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WIND WAVES IN NEW ZEALAND
AN ANNOTATED BIBLIOGRAPHY

by

R.A. Pickrill

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C O N T E N T S

	Page
INTRODUCTION	5
ACKNOWLEDGMENTS	6
BIBLIOGRAPHY	7
INDEXES	
Geographical	24
Subject	25
APPENDIX A	26

INTRODUCTION

In New Zealand the study of physical oceanography has concentrated on defining the oceanic and nearshore circulation, with wind waves and swell coming in for very little attention. However, in the last decade the demand for information about waves around New Zealand has increased. The collection of such information has concentrated on meeting specific demands rather than pursuing pure research, and as a result the research has been disjointed and fragmented, with much of the information obtained remaining unpublished.

The quality of the information on waves is extremely variable and is directly proportional to the funds available for data collection. Very few papers have been published using results from wave recorders, and where recorders have been used, they have been restricted generally to large ocean engineering developments, such as the Maui gas field and the iron sand resources of the west coast North Island. Harbour authorities have occasionally collected instrumented wave records, although most rely on visual observations of wave height and period for their design standards.

Other visual records have been compiled from ship reports of sea state conditions, from meteorological weather reports, and from coastal observers set up for specific projects. Probably the largest data group collected and most detailed analyses have been carried out in the course of post graduate research. Several theses have now been completed on the geomorphology of selected sections of coastline, and most of these research projects incorporate detailed analyses of the observed wave climate, wave refraction, and the effects of the wave climate on the beach system.

The need for information about waves around New Zealand resulted in a seminar in February 1979 jointly sponsored by the New Zealand Oceanographic Institute and the New Zealand Meteorological Service. One result of the meeting was *Ocean Waves*, a newsletter to aid communication and co-ordination between people whose interests require the use of, and access to,

wave research and observations. It was also clear that a review of the knowledge of ocean waves around New Zealand was needed and a review paper* has now been submitted for publication and should be available shortly.

The bibliography presented here represents the second stage in this review of information on waves around New Zealand. It has been compiled from a systematic search of the journals listed in Appendix A and from material forwarded by individuals following an appeal for information through *Ocean Waves*. In most instances, a brief note on the content of the paper, or its particular relevance to wave research is given. Any references without annotation have not been seen by the author.

Material included here is restricted to unpublished reports and published papers that make a direct reference to wave information. Papers referring to such processes as littoral drift, coastal erosion, and sediment transport that often contain indirect references to wave processes have been excluded.

The reference abbreviations used in this bibliography are according to the "World List of Scientific Periodicals, Fourth Edition" edited by Peter Brown and George Burder Stratton and published by Butterworths of London.

ACKNOWLEDGMENTS

Thanks are due to Miss J.M. Harris for assistance with the systematic search of the literature, and to the numerous contributors who responded to the appeal for information through *Ocean Waves*.

Thanks are also extended to Mrs E. Fouhy and Mrs R.M. Thompson for their editing and typing of the manuscript.

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* PICKRILL, R.A.; MITCHELL, J.S. : Ocean wave characteristics around New Zealand. *N.Z. Journal of Marine and Freshwater Research*.

BIBLIOGRAPHY

1. ADAMS, P.I.F.; BROWN, F.T.; BROWN, J.G.; FRIED, P.; WALLWORK, D.W. 1976: The development of the Maui gas and condensate field. *N.Z. Engng 31(1)* : 5-15.

Tabulates predicted design storm waves with a return period of 100 years for the Maui Platform.

2. ANON, 1965: Port Lyttelton Harbour extensions. *N.Z. Engng 20(1)* : 36.

Discusses wave heights within the harbour over a series of "investigation years".

3. ANON, 1976: Coming to grips with a complex problem. *N.Z. Engng 31(3)* : 88.

Describes simple methods to calculate wave refraction coefficients.

4. ARMON, J.W. 1970: Recent shorelines between Banks Peninsula and Coopers Lagoon. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes 41 days of visual observations of waves from Birdlings Flat.

5. BARBER, N.F. 1954: Finding the direction of travel of sea waves. *Nature, Lond. 174* : 1048.

Describes a method of determining the direction of travel of sea waves based on trial data from the Waitemata Harbour.

6. BARBER, N.F. 1958: Some relationships to be expected between the directional spectra of swell observed at different times and places on the ocean. *N.Z. Jl Sci. 1(2)* : 330-41.

A mathematical approach to deduce the character of the wave spectra from the known spectra at another time and place.

7. BARBER, N.F. 1959: A proposed method of surveying the wave state of the open ocean. *N.Z. Jl Sci. 2(1)* : 99-108.

Describes a method to determine the directional spectrum of waves and swell in the open sea using an aircraft-borne radar.

