 4.85 | 9.5 |
| Passage of trough through south-east Queensland with a high pressure system off central NSW | 1024 | 22-11-91 | | 3.20 | 5.50 | 10.2 |
| Low pressure system over south-east Queensland | 1004 | 12-12-91 | | ** | ** | ** |

| Meteorological event | Central pressure (HPa) | Date | Estimated position of cyclone relative to buoy (km) | Maximum Hsig recorded (metres) | Maximum Hmax recorded (metres) | Tp (secs) |
|---|---|---|---|---|---|---|
| Cyclone Betsy | 978 | 13-01-92 | 650 NE | 4.39 | 8.45 | 9.50 |
| Cyclone Daman | 998 | 18-02-92 | 400 E | 4.30 | 8.08 | 13.20 |
| Cyclone Fran | 980 | 15-03-92 | 260 N | 3.59 | 6.82 | 10.26 |
| High pressure system over Tasman Sea | 1036 | 05-04-92 | | 3.90 | 6.42 | 8.80 |
| Low pressure system over Tasman Sea | 994 | 13-05-92 | | ** | ** | ** |
| High pressure system off Queensland and trough across southern Australia | 1008 | 25-11-92 | | 2.07 | 3.65 | 7.10 |
| Cyclone Roger off south-east Queensland | 992 | 17-03-93 | 420 NE | 7.36 | 13.09 | 12.00 |
| High pressure system in Tasman Sea | 1032 | 14-09-93 | | 2.70 | 4.84 | 8.45 |
| Low over southern NSW coastline | 1000 | 04-10-93 | | 3.07 | 5.41 | 7.65 |
| Cyclone Rewa | 992 | 21-01-94 | 300 ENE | 3.23 | 5.47 | 9.93 |

** No data available due to buoy equipment failure.

The highest significant wave height (Hsig) recorded was 7.36 metres on 17 March 1993 due to the passage of Cyclone Roger off the south Queensland coast.
The highest maximum wave height (Hmax) recorded was 13.09 metres on 17 March 1993 due to the passage of Cyclone Roger off the south Queensland coast.
Meteorological information obtained from *Monthly Weather Review*, published by the Bureau of Meteorology.

***Table 1.*** *Wave statistics — Wave period/Wave height occurences - All data, all directions*

| Significant wave height (metres) | Peak energy wave period (seconds) | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|
| | 0 - 2.99 | 3 - 4.99 | 5 - 6.99 | 7 - 8.99 | 9 - 10.99 | 11 - 12.99 | 13 - 14.99 | > 14.99 | |
| 0.00 - 0.25 | 1.26 | - | - | - | - | - | 0.25 | - | 1.51 |
| 0.26 - 0.50 | 1.24 | 0.08 | 2.50 | 4.72 | 3.49 | 1.25 | - | - | 13.28 |
| 0.51 - 0.75 | 0.25 | 20.64 | 41.47 | 83.69 | 109.50 | 31.08 | 2.33 | 0.42 | 289.38 |
| 0.76 - 1.00 | 0.24 | 62.11 | 120.72 | 321.77 | 313.57 | 84.87 | 7.89 | 0.42 | 911.59 |
| 1.01 - 1.25 | - | 50.35 | 165.78 | 437.17 | 357.90 | 77.29 | 7.00 | 0.08 | 1095.58 |
| 1.26 - 1.50 | - | 18.35 | 165.06 | 381.37 | 354.30 | 75.00 | 6.08 | 0.42 | 1000.58 |
| 1.51 - 1.75 | - | - | 115.68 | 267.10 | 239.48 | 62.19 | 5.64 | 0.08 | 692.51 |
| 1.76 - 2.00 | - | 2.33 | 69.64 | 224.77 | 180.19 | 48.19 | 3.85 | - | 526.71 |
| 2.01 - 2.25 | - | 0.06 | 31.68 | 159.46 | 119.48 | 35.33 | 1.33 | - | 347.26 |
| 2.26 - 2.50 | - | - | 12.52 | 127.31 | 80.14 | 23.69 | 3.89 | 0.04 | 247.58 |
| 2.51 - 2.75 | - | - | 2.21 | 77.53 | 58.59 | 15.75 | 1.58 | 0.15 | 155.81 |
| 2.76 - 3.00 | - | - | 0.52 | 41.70 | 40.08 | 17.94 | 2.48 | 0.04 | 102.76 |
| 3.01 - 3.25 | - | - | - | 20.93 | 24.13 | 10.04 | 0.84 | 0.04 | 55.97 |
| 3.26 - 3.50 | - | - | 0.04 | 7.24 | 18.83 | 7.55 | 0.52 | - | 34.19 |
| 3.51 - 3.75 | - | - | - | 6.74 | 14.49 | 3.08 | 0.16 | - | 24.47 |
| 3.76 - 4.00 | - | - | - | 2.11 | 9.40 | 2.92 | - | - | 14.43 |
| 4.01 - 4.25 | - | - | - | 1.10 | 6.98 | 2.08 | 0.28 | - | 10.45 |
| 4.26 - 4.50 | - | - | - | 0.08 | 5.74 | 1.12 | 0.04 | - | 6.97 |
| 4.51 - 4.75 | - | - | - | - | 3.46 | 0.57 | - | - | 4.03 |
| 4.76 - 5.00 | - | - | - | - | 1.22 | 0.02 | - | - | 1.24 |
| 5.01 - 5.25 | - | - | - | - | 1.71 | 0.76 | - | - | 2.47 |
| 5.26 - 5.50 | - | - | - | - | 0.02 | 0.66 | - | - | 0.68 |
| 5.51 - 5.75 | - | - | - | - | 0.10 | 0.44 | - | - | 0.54 |
| 5.76 - 6.00 | - | - | - | - | - | 0.18 | - | - | 0.18 |
| 6.01 - 6.25 | - | - | - | - | 0.25 | 0.21 | 0.02 | - | 0.48 |
| 6.26 - 6.50 | - | - | - | - | 0.02 | 0.20 | - | - | 0.22 |
| 6.51 - 6.75 | - | - | - | - | - | 0.15 | - | - | 0.17 |
| 6.76 - 7.00 | - | - | - | - | - | 0.20 | 0.04 | - | 0.20 |
| 7.01 - 7.25 | - | - | - | - | - | 0.08 | - | - | 0.12 |
| 7.26 - 7.50 | - | - | - | - | - | 0.03 | - | - | 0.03 |
| Totals | 2.99 | 153.93 | 727.80 | 2164.81 | 1943.08 | 502.85 | 44.32 | 1.69 | 5600.94 |

Values are durations in days rounded to two decimal places.

***Table 2.*** *Wave statistics — Wave period/Wave height occurences — Summer data, all directions.*

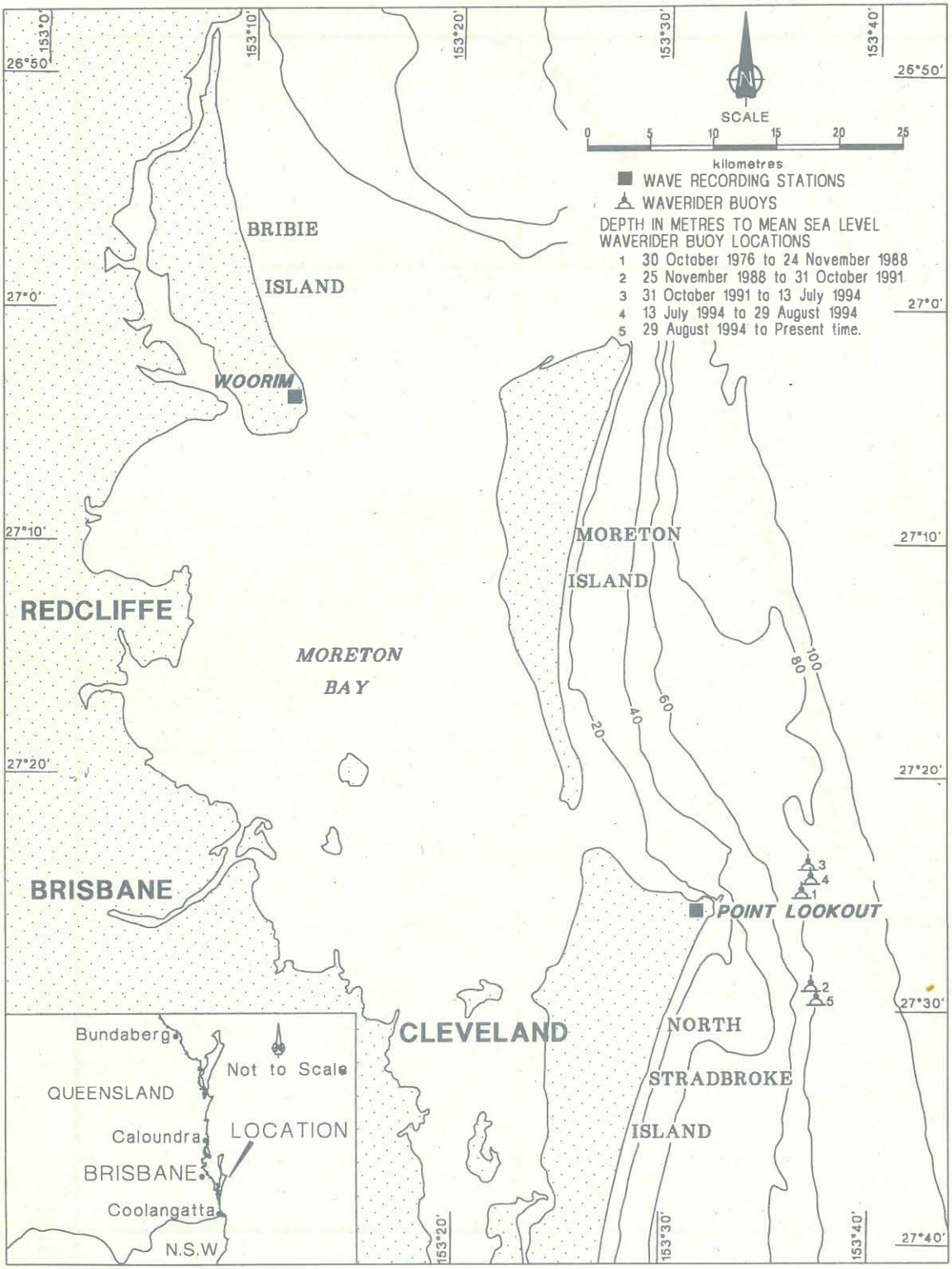
| Significant wave height (metres) | Peak energy wave period (seconds) | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|
| | 0 - 2.99 | 3 - 4.99 | 5 - 6.99 | 7 - 8.99 | 9 - 10.99 | 11 - 12.99 | 13 - 14.99 | > 14.99 | |
| 0.00 - 0.25 | 0.50 | - | - | - | - | - | - | - | 0.50 |
| 0.26 - 0.50 | - | - | 0.25 | 1.97 | 0.53 | - | - | - | 2.75 |
| 0.51 - 0.75 | - | 7.43 | 21.77 | 36.43 | 32.70 | 3.89 | 0.63 | 0.29 | 103.14 |
| 0.76 - 1.00 | - | 30.30 | 67.50 | 186.77 | 128.72 | 25.49 | 0.71 | 0.13 | 439.92 |
| 1.01 - 1.25 | - | 28.32 | 84.15 | 245.82 | 157.93 | 23.13 | 0.83 | - | 540.18 |
| 1.26 - 1.50 | - | 7.92 | 83.50 | 237.38 | 168.24 | 22.70 | 2.37 | - | 522.11 |
| 1.51 - 1.75 | - | 1.50 | 59.79 | 151.61 | 116.71 | 21.95 | 3.10 | 0.08 | 354.76 |
| 1.76 - 2.00 | - | 0.06 | 29.58 | 137.88 | 82.33 | 19.94 | 2.04 | - | 271.84 |
| 2.01 - 2.25 | - | - | 15.73 | 99.72 | 64.65 | 12.45 | 0.42 | - | 192.97 |
| 2.26 - 2.50 | - | - | 6.20 | 81.14 | 41.01 | 11.21 | 1.58 | - | 141.14 |
| 2.51 - 2.75 | - | - | 0.96 | 45.09 | 32.19 | 5.95 | 0.54 | - | 84.73 |
| 2.76 - 3.00 | - | - | 0.48 | 27.93 | 22.30 | 9.97 | 1.73 | - | 62.40 |
| 3.01 - 3.25 | - | - | - | 14.06 | 15.52 | 4.25 | 0.04 | - | 33.87 |
| 3.26 - 3.50 | - | - | 0.04 | 4.98 | 12.56 | 2.73 | 0.35 | - | 20.66 |
| 3.51 - 3.75 | - | - | - | 4.23 | 8.69 | 2.45 | 0.04 | - | 15.41 |
| 3.76 - 4.00 | - | - | - | 0.94 | 5.55 | 1.84 | - | - | 8.34 |
| 4.01 - 4.25 | - | - | - | 0.51 | 5.11 | 1.58 | 0.28 | - | 7.49 |
| 4.26 - 4.50 | - | - | - | 0.04 | 2.50 | 0.37 | 0.04 | - | 2.95 |
| 4.51 - 4.75 | - | - | - | - | 2.21 | 0.07 | - | - | 2.27 |
| 4.76 - 5.00 | - | - | - | - | 0.97 | 0.02 | - | - | 0.99 |
| 5.01 - 5.25 | - | - | - | - | 1.09 | 0.26 | - | - | 1.34 |
| 5.26 - 5.50 | - | - | - | - | 0.02 | 0.16 | - | - | 0.18 |
| 5.51 - 5.75 | - | - | - | - | 0.10 | 0.44 | - | - | 0.54 |
| 5.76 - 6.00 | - | - | - | - | - | 0.18 | - | - | 0.18 |
| 6.01 - 6.25 | - | - | - | - | 0.25 | 0.21 | 0.02 | - | 0.48 |
| 6.26 - 6.50 | - | - | - | - | 0.02 | 0.20 | - | - | 0.22 |
| 6.51 - 6.75 | - | - | - | - | 0.02 | 0.15 | - | - | 0.17 |
| 6.76 - 7.00 | - | - | - | - | - | 0.20 | - | - | 0.20 |
| 7.01 - 7.25 | - | - | - | - | - | 0.08 | 0.04 | - | 0.12 |
| 7.26 - 7.50 | - | - | - | - | - | 0.03 | - | - | 0.03 |
| Totals | 0.50 | 75.54 | 369.96 | 1276.50 | 901.92 | 171.89 | 14.77 | 0.51 | 2834.35 |

Values are durations in days rounded to two decimal places.