8. BARBER, N.F.; DOYLE, D. 1956: A method of recording the direction of travel of ocean swell. *Deep Sea Res. 3* : 206-13.

Describes a detector capable of recording the direction of ocean swell. An example is given from Opotiki in the Bay of Plenty.

9. BLAKE, G.J. 1964: Coastal progradation in Pegasus Bay. Unpublished M.Sc. thesis, University of Canterbury, Christchurch.

Includes a few visual observations of wave characteristics from several points along the bay.

10. BRODIE, J.W. 1955: Sedimentation in Lyttelton Harbour, South Island, New Zealand. *N.Z. Jl Sci. Technol. Sect. B, 36(6)* : 603-21.

Discusses the present form of the harbour in relation to refracted swell waves. No wave data included.

11. BROWN, A.F. 1976: Beach and nearshore dynamics Pegasus Bay. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes daily visual observations of breaker height, period and angle of approach from 7 November 1975 to 4 September 1976 at South Brighton.

12. BROWN, D.A. 1975: The dynamics of pebble shape and size selection by waves. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Describes shingle movement on both high and low energy beaches at Kaikoura. Painted particles are used to assess size and shape selective transport by waves.

13. BURGESS, J.S. 1968a: Beach morphology in southern Pegasus Bay. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes a full discussion of daily wave observations from New Brighton for the period 22 December 1967 to 24 April 1968.

14. BURGESS, J.S. 1968b: Seasonal beach changes in southern Pegasus Bay. *N.Z. geogrl Soc. Rec. 46* : 15-16.

Reproduces some of the findings and wave data presented in Burgess (1968a).

15. BURGESS, J.S. 1970: Coastline changes near Wanganui. *Proc. 6th N.Z. geogr. Conf. 1* : 104-10.

Reproduces some of the findings and wave data in Burgess (1971).

16. BURGESS, J.S. 1971: Coastline changes at Wanganui, New Zealand. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

Includes a full discussion of daily wave observations collected by the Wanganui Harbour Board over the period 1 October 1968 to 31 December 1968, and offshore records collected over the period October 1969 to February 1970 by Shell-BP and Todd from the Maui gas field.

17. BURGESS, J.S. 1976: Beach changes - A vital factor in coastal erosion control. *Soil Water 12(1)* : 25.

A generalised discussion of cyclical changes on New Zealand beaches in relation to the wave climate.

18. BURLING, R.W. 1959: The phase-velocity of wave-components under the action of wind. *N.Z. Jl Geol. Geophys. 2(1)* : 66-87.

A theoretical approach investigating the effects of various features in real wave systems upon the phase velocity of wave components.

19. BUSHELL, J.B.; TEAR, G.G. 1975: Lyttelton Harbour - dredging and regime improvement. Pp 53-68 *in* "Second Australian Conference on Coastal and Ocean Engineering. April/May 1975". Institution of Engineers, Australia, Barton. *Publication No. 75/2.*

Discusses the hydraulic regime within the harbour and the problems this created in maintaining a stable dredged channel. Proposals to alter wave refraction patterns by dumping in selected areas are planned to reduce dredging requirements.

20. CARTER, L. 1977: Sand transport, Wellington Harbour entrance, New Zealand. *N.Z. Jl Geol. Geophys. 20(2)* : 335-51.

Includes a discussion of results from an instrument module (which includes a wave recorder) designed to monitor sediment interaction at the sea floor.

21. CARTER, L.; HEATH, R.A. 1975: Role of mean circulation, tides, and waves in the transport of bottom sediment on the New Zealand continental shelf. *N.Z. Jl mar. Freshwat. Res. 9(4)* : 423-48.

Includes wave records for Taranaki from the *Sedco 135-F* and *Discovery 2* oil drilling ships.

22. CARTER, L.; HEATH, R.A.; HUNT, B.J.; BARNES, E.J. 1976: Instrument package to monitor sediment water interaction on the continental shelf. *N.Z. Jl Geol. Geophys. 19(4)* : 503-12.

The instrument package designed to sit on the sea floor, includes a wave recorder. Results from the south Wellington coast are presented as examples.

23. CARTER, L.; HERZER, R.H. 1978: The hydraulic regime and its potential to transport sediment on the Canterbury continental shelf. *Mem. N.Z. oceanogr. Inst. 83* : 33 pp.

Wave records from the *Sedco 135-F* and *Glomar Tasman* oil exploration rigs from North Otago and Canterbury form the basis of this discussion.

24. CHISHOLM, D.H. 1976: Wellington Airport extension - additional sea protection. *N.Z. Engng 31(6)* : 157-61.

After damage to the south end of the airport in heavy seas additional protection is proposed. Contains references to storm wave heights.

25. CHISWELL, S.M. 1979: Ocean wave generation and forecasting. Unpublished M.Sc. thesis, University of Auckland, Auckland.

Reviews processes of wave generation and forecasting. A forecasting model based on the PNJ model is developed and tested with hindcast data from the Maui tower.

26. CHRISTOPHERSEN, M.J. 1977: The effect of sand mining on the erosion potential of Whiritoa Beach. Unpublished M.Sc. thesis, University of Waikato, Hamilton.

Includes 179 days of visual observations from this beach on the east coast of the Coromandel Peninsula.

27. CRAWFORD, J.P. 1974: The forecasting of sea and swell in the New Zealand area. *N.Z. met. Serv. tech. Note 226* : 21 pp.

Two forecasting techniques (PNJ and Scripps) are tested using available meteorological data. Predicted wave heights are compared with those recorded on the *Sedco 135-F* drilling rig and by local shipping.

28. DAVIES, J.L. 1964: A morphogenic approach to world shorelines. *Z. geomorph. 8* : 127-42.

A global classification of the wave climates of the world.

29. DAVIES-COLLEY, R.J. 1976: Sediment dynamics of Tauranga Harbour and the Tauranga Inlet. Unpublished M.Sc. thesis, University of Waikato, Hamilton.

Includes a discussion of visual wave records collected over a 12-month period by the Tauranga Harbour Board from the harbour entrance.

30. DAVIES-COLLEY, R.J.; HEALY, T.R. 1978: Sediment and hydrodynamics of the Tauranga entrance to Tauranga Harbour. *N.Z. Jl mar. Freshwat. Res. 12(3)* : 225-36.

Based on the data in Davies-Colley (1976). The hydrodynamics and sedimentation are discussed in relation to the wave climate.

31. DELGROSSO, R.F. 1971: Some aspects of beach morphology and sediments at Bethells and Piha, Auckland west coast. Unpublished M.A. thesis, University of Auckland, Auckland.

Includes a discussion of visual observations collected from Piha Beach over a 125-day period.

32. DINGWALL, P.R. 1966: Bay-head beaches of Banks Peninsula. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Infrequent visual observations from a number of bays around the peninsula are discussed. Wave refraction diagrams for dominant wave directions are included.

33. DINGWALL, P.R. 1974: Bay-head sand beaches of Banks Peninsula, New Zealand. *Mem. N.Z. oceanogr. Inst. 15*: 63 pp.

Reproduces the wave data and refraction diagrams in Dingwall (1966).

34. DUCKMANTON, N.M. 1974: The shore platforms of the Kaikoura Peninsula. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Approximately six months visual records from both the north and south sides of the peninsula, and wave refraction diagrams for the dominant swell directions are presented.

35. ELLIOTT, E.L. 1958: Sandspits of the Otago coast. *N.Z. Geogr. 14(1)* : 65-74.

Includes a general discussion on waves and the relationship between winds and waves on this coast.

36. FISHER, S. 1972: Definition and measurement of dangerous harbour waves. Presented at "Fourth Conference of Harbour Engineers, Tauranga, 27-30 September 1972". Held by Harbours Association of New Zealand, Wellington. 8 pp.

Outlines the techniques of measuring long-period waves used in Napier Harbour and the effects of these waves on moored vessels. A model of the harbour is presented.

37. FRANKLIN, P.L. 1973: Wave study at Taharoa Beach. Unpublished M.Sc. thesis, University of Auckland, Auckland.

Describes a pressure transducer wave recorder installed beyond the surf zone in 18 m of water for four months. Results are discussed and hindcasting attempted. A 16-ft wave staff incorporating a magnet and reed switches is also described.

38. GIBB, J.G. 1962: Wave refraction patterns in Hawke Bay. *N.Z. Jl Geol. Geophys. 5(3)* : 435-44.

Wave refraction diagrams for a range of wave approach directions and wave periods are presented and discussed.

39. GIBB, J.G. 1977: Late Quaternary sedimentary processes at Ohiwa Harbour eastern Bay of Plenty, with special reference to property loss on Ohiwa Spit. *Water Soil tech. Publ. 5* : 16 pp.

Includes a discussion of storm waves that caused severe erosion during April 1976.

40. GIBBARD, R.G. 1972: Beach morphology and sediments of the west Wellington coast : Wanganui to Paekakariki. Unpublished M.Sc. thesis, Massey University, Palmerston North.

Includes infrequent visual observations and wave refraction diagrams for a range of wave approach directions.

41. GILLIE, R.D. 1979: Sand and gravel deposits of the coast and inner shelf east coast, Northland Peninsula, New Zealand. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

Includes an analysis of nine years daily sea condition reports (Beaufort Scale) from the Leigh Marine Laboratory.

42. GLENN, A.H. & ASSOCIATES, 1973: Meteorological oceanographic conditions affecting design and operation of offshore tanker terminal facilities : New Plymouth Power Project. Unpublished Report. Library, Ministry of Works and Development, Wellington.