***Table 3.*** *Wave statistics — Wave period/Wave height occurences — Winter data, all directions.*

| Significant wave height (metres) | Peak energy wave period (seconds) | | | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|
| | 0 - 2.99 | 3 - 4.99 | 5 - 6.99 | 7 - 8.99 | 9 - 10.99 | 11 - 12.99 | 13 - 14.99 | > 14.99 | |
| 0.00 - 0.25 | 0.76 | - | - | - | - | - | 0.25 | - | 1.01 |
| 0.26 - 0.50 | 1.24 | 0.08 | 2.25 | 2.75 | 2.96 | 1.25 | - | - | 10.53 |
| 0.51 - 0.75 | 0.25 | 13.20 | 19.70 | 47.26 | 76.80 | 27.19 | 1.71 | 0.13 | 186.24 |
| 0.76 - 1.00 | 0.24 | 31.81 | 53.21 | 135.01 | 184.85 | 59.38 | 7.18 | 0.29 | 471.99 |
| 1.01 - 1.25 | - | 22.02 | 81.63 | 191.37 | 199.99 | 54.17 | 6.17 | 0.08 | 555.42 |
| 1.26 - 1.50 | - | 10.43 | 81.56 | 144.01 | 186.07 | 52.30 | 3.71 | 0.42 | 478.50 |
| 1.51 - 1.75 | - | 0.83 | 55.89 | 115.49 | 122.76 | 40.24 | 2.53 | - | 337.75 |
| 1.76 - 2.00 | - | - | 40.06 | 86.88 | 97.86 | 28.25 | 1.81 | - | 254.87 |
| 2.01 - 2.25 | - | - | 15.93 | 59.74 | 54.83 | 22.87 | 0.92 | - | 154.28 |
| 2.26 - 2.50 | - | - | 6.31 | 46.17 | 39.13 | 12.48 | 2.30 | 0.04 | 106.44 |
| 2.51 - 2.75 | - | - | 1.25 | 32.45 | 26.39 | 9.79 | 1.04 | 0.15 | 71.08 |
| 2.76 - 3.00 | - | - | 0.04 | 13.77 | 17.78 | 7.98 | 0.75 | 0.04 | 40.36 |
| 3.01 - 3.25 | - | - | - | 6.87 | 8.61 | 5.79 | 0.80 | 0.04 | 22.10 |
| 3.26 - 3.50 | - | - | - | 2.27 | 6.28 | 4.81 | 0.17 | - | 13.53 |
| 3.51 - 3.75 | - | - | - | 2.51 | 5.80 | 0.63 | 0.13 | - | 9.06 |
| 3.76 - 4.00 | - | - | - | 1.17 | 3.84 | 1.08 | - | - | 6.09 |
| 4.01 - 4.25 | - | - | - | 0.59 | 1.87 | 0.50 | - | - | 2.96 |
| 4.26 - 4.50 | - | - | - | 0.04 | 3.24 | 0.75 | - | - | 4.02 |
| 4.51 - 4.75 | - | - | - | - | 1.25 | 0.50 | - | - | 1.75 |
| 4.76 - 5.00 | - | - | - | - | 0.25 | - | - | - | 0.25 |
| 5.01 - 5.25 | - | - | - | - | 0.63 | 0.50 | - | - | 1.13 |
| 5.26 - 5.50 | - | - | - | - | - | 0.50 | - | - | 0.50 |
| 5.51 - 5.75 | - | - | - | - | - | - | - | - | 0.00 |
| 5.76 - 6.00 | - | - | - | - | - | - | - | - | 0.00 |
| 6.01 - 6.25 | - | - | - | - | - | - | - | - | 0.00 |
| 6.26 - 6.50 | - | - | - | - | - | - | - | - | 0.00 |
| 6.51 - 6.75 | - | - | - | - | - | - | - | - | 0.00 |
| 6.76 - 7.00 | - | - | - | - | - | - | - | - | 0.00 |
| 7.01 - 7.25 | - | - | - | - | - | - | - | - | 0.00 |
| 7.26 - 7.50 | - | - | - | - | - | - | - | - | 0.00 |
| Totals | 2.49 | 78.39 | 357.84 | 888.35 | 1041.09 | 330.96 | 29.46 | 1.18 | 2766.66 |

Values are durations in days rounded to two decimal places.

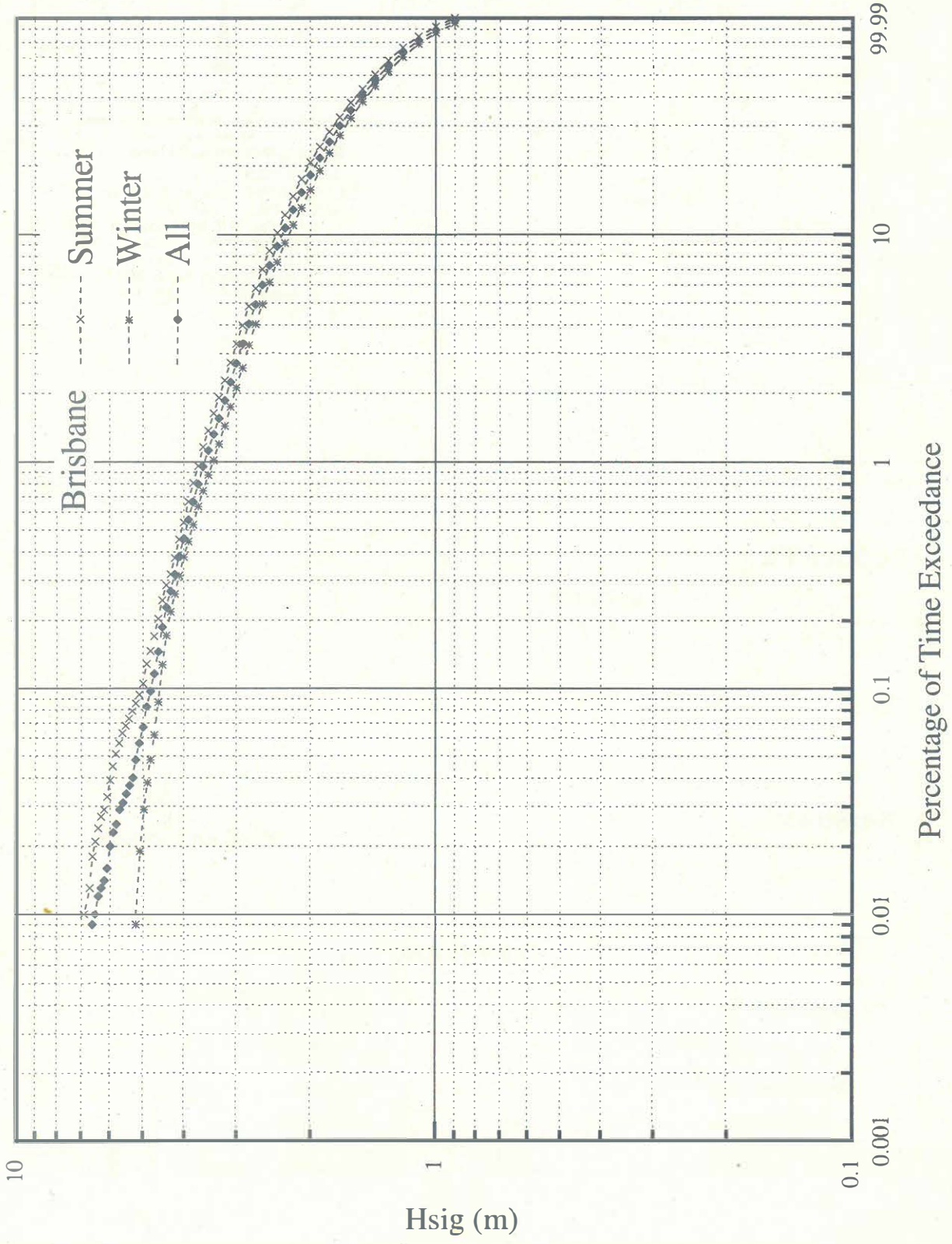



LOCALITY MAP

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 1**

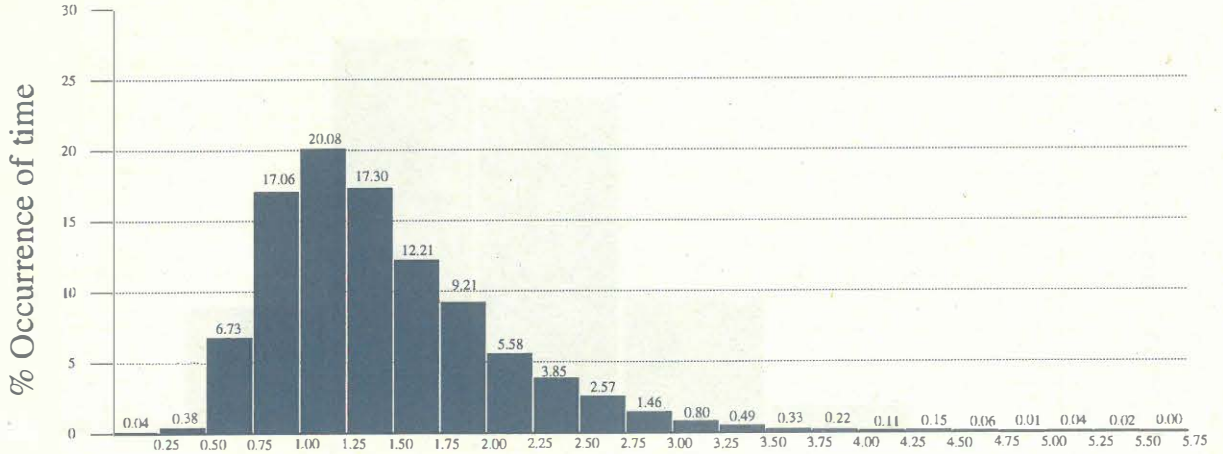



PERCENTAGE (of time) EXCEEDANCE
OF WAVE HEIGHTS (Hsig) FOR ALL WAVE PERIODS
30 October 1976 to 30 June 1994

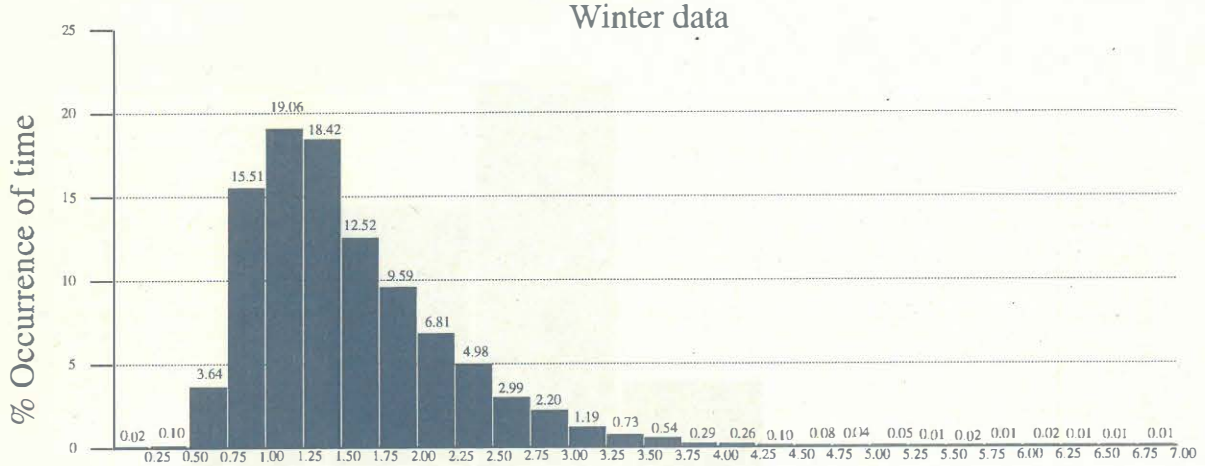
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