Presents wave forecast curves based on available meteorological data.

43. GRANT, B.C.; THOMPSON, S.M. 1972: Storm waves at Lyall Bay. *N.Z. Ministry Works Development, Cent. Lab. Rep. 403* : 29 pp.

Wave refraction is modelled for storm waves in Lyall Bay using a technique developed by the U.S. Army Coastal Engineering Research Center.

44. HARRAY, K. 1976: Beach erosion at Waihi. Unpublished M.Sc. thesis, University of Waikato, Hamilton.

Describes daily visual wave records from Waihi Beach for the period 1 April 1974 to 9 May 1975, plus a few days records from a wave recorder.

45. HARRAY, K.; HEALY, T.R. 1978: Beach erosion at Waihi Beach, Bay of Plenty, New Zealand. *N.Z. Jl mar. Freshwat. Res. 12(2)* : 99-107.

Based on the data presented in Harray (1976). Presents a summary of the wave data and discusses their effects on the beach.

46. HEALY, T.R. 1975: Beach erosion research programme. *Soil Water 11(1)* : 53-54.

Outlines a beach-erosion study which will incorporate wave observations to be undertaken in the Bay of Plenty.

47. HEATH, R.A.; CARTER, L.; BARNES, E.J.; HUNT, B.J. 1976: An instrument for remote monitoring of sediment movement and associated hydraulic conditions on the continental shelf. *N.Z. Engng 31(10)* : 242-43.

Describes an instrument package which includes a wave recorder, and is designed to sit on the sea floor. (*See* Carter *et al.*. 1976.)

48. HEWSON, P.A. 1977: Coastal erosion and beach dynamics in South Canterbury - North Otago. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes an analysis of visual data from Timaru and the *Sedco 135-F* exploration rig off North Otago.

49. HODGSON, W.A. 1966: Coastal processes around the Otago Peninsula. *N.Z. Jl Geol. Geophys. 9(1)* : 78-90.

Twelve months visual wave records from the Taiaroa Heads and Cape Saunders light houses are discussed. Wave refraction diagrams for several wave approach directions are included.

50. HOGBEN, N.; LUMB, F.E. 1967: Ocean wave statistics. National Physical Laboratory, Ministry of Technology, Publication. H.M.S.O. London.

The oceans of the world are split into 50 areas, three of which include New Zealand. Ship reports of ocean wave conditions in these areas are tabulated.

51. HOLMES, P.D.L.; PARK, A.G. 1965: Design of a mound type breakwater for Port Taranaki. *N.Z. Engng 20* : 441-51.

Maximum observed wave heights over a 12-month period are discussed. Hindcasting is used to predict maximum possible storm waves.

52. HULLS, K. 1977: Wave power. *N.Z. Energy J. 50(4)* : 44-47.

Discusses machines on trial in Britain to harness wave energy. Suggests these could be used in New Zealand because of the high energy wave climate.

53. HULLS, K.; ROGERS, N.C. 1973: Wave recorder. *N.Z. Ministry Works Development Cent. Lab. Rep. 472* : 8 pp.

54. HYDRAULIC RESEARCH STATION, WALLINGFORD, 1963: Tauranga Harbour investigation report on the first stage. Unpublished report to Tauranga Harbour Board. Ex 201. 69 pp.

55. HYDRAULIC RESEARCH STATION, WALLINGFORD, 1966: Report on development of Wanganui Harbour. Unpublished report to Engineer, Wanganui Harbour Board.

56. HYDRAULIC RESEARCH STATION, WALLINGFORD, 1967: Wave model investigation of harbour improvement schemes at Napier, N.Z. Unpublished report to Napier Harbour Board.

57. HYDRAULIC RESEARCH STATION, WALLINGFORD, 1968: Further wave model tests with a revised harbour layout at Napier. Unpublished report to Napier Harbour Board.

58. HYDRAULIC RESEARCH STATION, WALLINGFORD, 1970: Timaru Harbour : An appraisal of littoral drift and wave problems. Unpublished report to Timaru Harbour Board. Ex 481. 24 pp.

Includes a discussion of wave records collected off the harbour between July and December 1968.

59. KELK, J.G. 1974: A morphological approach to process interaction on the mid-Canterbury coastline. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Several months visual wave records from the Ashburton River mouth are included in this thesis.

60. KIRK, R.M. 1967: Beach morphology and sediments of the Canterbury Bight. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Several months visual wave observations from Timaru Harbour are presented. Wave refraction diagrams for the South Canterbury coast are included.

61. KIRK, R.M. 1969: Beach erosion and coastal development in the Canterbury Bight. *N.Z. Geogr. 25* : 23-25.

Relationships between swash lengths and breaker heights are discussed. Based on the data presented in Kirk (1967).

62. KIRK, R.M. 1970: Swash zone processes : An examination of water motion and the relations between water motion and foreshore response on some mixed sand and shingle beaches, Kaikoura, New Zealand. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

Includes visual wave observations, swash/backwash measurements and relationships between these.

63. KIRK, R.M. 1971: Instruments for investigating shore and nearshore processes. *N.Z. Jl mar. Freshwat. Res. 5(2)* : 358-75.

Describes equipment used to measure wave properties in the swash/backwash zone.

64. KIRK, R.M. 1972-1975: Statistical summary of sea-state observations in New Zealand. Unpublished report, University of Canterbury, Christchurch.

Report for 1971, dated 1972;
Report for 1972, dated 1973;
Report for 1973, dated 1974;
Report for 1974, dated 1975.

A summary of sea-state conditions from 27 points around the coast as reported in daily 9.00 am weather reports. (*See also* McLean, 1965.)

65. KIRK, R.M. 1974: The sea. *N.Z. Nature Heritage 1(2)* : 313-22.

Includes a brief discussion of the wave climate around New Zealand.

66. KIRK, R.M. 1975a: Aspects of surf and runup processes on mixed sand and gravel beaches. *Geogr. Annlr 57A (1-2)* : 117-33.

Discusses relationships between breaker height and swash length. Velocity distributions within the swash and backwash are outlined.

67. KIRK, R.M. 1975b: Coastal changes at Kaikoura, 1942-74, determined from air photographs. *N.Z. Jl Geol. Geophys. 18* : 787-801.

Includes a short section outlining the general wave climate of the Kaikoura Peninsula. Based on the findings of Kirk (1970).

68. KIRK, R.M. 1977a: Presidential address - Wave data for the New Zealand coast. *N.Z. mar. Sci. Newsl. 20* : 1-2.

Points out the lack of good wave data from the New Zealand coast and the many uses to which they could be put, if available.

69. KIRK, R.M. 1977b: Rates and forms of erosion on intertidal platforms at Kaikoura Peninsula, South Island, New Zealand. *N.Z. Jl Geol. Geophys. 20(3)* : 572-613.

An outline of the wave climate around the peninsula is given. Similar to Kirk (1975b).

70. KIRK, R.M. 1977c: Survey of inner shelf sediments in the vicinity of the [Timaru] Harbour. Unpublished report to the Engineers Department, Timaru Harbour Board.

71. KNOWLES, B. 1976: Coastal changes in southern Hawke Bay during the last forty years. Pp 33-36 *in* McLean, R.F. (ed.) "Case studies of coastal progradation in New Zealand". Unpublished report for International Geographical Union's Working Group on the Dynamics of Shoreline Erosion. (Copy held at N.Z. Oceanographic Institute Library.)

Refers to an extensive set of visual wave observations, and gives a short general account of the wave climate. No wave data are presented.

72. KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT, 1961: Marine climatological summaries for the Mediterranean and southern Indian Ocean. Vol. 1. *Publtienummer K. ned. met. Inst. 151-1* : 529 pp. (Reprinted 1977)

Includes a summary of sea states reported by shipping from the New Zealand region.

73. McFARLANE, C.J. 1973: Wharf for Bluff aluminium smelter. *N.Z. Engng 28* : 247-53.

A brief reference is made to wave heights within Bluff Harbour.

74. MACINTYRE, R.J. 1961: The supra-littoral fringe of New Zealand sand beaches. *Trans. R. Soc. N.Z., Gen. 1(8)* : 90-103.

Brief mention is made of wave energy levels on beaches along the Canterbury coast.

75. McLEAN, R.F. 1967: Plan shape and orientation of beaches, along the east coast, South Island. *N.Z. Geogr. 23(1)* : 16-22.

The plan shape and orientation of the beaches are discussed. in relation to the direction of approach of deep water swell. A general discussion with no wave data included.

76. McLEAN, R.F. 1968: Statistical summary of sea state conditions in New Zealand 1967. Unpublished report, Geography Department, University of Canterbury, Christchurch. 18 pp.

A summary of sea state conditions from 27 points around the coast as reported in daily 9.00 am weather reports. (*See also* Kirk 1972-1975.)

77. McLEAN, R.F. 1971: Wave heights along two beaches at Kaikoura, New Zealand. Unpublished report, Geography Department, University of Canterbury, Christchurch. 11 pp.

Wave heights observed during 12 surveys at monthly intervals during 1966-67 are reported for 22 stations along the coast.

78. McLEAN, R.F. 1972: Sea conditions off the north-east coast, South Island, New Zealand : Ship reports, January - June 1967. Unpublished report, University of Canterbury, Christchurch. 18 pp.