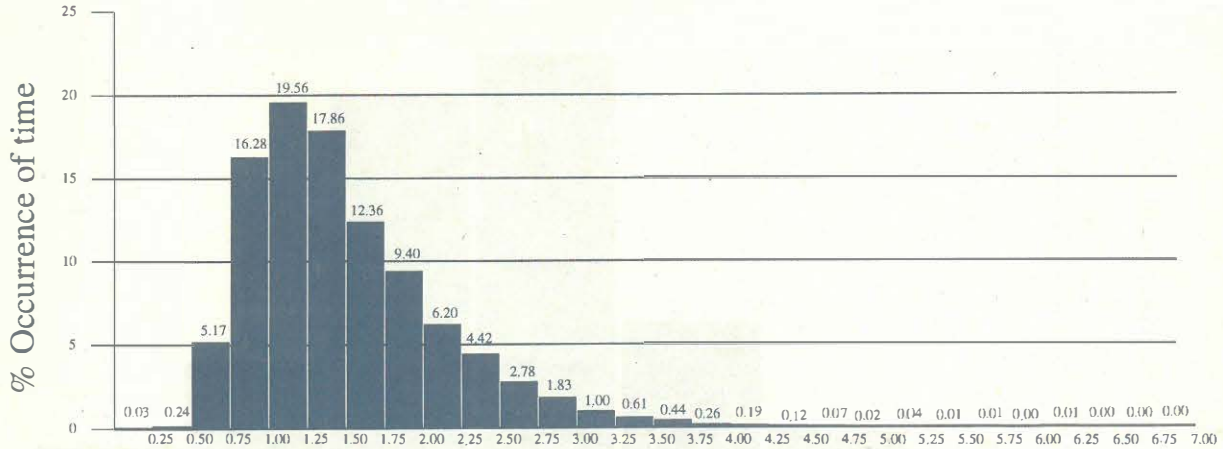
**Figure 2**




Winter data



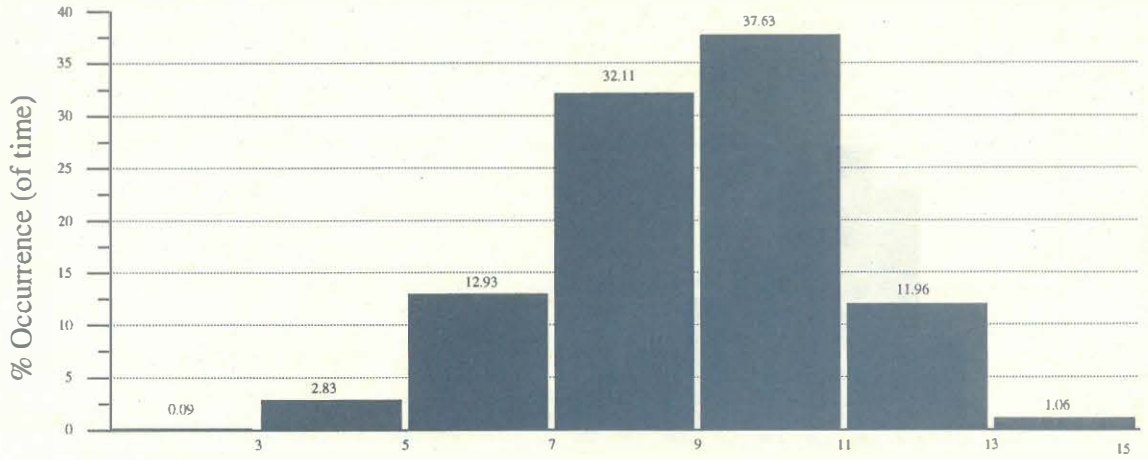

Summer data



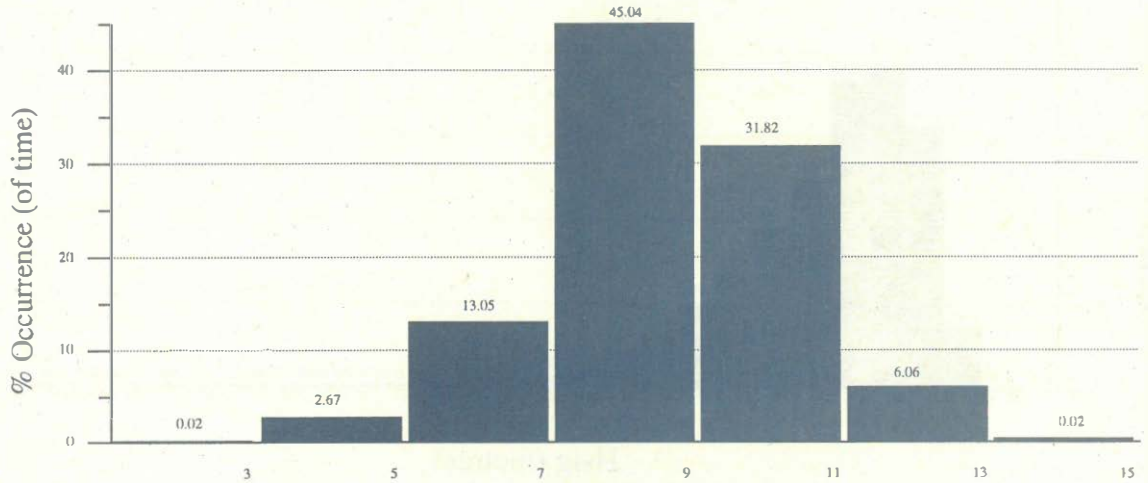

All data

HISTOGRAM PERCENTAGE (of time)
OCCURRENCE OF WAVE HEIGHTS (Hsig)
FOR ALL WAVE PERIODS (Tp)

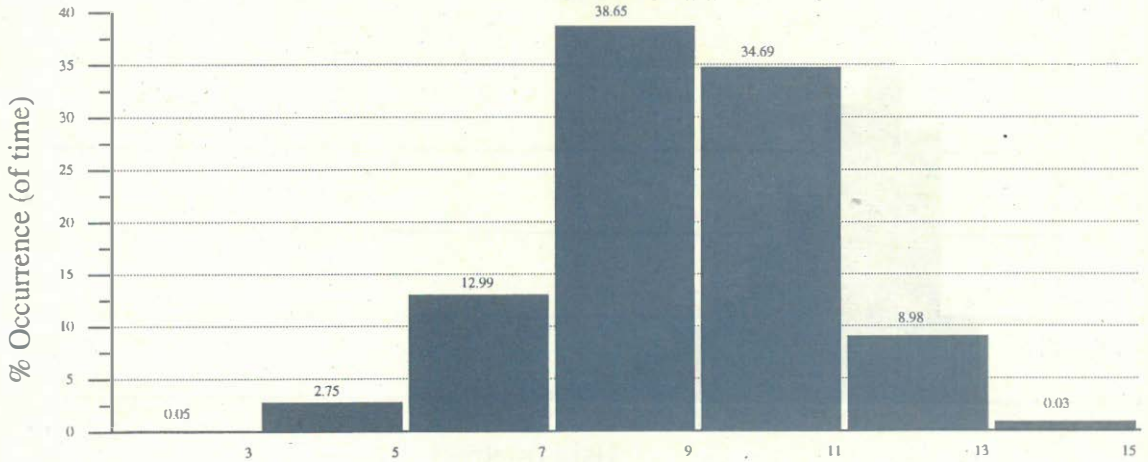
| | | |
|---|---|---|
| Beach Protection Authority Queensland<br>Queensland Department of Environment and Heritage | Wave Data Recording Program<br>BRISBANE REGION | **Figure 3** |




Winter data




Summer data



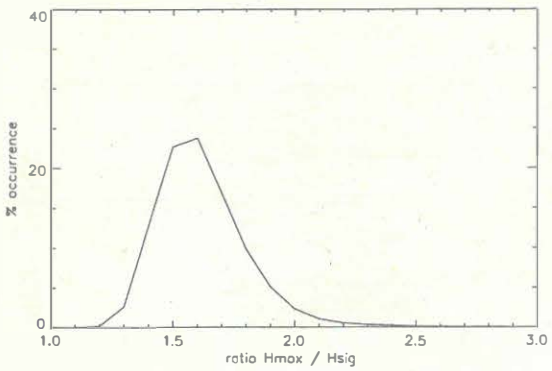

All data

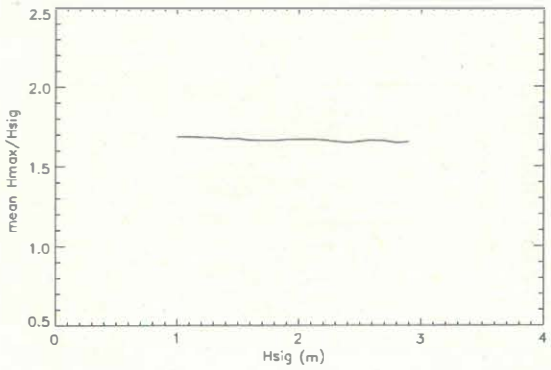
HISTOGRAM PERCENTAGE (of time)
OCCURRENCE OF WAVE PERIODS (Tp)
FOR ALL WAVE HEIGHTS (Hsig)

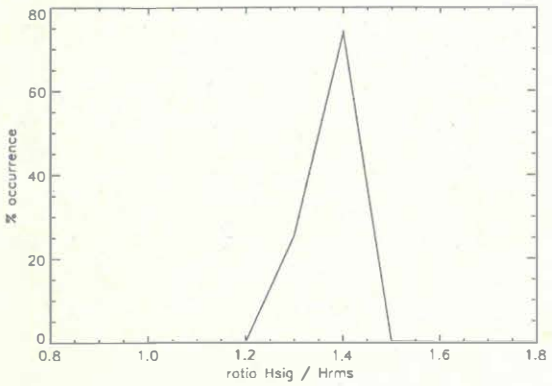
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

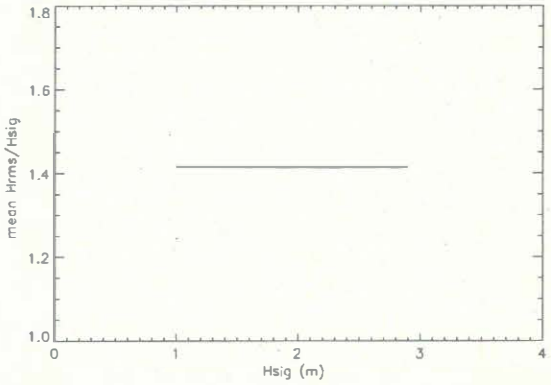
Wave Data Recording Program
BRISBANE REGION

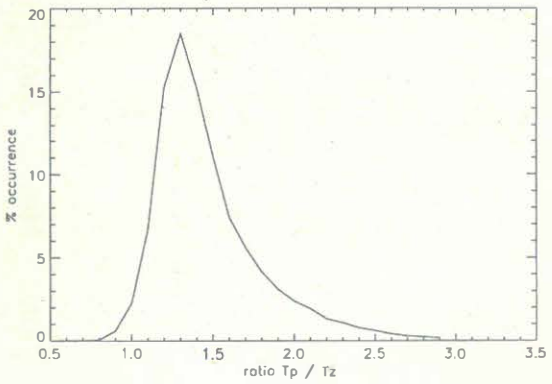
**Figure 4**

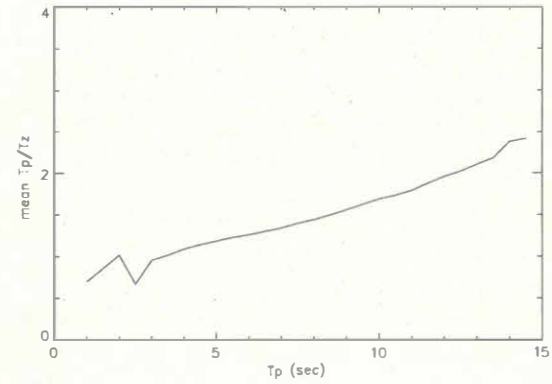


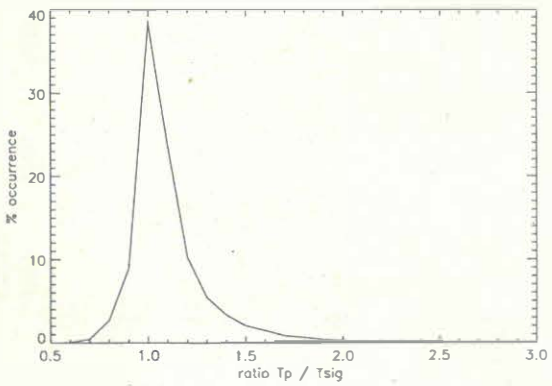



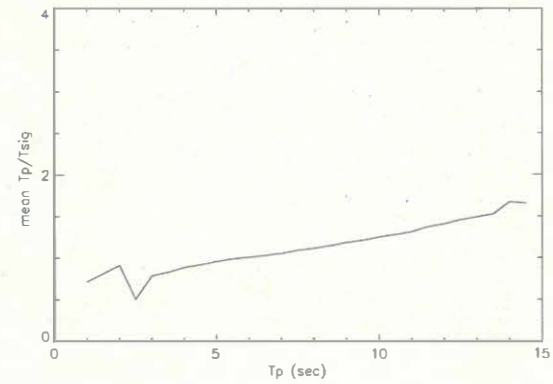



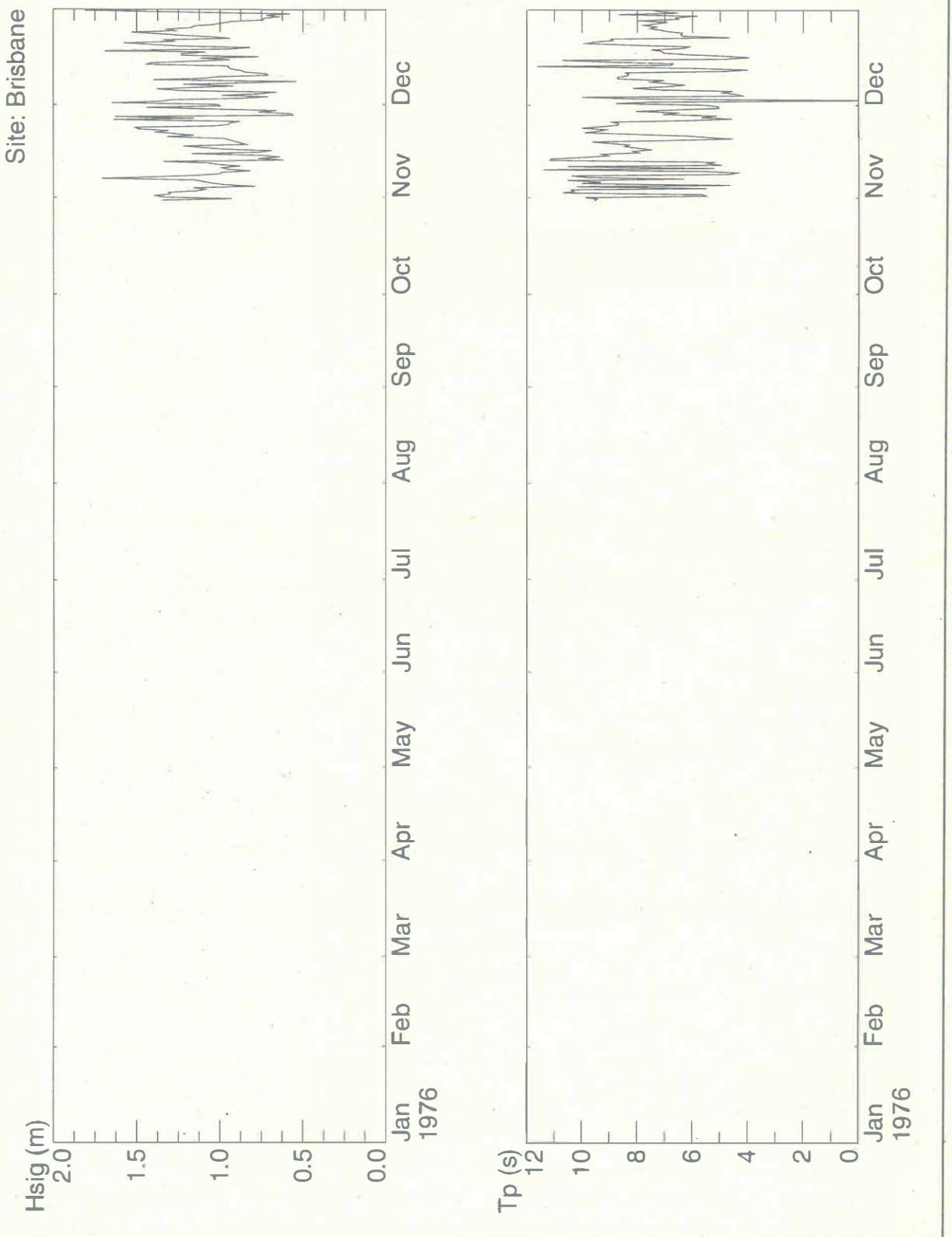




WAVE PARAMETER RELATIONSHIPS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 5**