Summarises the ship reports in table form and comments on the significance of these.

79. McLEAN, R.F.; BURGESS, J.S. 1975: Bar depth and beach changes around a New Zealand river mouth port : Wanganui 1850-1970. Pp 67-74 *in* "Second Australian Conference on Coastal and Ocean Engineering. April/ May 1975". Institution of Engineers, Australia, Barton. *Publication No. 75/2.*

Includes a brief description of the wave climate at Wanganui. These data are reported in full in Burgess (1970, 1971).

80. McLEAN, R.F.; KIRK, R.M. 1969: Relationships between grain size, size-sorting, and foreshore slope on mixed sand-shingle beaches. *N.Z. Jl Geol. Geophys. 12* : 138-55.

Includes a short section in which a general reference is made to the wave climate of the east coast South Island.

81. MACPHERSON, J.M. 1978: Environmental geology of the Avon-Heathcote estuary. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

The wave climate within the estuary is predicted from wind records using standard forecasting techniques.

82. MANGIN, C.M. 1973: Coastal processes and development in the southern Karamea Bight. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes an analysis of visual wave records collected by the N.Z. Ministry of Works and Development for 12 months in 1952 and 6 months records collected by the N.Z. Ministry of Transport in 1972-73. Wave refraction diagrams are presented.

83. MARINE ADVISERS INC., JUNE 1965: Oceanographic considerations pertinent to a shoreside power plant site at Marsden Point, New Zealand. Unpublished report prepared for Bechtel Corporation. Available from Morris and Wilson, P.O. Box 2644, Auckland.

84. MARINE ADVISERS INC., APRIL 1970: Climatological study for Taharoa Beach, New Zealand. Unpublished report for Imodco International. Available from Morris and Wilson, P.O. Box 2644, Auckland.

85. MATTHEWS, E.R. 1977: The movement of sand on some western Taranaki beaches. Unpublished M.Sc. thesis, University of Auckland, Auckland.

Wave records from the Maui A tower and ship reports of wave conditions from the west coast North Island, are analysed in this thesis.

86. MATTHEWS, E.R. (in press): Seasonal variation on some western Taranaki beaches. *N.Z. Jl Geol. Geophys.*

Two years wave records from the Maui A tower and 20 months ship reports from the west coast North Island are used as a basis for this discussion on beach changes.

87. MATTHEWS, L.S. 1971: Heavy swell observed in the South Pacific in December 1969. *N.Z. met. Serv. tech. Note 196*: 11 pp.

Describes a heavy swell generated in the northern hemisphere which travelled south 4,000 nautical miles, causing damage in Fiji and Rarotonga.

88. MEAR, M.D. 1975: Coastal investigation Hawke Bay : Preliminary assessment of data from voluntary observers. Unpublished report, N.Z. Ministry of Works and Development, Napier.

89. MARTIN, D.E. 1969: Beach characteristics of an embayed coastline : Two bay-head beaches of Banks Peninsula. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes a discussion of wave observations collected at Taylors Mistake from July 1968 to August 1969.

90. MORRISON, W.G.; BUTCHER, G.W. 1958: Mouturoa Wharf, Port Taranaki. *N.Z. Engng 13* : 46-59.

Brief reference to the wave climate at Port Taranaki is made. The problem of wave surge within the harbour is also mentioned.

91. MUNK, W.H.; MILLER, G.R.; SNODGRASS, F.E.; BARBER, N.F. 1963: Directional recording of swell from distant storms. *Phil. Trans. R. Soc. Ser. A 255* : 505-84.

Summer swell waves recorded on the coast of California are attributed to origins in the New Zealand - Australia - Antarctic section of the South Pacific.

92. NEWTON, C.G.H. 1977: The sedimentary dynamics of Tory Channel. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes a discussion of the effects of ferry wake waves on the beaches flanking Tory Channel.

93. PATTLE, W.N. 1974: Coastal processes and beach development, Cape Wanbrow to Shag Point. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes a discussion of wave records collected by the *Sedco 135-F* oil exploration rig from North Otago. Wave refraction diagrams for the North Otago coast are presented.

94. PICKRILL, R.A. 1973: Coastal dynamics : Rarangi to Cape Campbell. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Includes a discussion of visual wave records from Cape Campbell lighthouse. Wave refraction diagrams for the Marlborough coastline are presented.

95. PICKRILL, R.A. 1976: The lacustrine geomorphology of Lakes Manapouri and Te Anau. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

Includes recorded wave data, forecasted wave climates, and measurements of waves produced by boats.

96. PICKRILL, R.A. 1977: Coastal processes, beach morphology and sediments along the north-east coast of the South Island, New Zealand. *N.Z. Jl Geol. Geophys. 20* : 1-15.