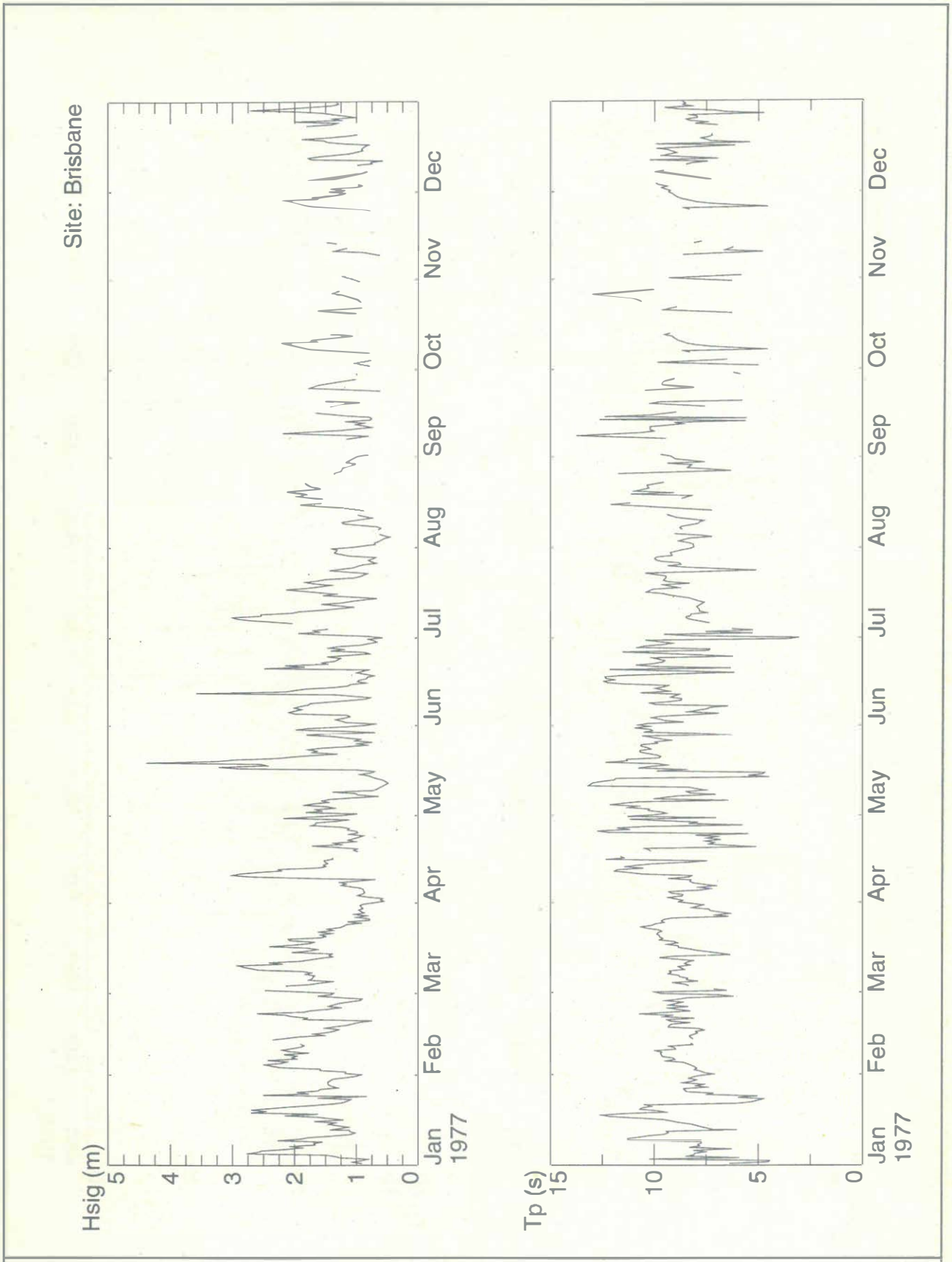



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.1**

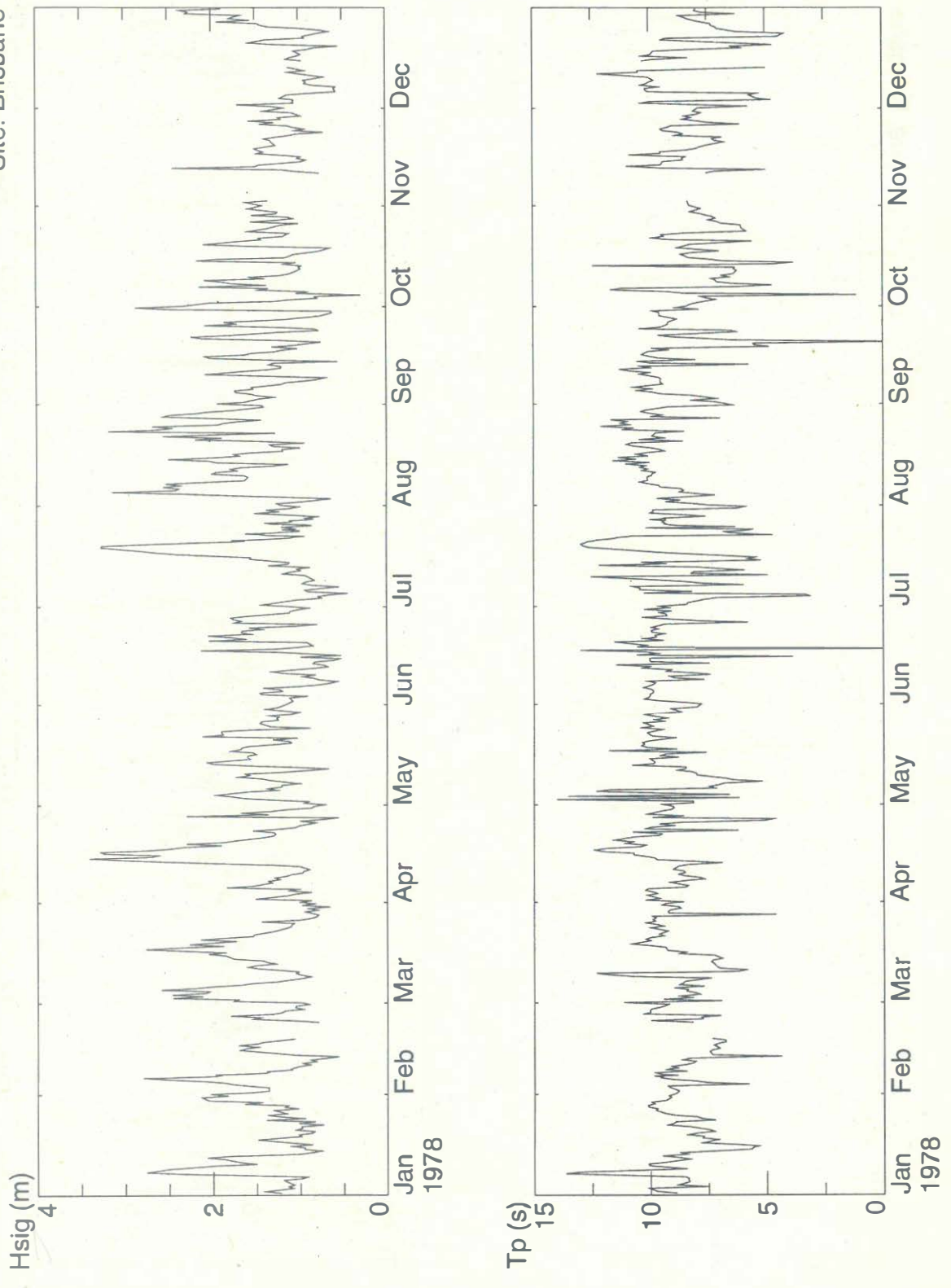



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.2**

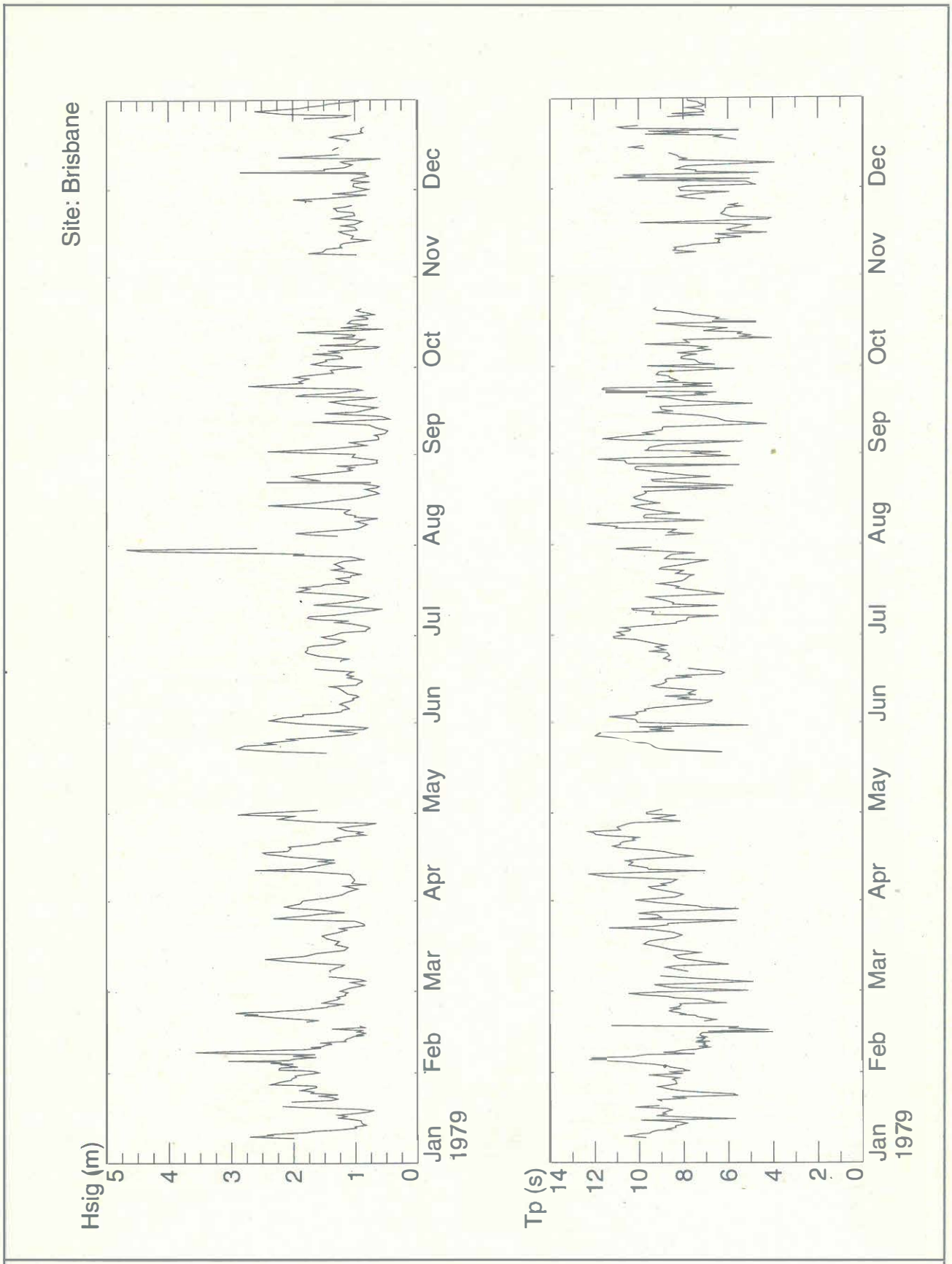



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.3**

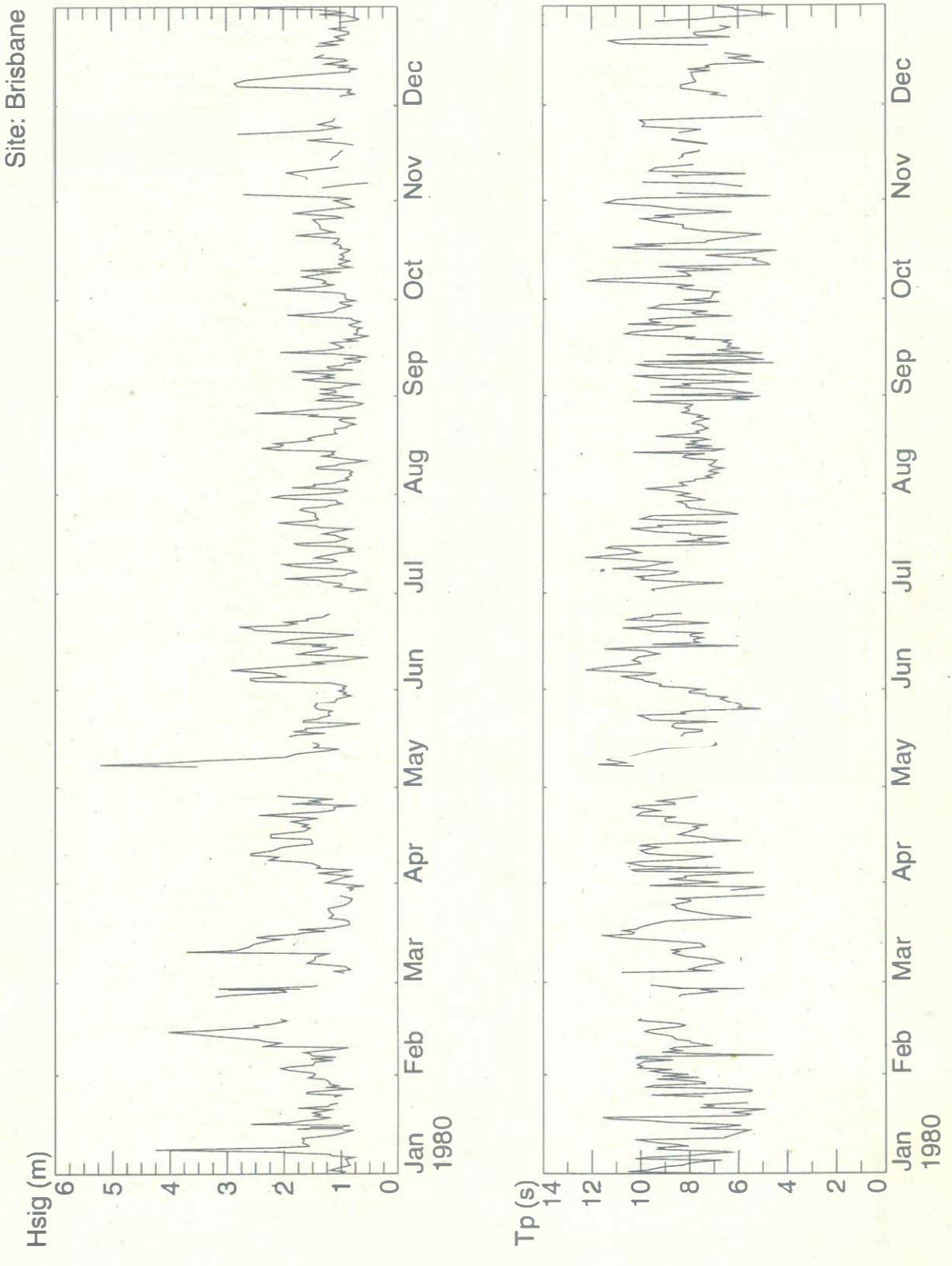



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.4**

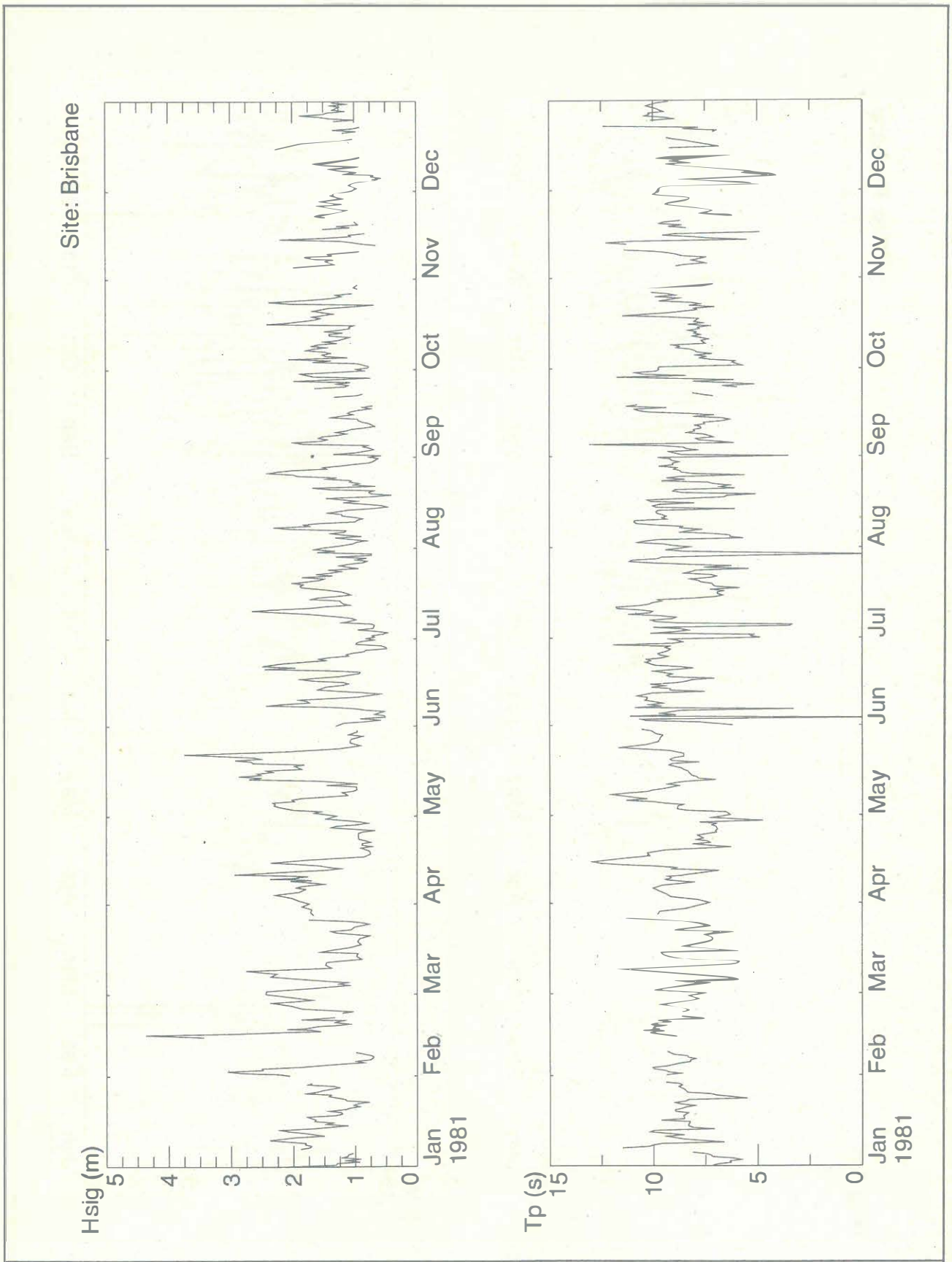



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.5**




DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
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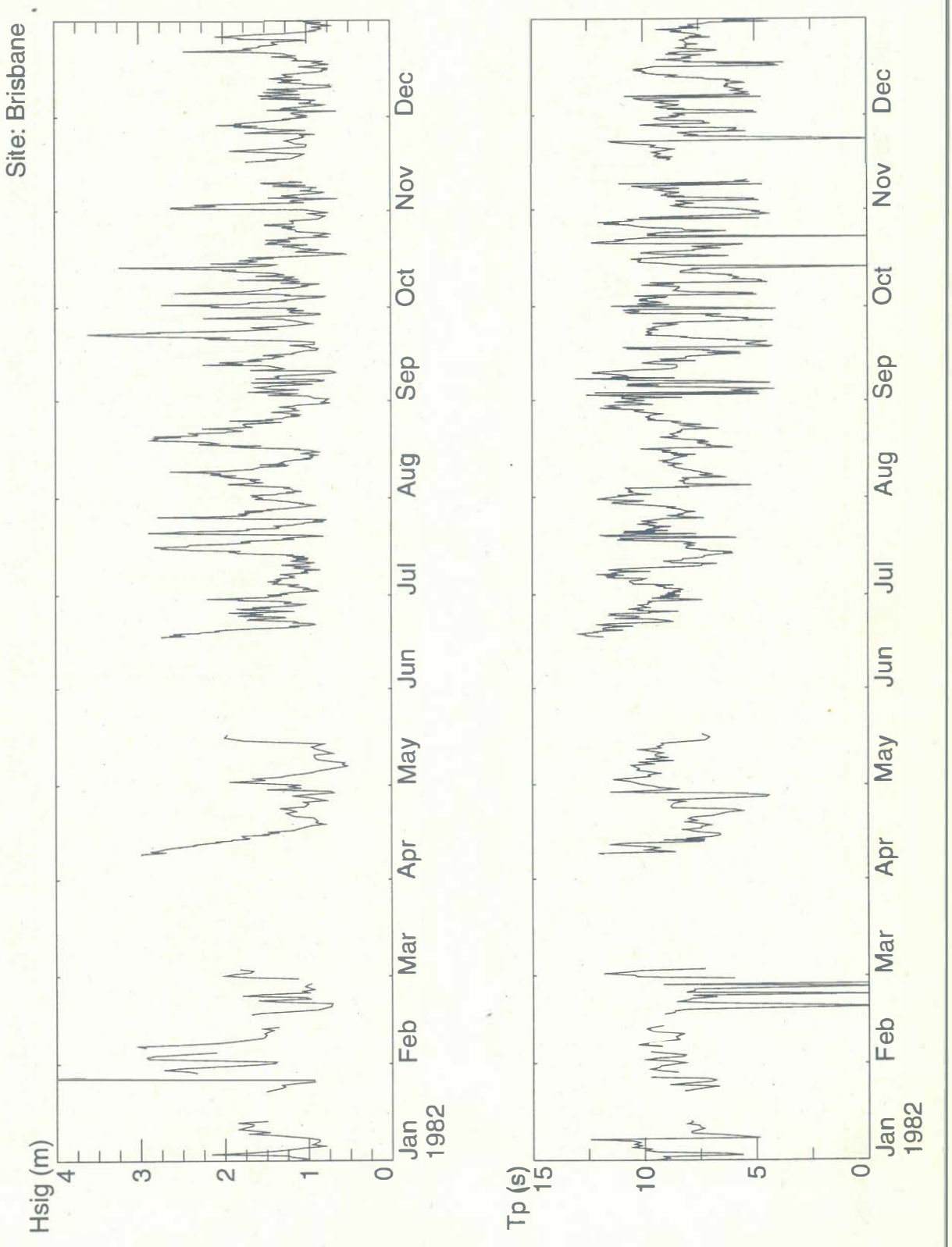
Wave Data Recording Program
BRISBANE REGION

**Figure 6.6**

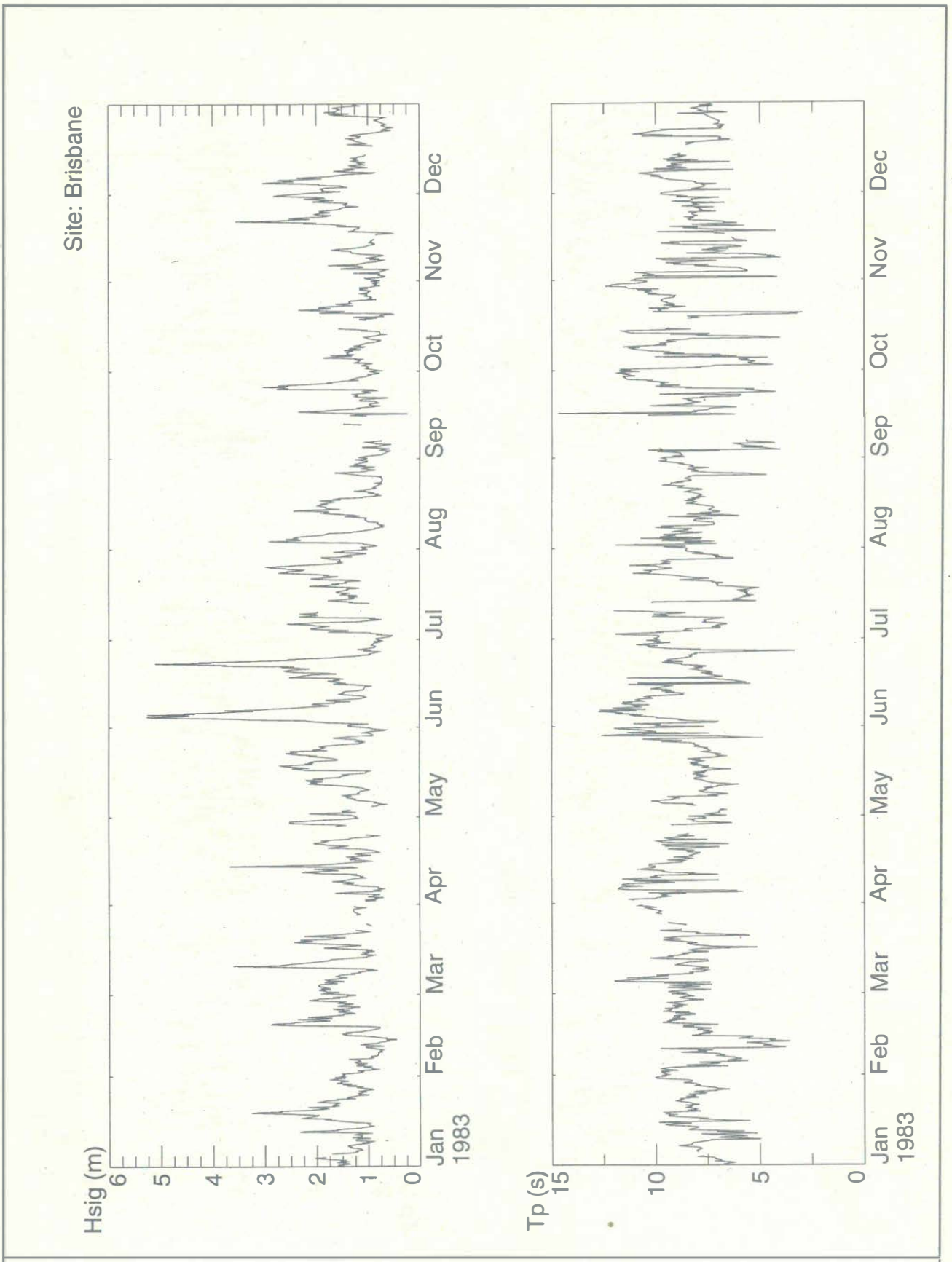



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.7**




DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

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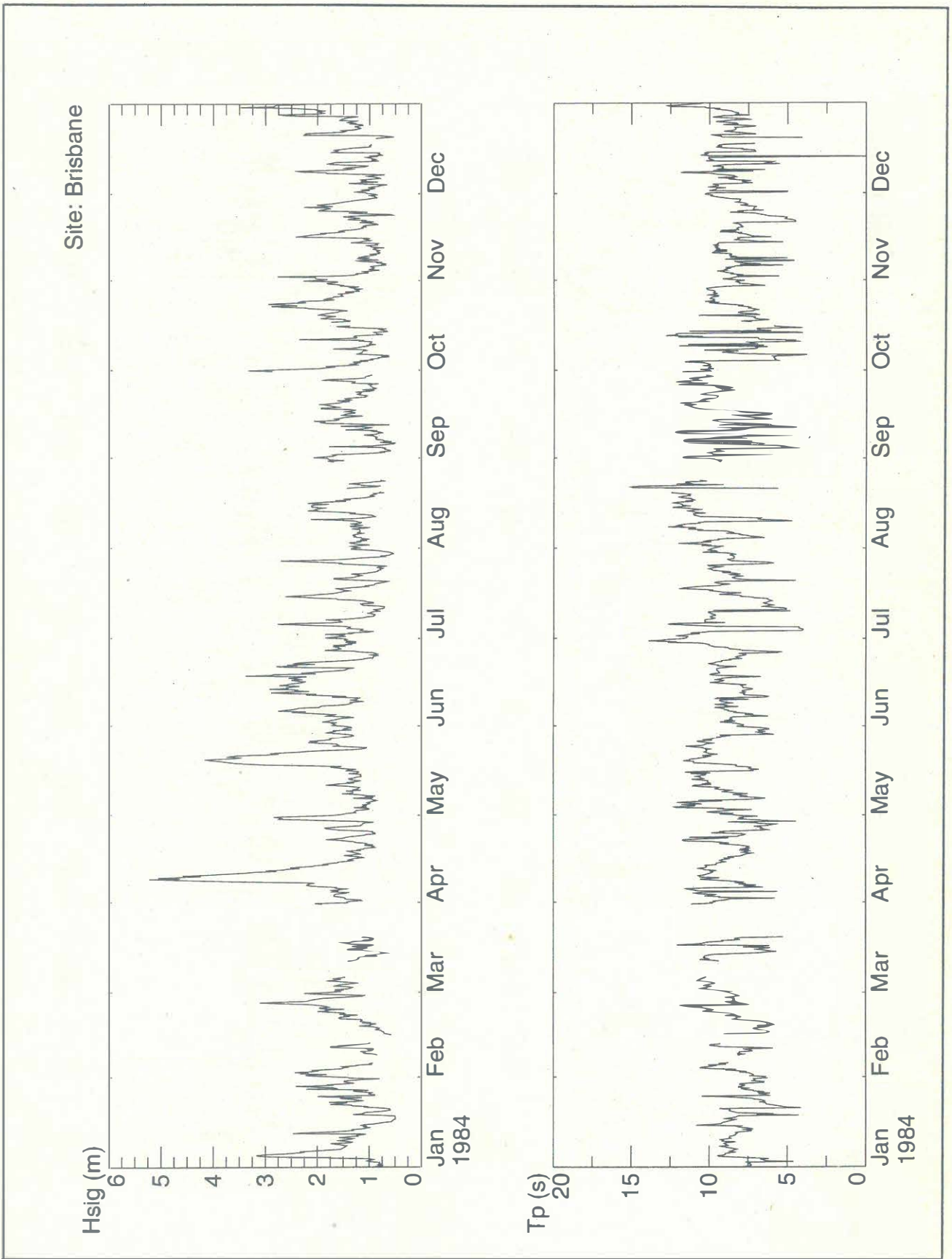
BRISBANE REGION

**Figure 6.8**

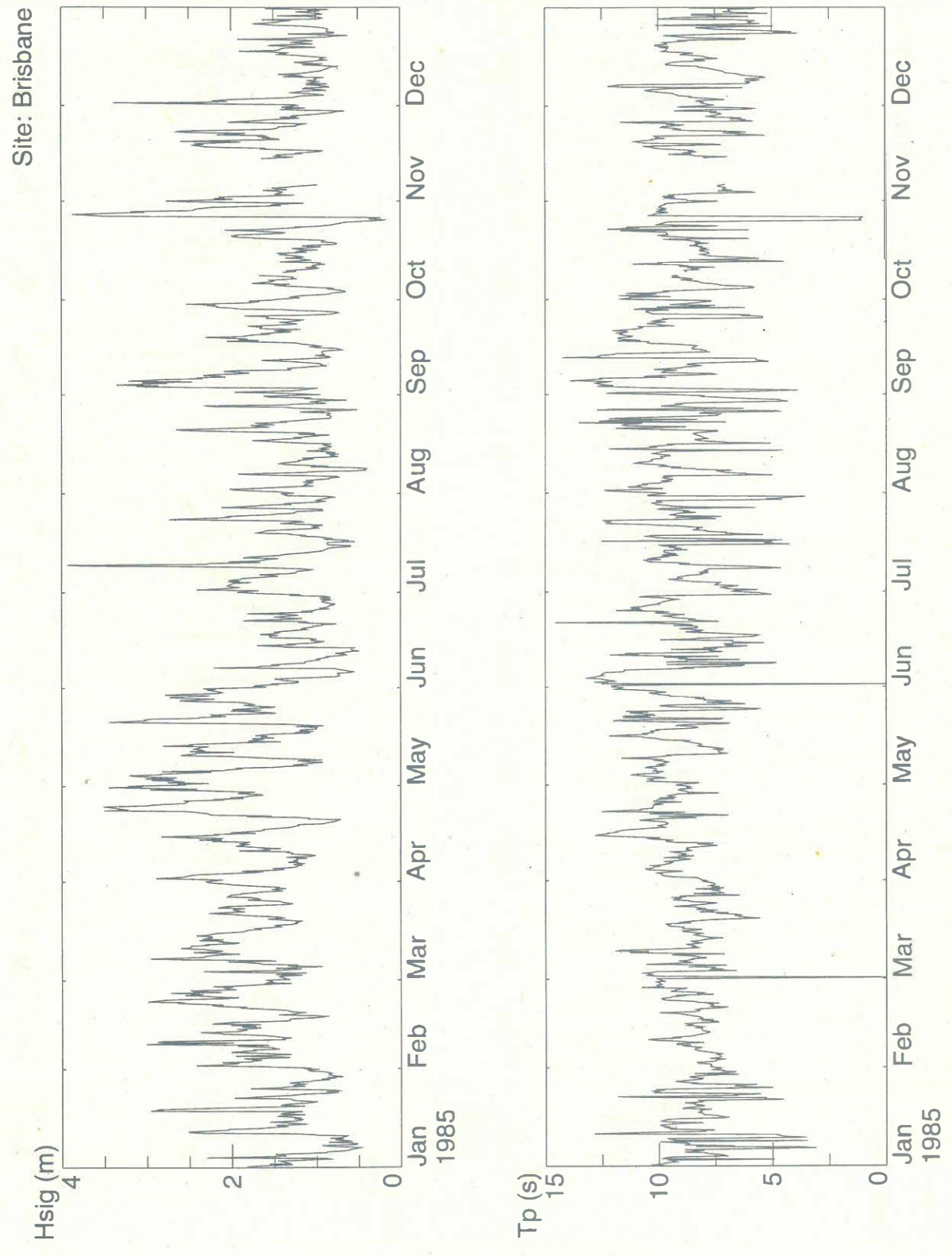



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.9**

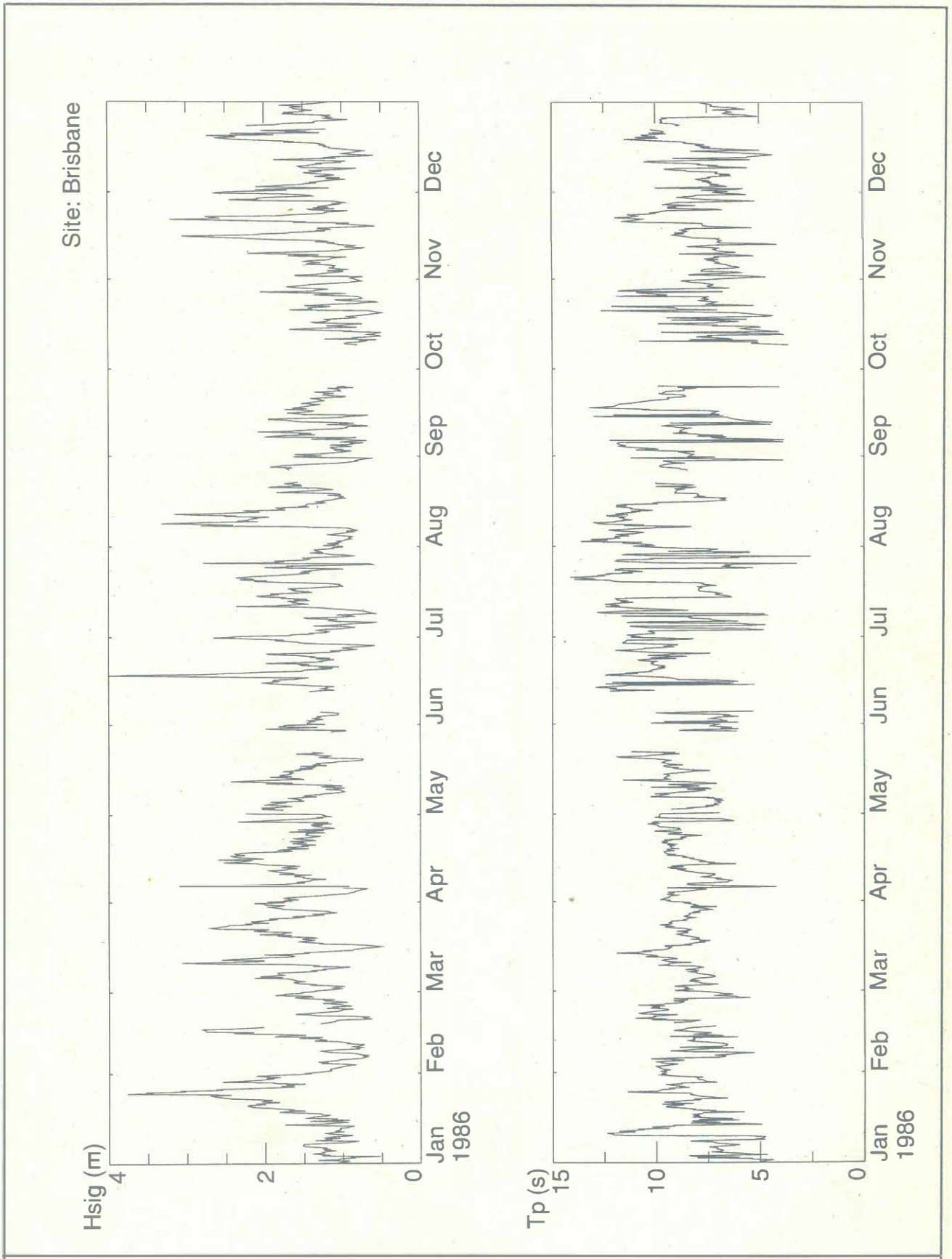



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.10**

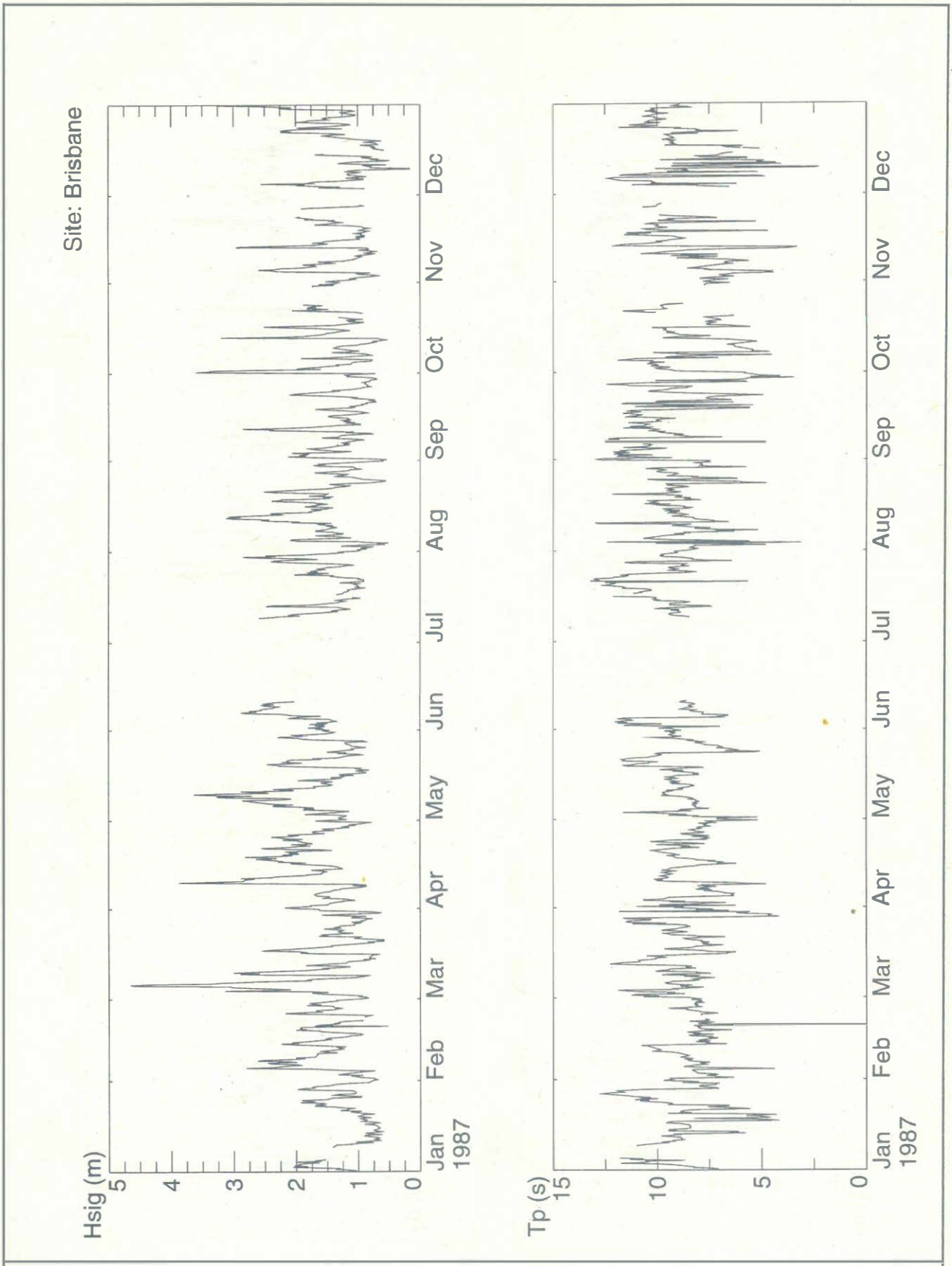



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.11**

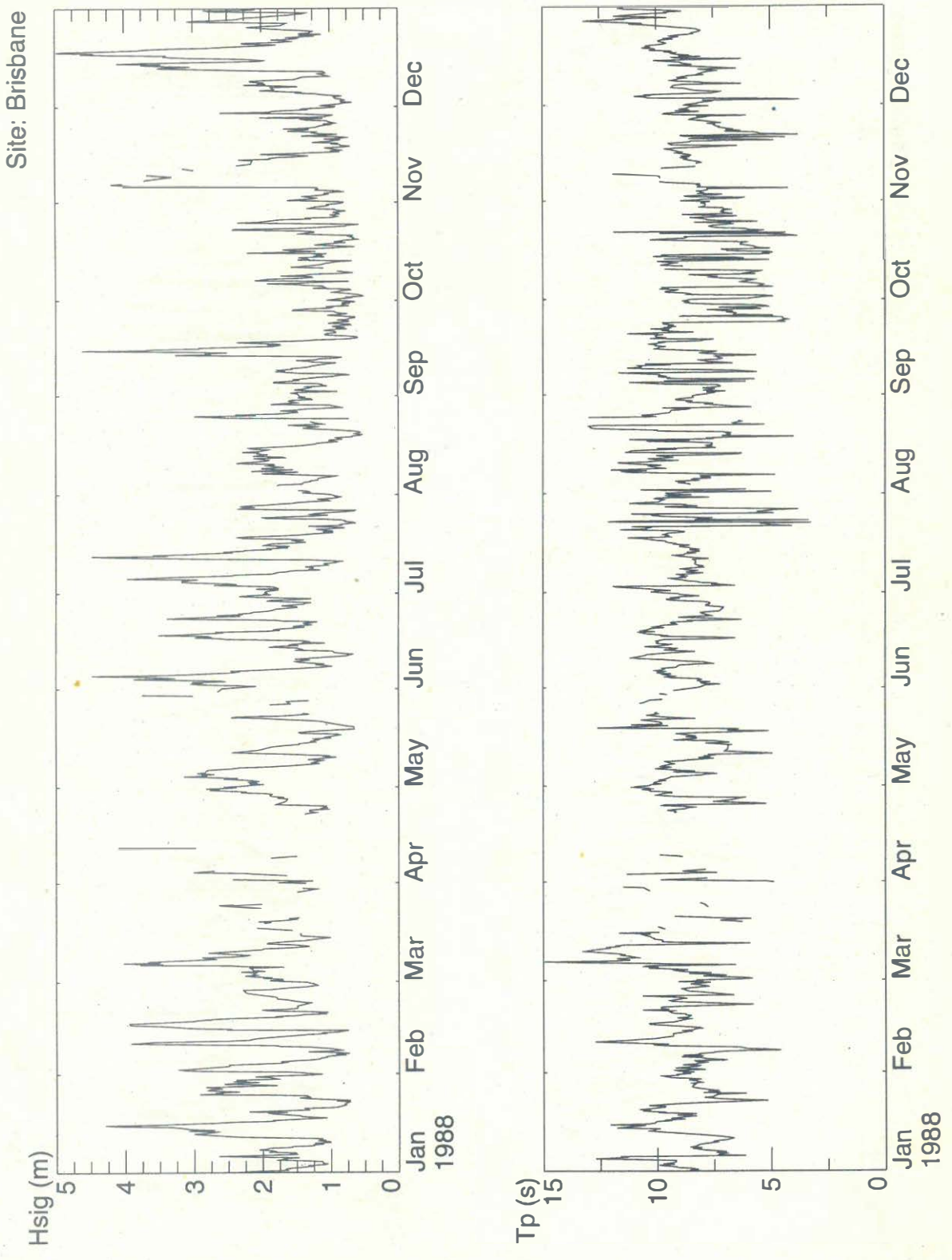



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.12**




DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

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Queensland Department of Environment and Heritage