The wave climate in southern Cook Strait is outlined using visual wave observations from Cape Campbell. Relationships between wind and wave conditions are outlined. Wave refraction diagrams are presented.

97. PICKRILL, R.A. 1978: Effects of boat wakes on the shoreline of Lake Manapouri. *N.Z. Engng 33(9)* : 194-98.

A comparison is drawn between the energy in waves produced by passing boats and the natural wave climate.

98. PICKRILL, R.A. 1979: Beach and nearshore morphology Lyall Bay, Wellington. *NZOI oceanogr. Fld Rep. 13* : 23 pp.

Twelve months visual waves observations for 1976-77 from Beacon Hill are described. Wave refraction diagrams are presented for Lyall Bay.

99. PICKRILL, R.A.; IRWIN, J. 1978: Shallow water sand bars on the Ruamahunga River delta, Lake Wairarapa. *N.Z. Jl mar. Freshwat. Res. 12(2)* : 109-19.

The wave climate for the lake is forecast from wind records.

100. PICKRILL, R.A.; MITCHELL, J.S. (in press): Ocean wave characteristics around New Zealand. *N.Z. Jl mar. Freshwat. Res.*

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101. REID, W.J.; WADE, J.B. 1963: Surf beats at Taranaki, New Zealand. *Int. Ass. hydraul. Res. 1* : 93-100.

Discusses the problems surf beat within Port Taranaki creates in mooring vessels. Wave records from inside the harbour are discussed.

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Beach changes are discussed in relation to general wave energy conditions.

104. SCHOFIELD, J.C. 1975b: Sea-level fluctuations cause periodic, post-glacial progradation, Kaipara Barrier, North Island, New Zealand. *N.Z. Jl Geol. Geophys. 18* : 295-316.

Includes a general discussion on energy inputs and the maximum water depth in which changes in the nearshore profile can be expected.

105. SCOTT, W.H. 1955: Sea erosion and coast protection at Sumner, New Zealand. *N.Z. Engng 10(12)* : 438-47.

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106. SHERWOOD, A.M. 1973: Surficial sediments of Raglan Harbour. Unpublished M.Phil. thesis, University of Waikato, Hamilton.

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107. SIMPSON, R.A.; FYSON, J. 1971: Westport Harbour entrance. *N.Z. Engng 26(9)* : 266-71.

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108. SMITH, R.K. 1968: South Hawke Bay beaches : Sediments and morphology. Unpublished M.A. thesis, University of Canterbury, Christchurch.

Outlines visual wave observations from Napier for the period November 1967 to May 1978.

109. SNODGRASS, F.E.; GROVES, G.W.; HASSELMANN, K.F.; MILLER, G.R.; MUNK, W.H.; POWERS, W.H. 1966: Propagation of ocean swell across the Pacific. *Phil. Trans. R. Soc. Ser. A, 259* : 431-97.

Six wave stations, including one in New Zealand, are used to track major wave events across the Pacific.

110. STANTON, B.R. 1974: Wind and sea. *N.Z. Nature Heritage 3(35)* : 957-63.

Includes a general discussion of waves around New Zealand.

111. STEPHEN, W.J. 1974: Wave processes and beach responses on a coarse gravel delta. Unpublished Ph.D. thesis, University of Canterbury, Christchurch.

Presents 153 days of wave observations taken from four closely-spaced stations around the Hapuka delta, Kaikoura coast, in 1970.

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An analysis of wave heights and periods from a Waverider Buoy used for short periods in eight locations off the Taranaki, Canterbury and Otago coasts.

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Starting in April 1976 monthly analyses of wave heights and periods from a Waverider Buoy have been prepared. These separate reports were extended in February 1978 to include the Maui "B" site. At date of publication of this bibliography these reports were still being prepared.

114. TIERNEY, B.W. 1968: Design of a long wave recorder for installation inside a harbour. Presented at "Second Conference of N.Z. Harbour Engineers, New Plymouth, 18-19 September 1968". Held by Harbours Association of New Zealand, Wellington. 3 pp.

115. TIERNEY, B.W. 1976: Coastal changes around the Port of Timaru. Pp 61-72 *in* McLean, R.F. (ed.) "Case studies of coastal progradation in New Zealand". Unpublished report for International Geographical Union's Working Group on the Dynamics of Shoreline Erosion. (Copy held at N.Z. Oceanographic Institute Library.)

Includes a summary of wave heights at the port from a 30-week period of visual observations and a 70-week period of observations of direction.

116. TIERNEY, B.W. 1977: Coastal changes around the port of Timaru, New Zealand. *N.Z. Geogr. 33(2)* : 80-83.

Reprints the wave data in Tierney (1976).

117. TOMLINSON, A.I. 1971: Sea conditions in New Zealand waters 1968-1970 reported by oil drilling rigs. *N.Z. met. Serv. tech. Note 205* : 8 pp.