Wave Data Recording Program
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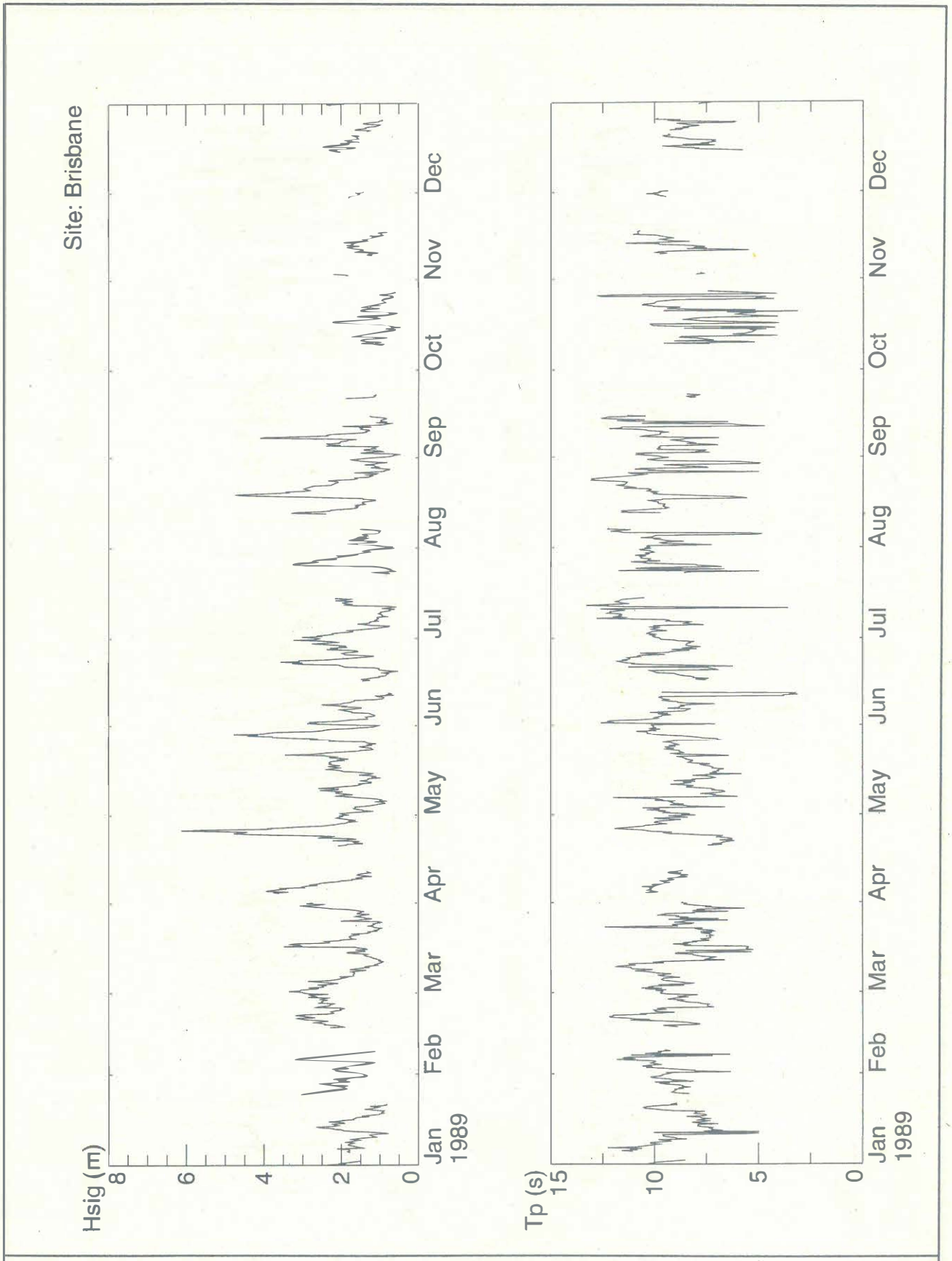
**Figure 6.13**



*Wave data recording program, Brisbane Region — 1976-1994 • August 1994 • ISSN 0158-7757*

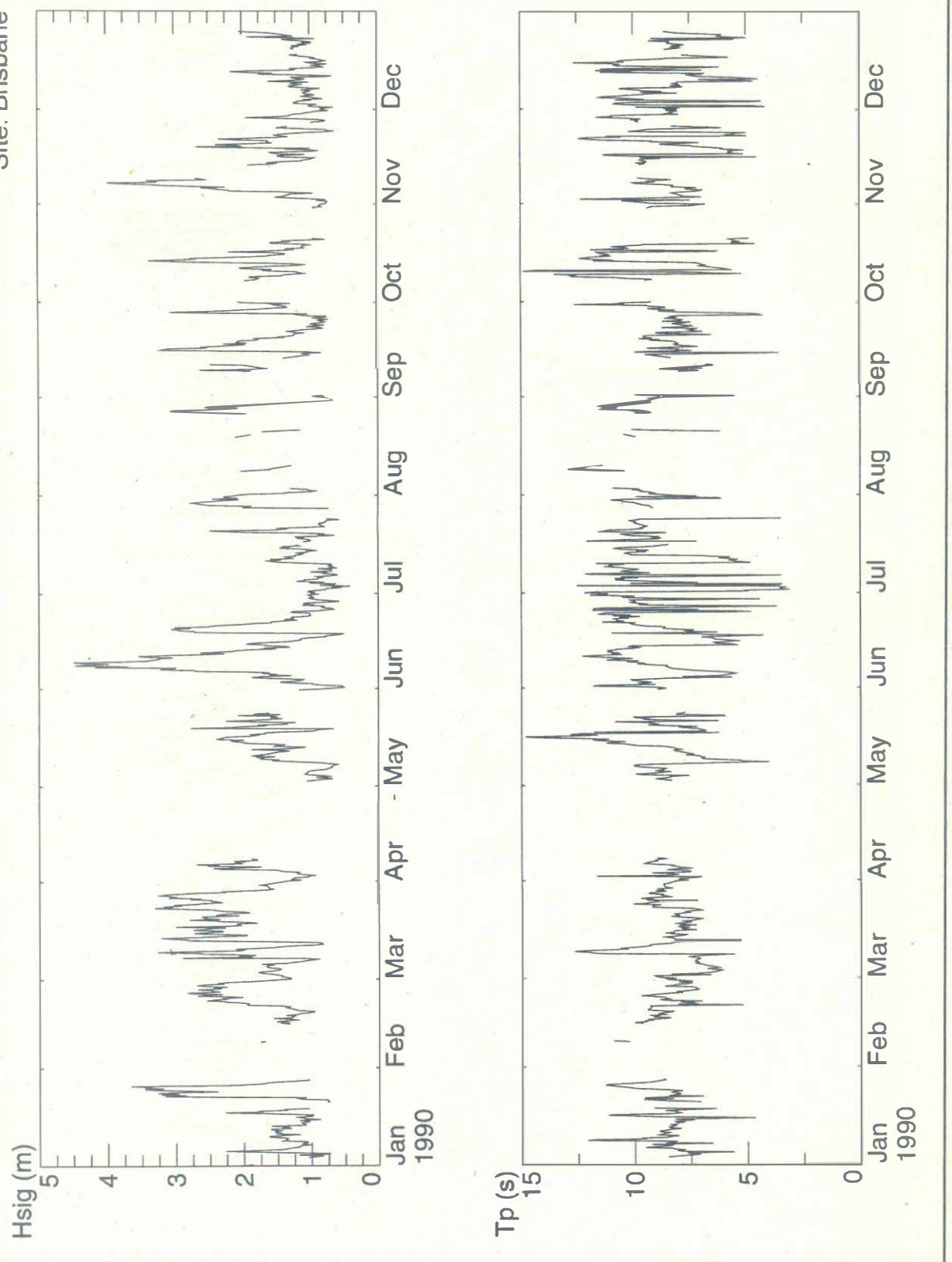



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.14**

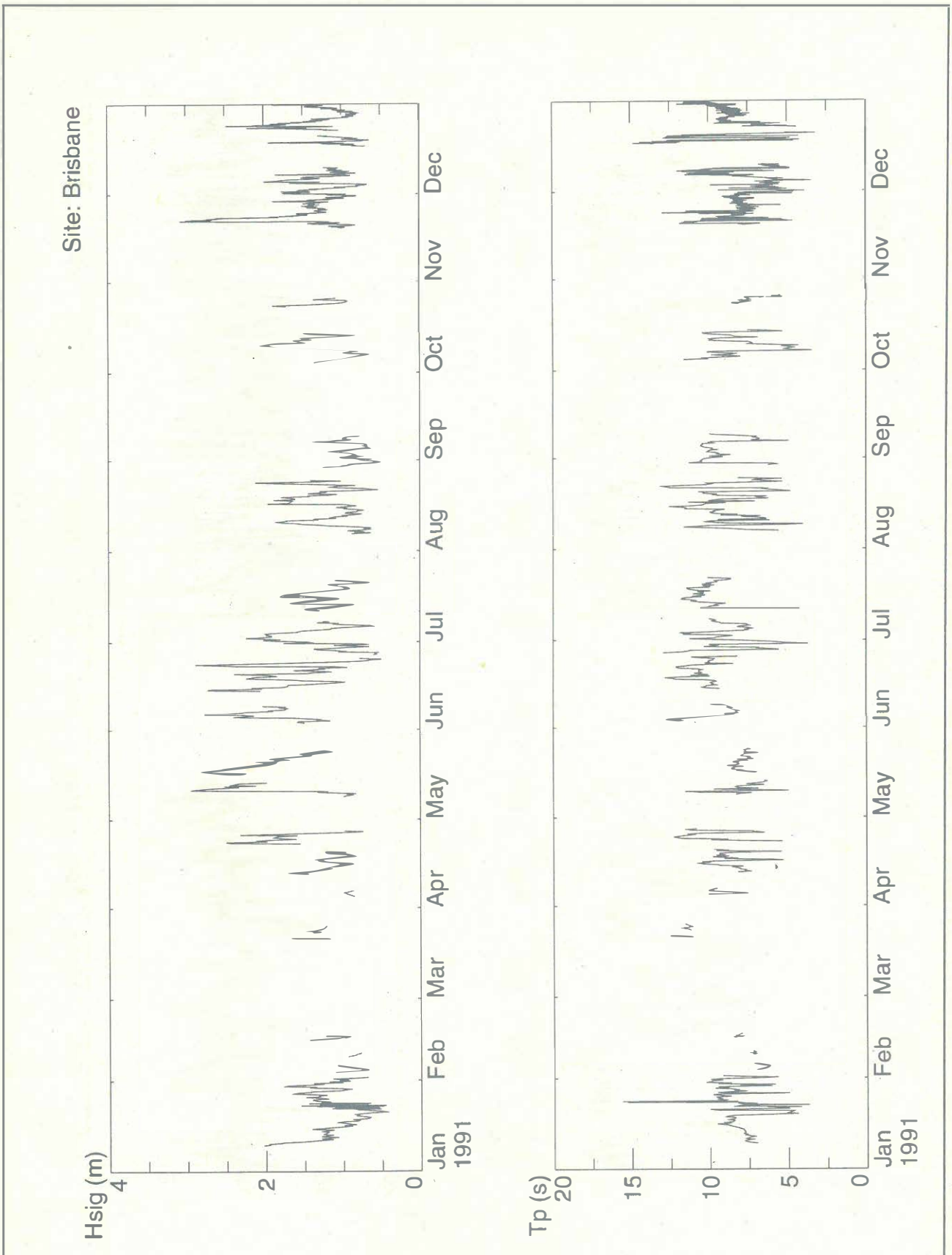



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.15**

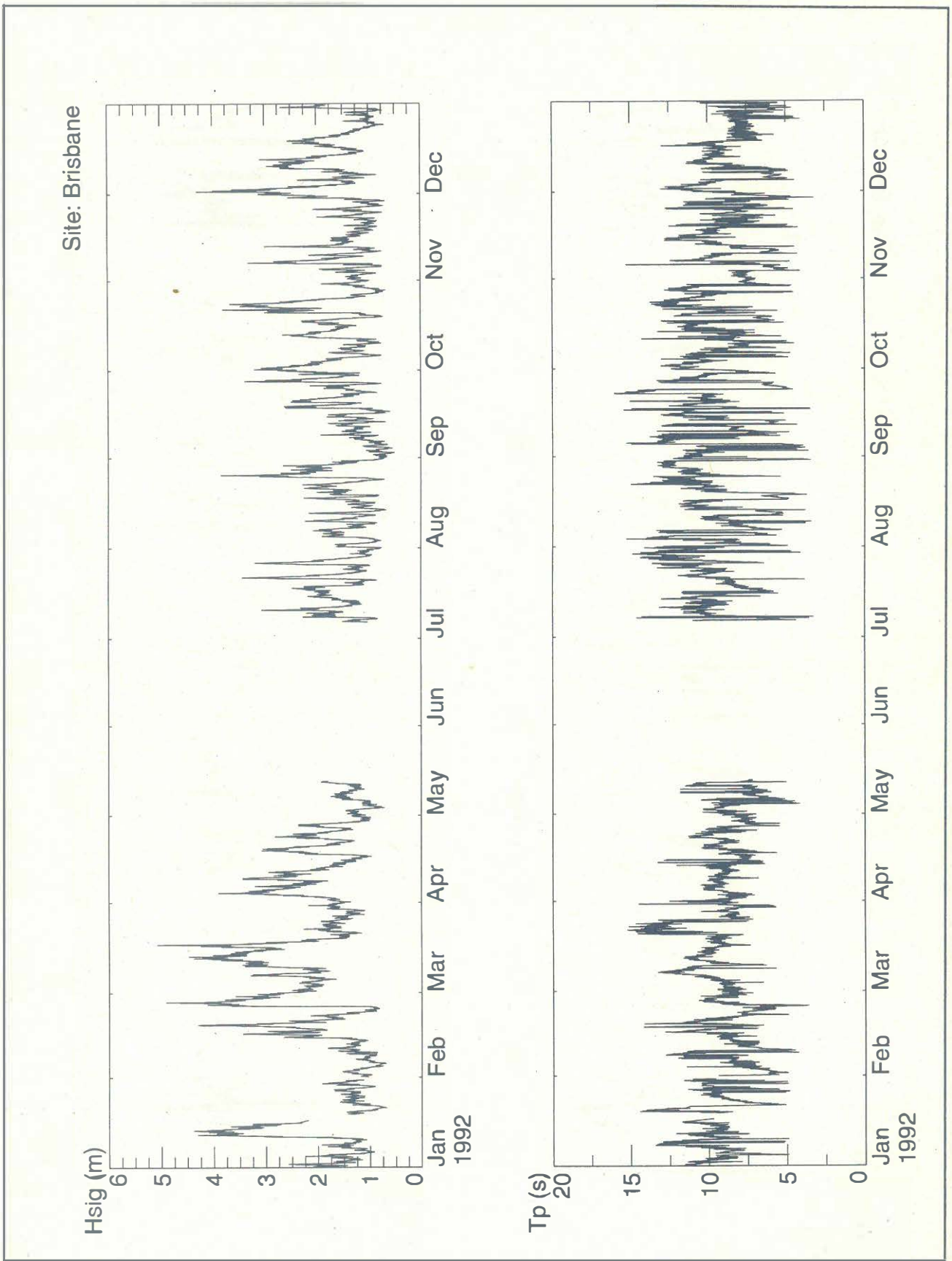



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.16**

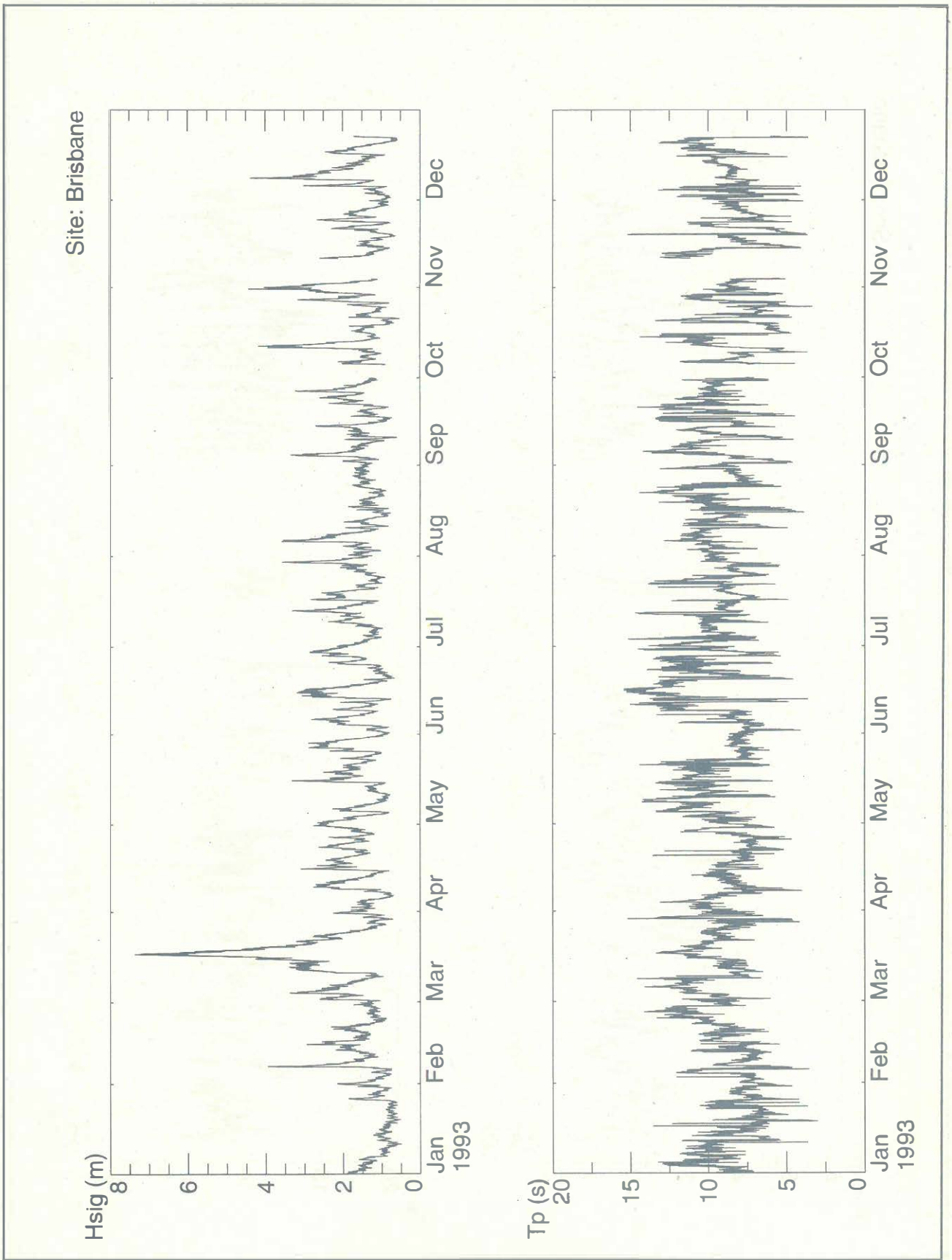



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.17**

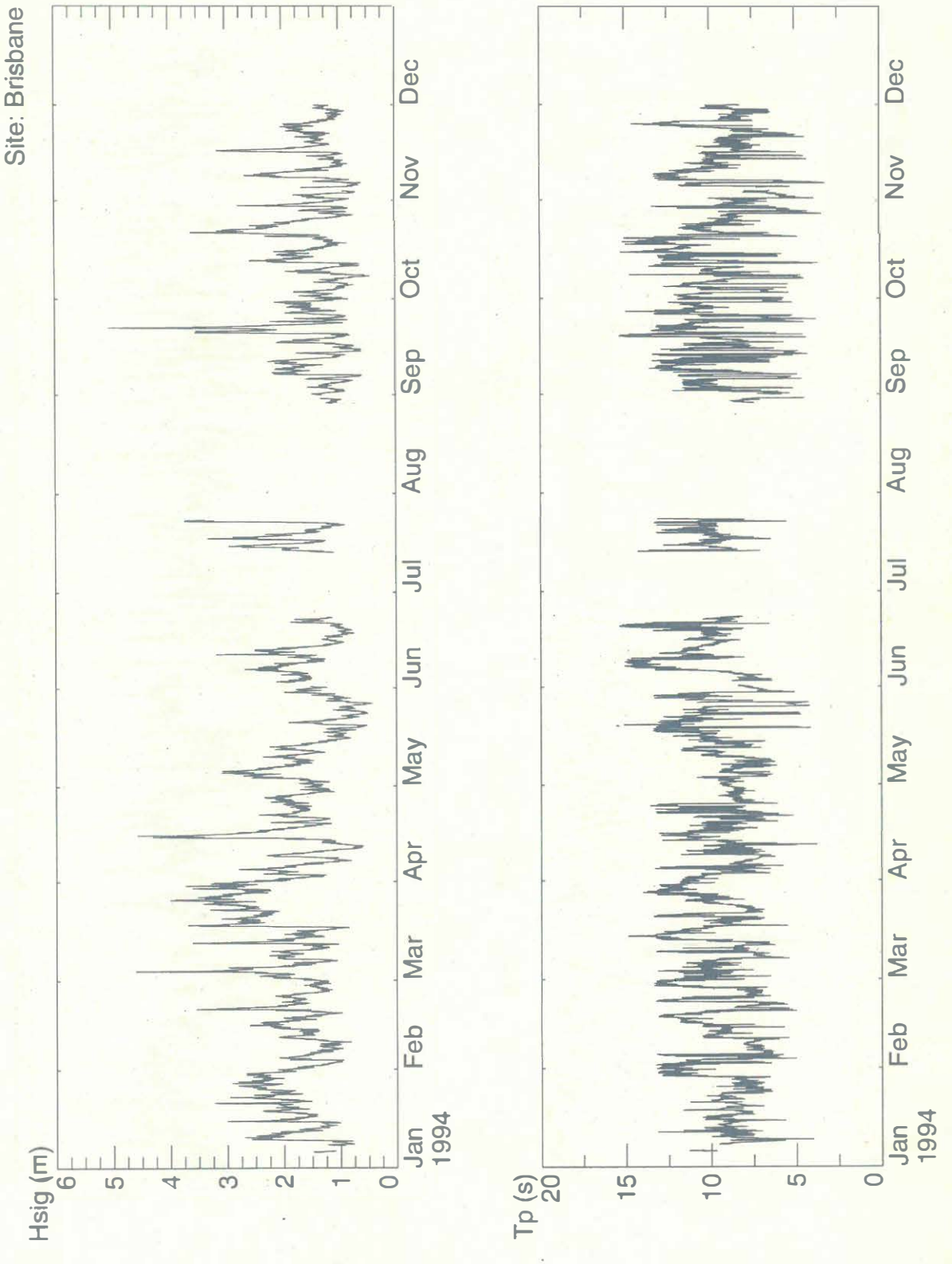



DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.18**




DAILY WAVE RECORDINGS
30 October 1976 to 30 June 1994

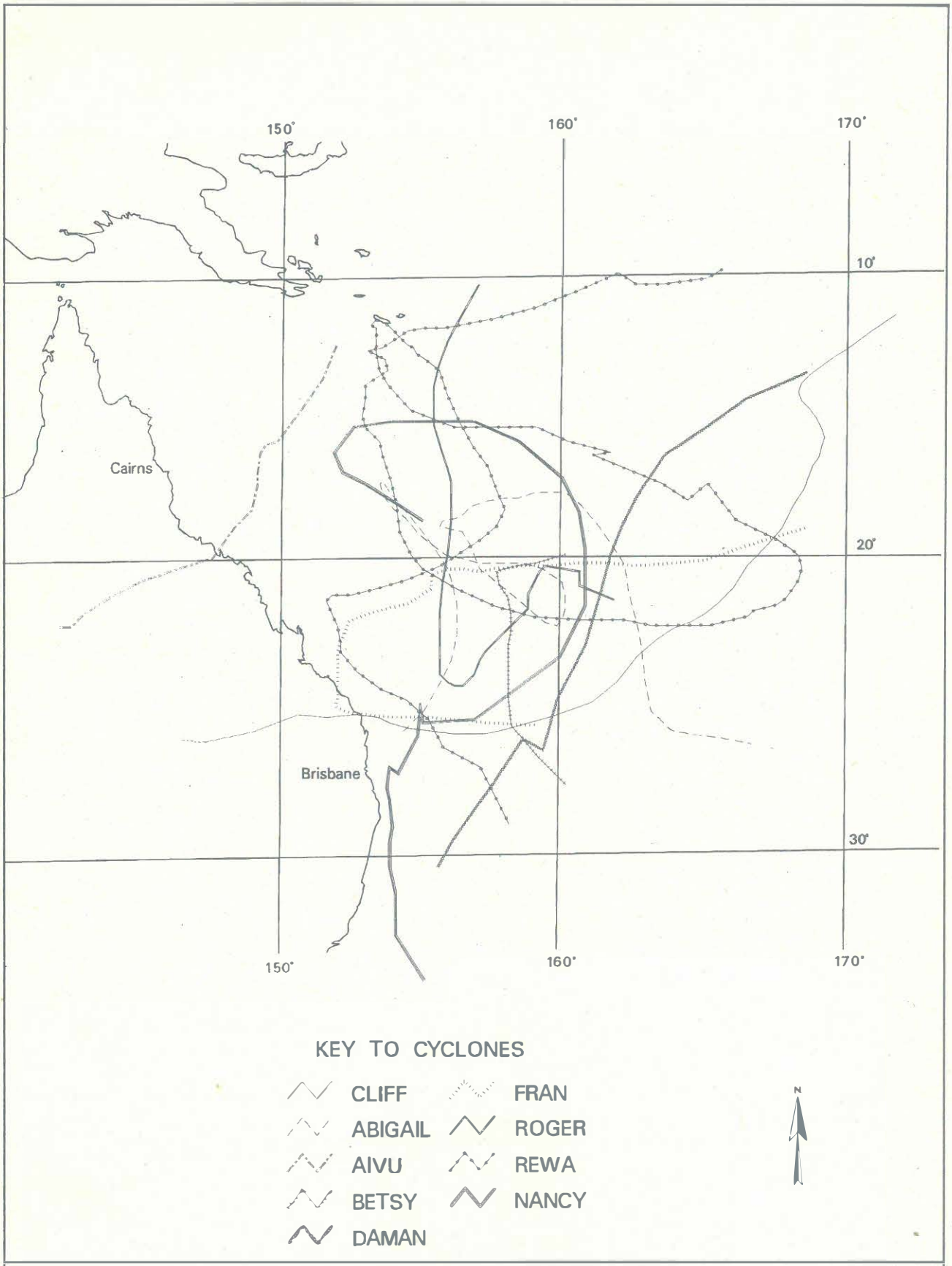
Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 6.19**



*Wave data recording program, Brisbane Region — 1976-1994 • August 1994 • ISSN 0158-7757*




Cyclone Tracks

Beach Protection Authority Queensland
Queensland Department of Environment and Heritage

Wave Data Recording Program
BRISBANE REGION

**Figure 7**