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119. UNION STEAM SHIPPING COMPANY / ISHIKAWAJIMA - HARIMA HEAVY INDUSTRY COMPANY PROJECT, (undated): Unpublished report. Held at Union Steam Shipping Company, Wellington.

Confidential report on behaviour of new 600-ft vessel in waves to be encountered in a trans-Tasman service.

120. UNION STEAM SHIPPING COMPANY / ISHIKAWAJIMA - HARIMA HEAVY INDUSTRY COMPANY PROJECT, (undated): Unpublished report. Held at Union Steam Shipping Company, Wellington.

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123. WELLS-GREEN, P.S. 1975: Current, waves, and sediment transport, Upper Waitemata Harbour. *N.Z. Engng 30* : 291-93.

Recorded waves and forecasted waves for the Upper Waitemata Harbour are described. Waves produced in a scale model are also discussed.

124. WOODING, R.A. 1955: An approximate joint probability distribution for wave amplitude and frequency in random noise. *N.Z. Jl Sci. Technol. Sect. B, 36(6)* : 537-44.

A theoretical approach to the distribution of wave amplitude.

GEOGRAPHICAL INDEX

NEW ZEALAND -

General	17, 21, 25, 27, 28, 50, 52, 64, 65, 66, 68, 72, 75, 76, 80, 87, 91, 100, 109, 110, 112, 117, 122

NORTH ISLAND -

Auckland	5, 31, 37, 100, 102, 103, 123
Bay of Plenty	8, 26, 29, 30, 39, 44, 45, 46, 54, 100
Hawke Bay	36, 56, 57, 71, 88, 100, 108
Northland	41, 87, 100, 102, 104
Taranaki	1, 16, 21, 25, 27, 42, 51, 85, 86, 90, 100, 101, 112, 113, 117, 118
Waikato	37, 84, 100, 106
Wanganui/Manawatu	15, 16, 40, 55, 79, 100
Wellington	20, 22, 24, 40, 43, 91, 98, 99, 100

SOUTH ISLAND -

Canterbury	2, 4, 9, 10, 11, 13, 14, 19, 23, 32, 33, 48, 58, 59, 60, 61, 70, 74, 78, 80, 81, 89, 100, 105, 112, 115, 116, 117
Fiordland	95, 97
Marlborough	12, 34, 62, 67, 69, 77, 78, 80, 92, 94, 96, 100, 111
Nelson	100, 112, 117
Otago	23, 35, 48, 49, 93, 100, 112, 117
Southland	73, 100
West Coast	82, 100, 107, 117, 121

SUBJECT INDEX

Boats and Shipping	42, 50, 72, 78, 85, 86, 92, 95, 97, 119, 120
Coastal erosion and protection	17, 24, 26, 39, 43, 44, 45, 46, 48, 61, 67, 98, 105
Estuary, harbour and lake waves	73, 81, 90, 92, 95, 97, 99, 101, 106, 123
Geomorphology and geology	4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 29, 30, 31, 32, 33, 34, 35, 39, 40, 41, 44, 45, 48, 59, 60, 61, 62, 66, 67, 69, 70, 71, 75, 79, 80, 81, 85, 86, 89, 92, 93, 94, 95, 96, 97, 98, 99, 102, 103, 104, 106, 108, 111, 116, 123
Ocean Engineering :	
Harbours and Ports	2, 10, 15, 16, 19, 20, 29, 30, 36, 39, 42, 51, 54, 55, 56, 57, 58, 70, 73, 79, 82, 83, 90, 101, 107, 114, 116
Offshore structures	1, 42, 52, 83, 84
Wave forecasting and hindcasting	25, 27, 42, 81, 83, 84, 85, 99, 118
Wave power	52
Wave recorders	5, 7, 8, 20, 22, 37, 47, 53, 62, 63, 95, 114
Wave refraction	3, 13, 16, 19, 26, 31, 32, 33, 34, 38, 40, 43, 49, 60, 82, 89, 93, 94, 96, 98, 100, 111
Wave theory	6, 18, 124

APPENDIX A

List of Journals and Periodicals Searched

Annual Research Report - Water and Soil Division, N.Z. Ministry of Works and Development 1971-1974

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International Geographical Union, Working Group on Dynamics of Shoreline Erosion. Bibliography. 1971-1974

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Tane 1-23

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(Formerly Transactions of the New Zealand Institute and Transactions and Proceedings of the New Zealand Institute)

Series : General 1-2; Geology 1-6; Earth Sciences 7-8.

Tuatara 1-22

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Victoria University of Wellington Publications, Geology Department Reprints

Water and Soil Miscellaneous Publications 1-7

Water and Soil Technical Publications 1-10

Wellington Harbour Beacon 1-9(10)