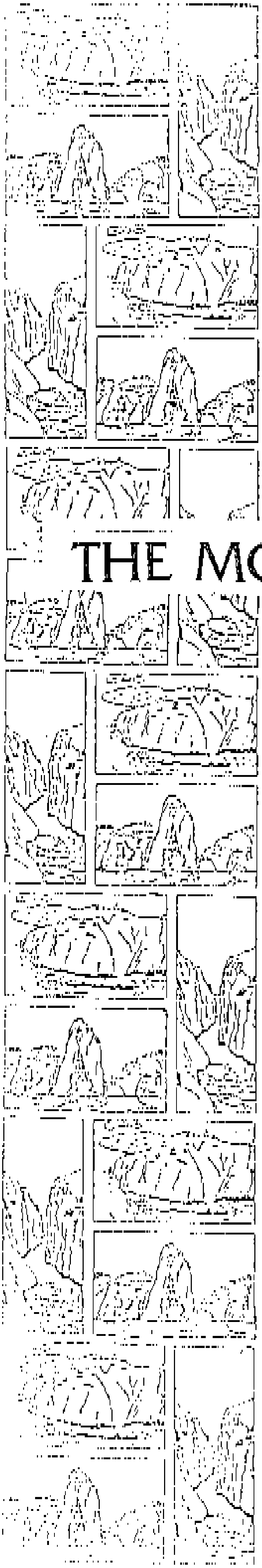


THE MOKOHINAU ISLANDS

A MARINE SURVEY

LEIGH LAB. BULLETIN No. 21

PREFACE

Because of the isolated location of the Mokohinaus, and the difficulty of gaining access to the islands, few detailed quantitative surveys have been attempted, especially of the marine biota. The Royal New Zealand Air Force conducted a diving expedition to Mokohinaus in 1978, as part of their expedition training programme. Lead by Wing Commander Knight, the RNZAF made their main object a marine survey around Burgess Island, the largest island of the Mokohinau group. The impetus for producing this report stems from their pioneering expedition, and I would like to congratulate all members of the expedition on the way that they, as non-biologists, applied themselves to this unfamiliar task.

Advice on conducting the marine survey was provided by Dr Bill Ballantine from the Leigh Marine Laboratory, assisted by Drs Tony Ayling and Floor Anthoni. As well as supervising the mapping effort by the Air Force divers, these three each carried out individual projects, the results of which are reproduced in this report: Dr Ballantine carried out a baseline survey of rocky intertidal shores, Dr Ayling made a census of fish populations, and Dr Anthoni kept a photographic record of the whole operation (which was subsequently made into a scientific and public education film).

One of the major tasks to be done at the completion of the expedition was to produce a map of the underwater habitats. This was done over several years by student assistants at the Leigh Marine Laboratory, particularly Susan Owen. I thank her for her efforts, and also the many other people who helped at various stages in the production of this report, particularly Neil Andrew, Brigid Kerrigan, Laura Stocker and Jane Robertson.

Our input into the production of this report was mainly supervisory; all the hard work was done by Peter Berben and Anne McCrone. We are extremely grateful to them for their enthusiasm and perseverance in gathering, sorting and writing up the information. It is hoped that their efforts will help to increase our awareness of the Mokohinaus, and will stimulate others to carry out further quantitative studies of this unique island group.

R.G. Creese
W.J. Ballantine

Febuary 1988.

CONTENTS

INTRODUCTION

The Mokohinau Islands lie off the east coast of the North Island of New Zealand some 100km north of the city of Auckland and 50km east of Whangarei Heads. Of all the coastal islands the Mokohinau Islands are the most remote, situated at the enterance of the Hauraki Gulf (Fig.1 & 2).

The Mokohinau group embraces about a dozen small islets and many rocks and reefs of negligible area; they extend from Groper Rock in the north-west, to Fanal Island in the south-east a distance of about 10km and as an irregular belt about 4km wide from Cathedral Rocks to Nairve Rock. About 5km south of Naivire Rock is the low projecting reef of Simpson Rock.

It is unlikely that the Mokohinau Group was ever inhabited, except occasionally by Maoris on fishing and birdsnaring expeditions. During early settlement of New Zealand the Government purchased the islands for light house purposes, the islands being ideally situated to provide the mariner with a good landfall position when arriving from the Pacific Ocean and the Tasman Sea.

All the islands (except Burgess) were made into Wildlife Sanctuaries in 1958. Today the whole group is protected, and access is limited to scientific purposes. The management and administration of the islands is under the control of the Hauraki Gulf Maritime Park Board. Interest in the flora and fauna of the Mokohinaus has always been high, and accurate observations of the terrestrial biota (particularly the birds) have been made by competent naturalists since the 1880's. Knowledge of the marine biota associated with the islands, however, is sparse and, prior to the late 1970's was virtually limited to catches of fish made by commercial fishermen in the waters surrounding the islands. The first quantitative analysis of the marine organisms and habitats at the Mokohinaus was made during the Air Force Expedition in 1978.

The main aim of the booklet is to present the results of that survey,

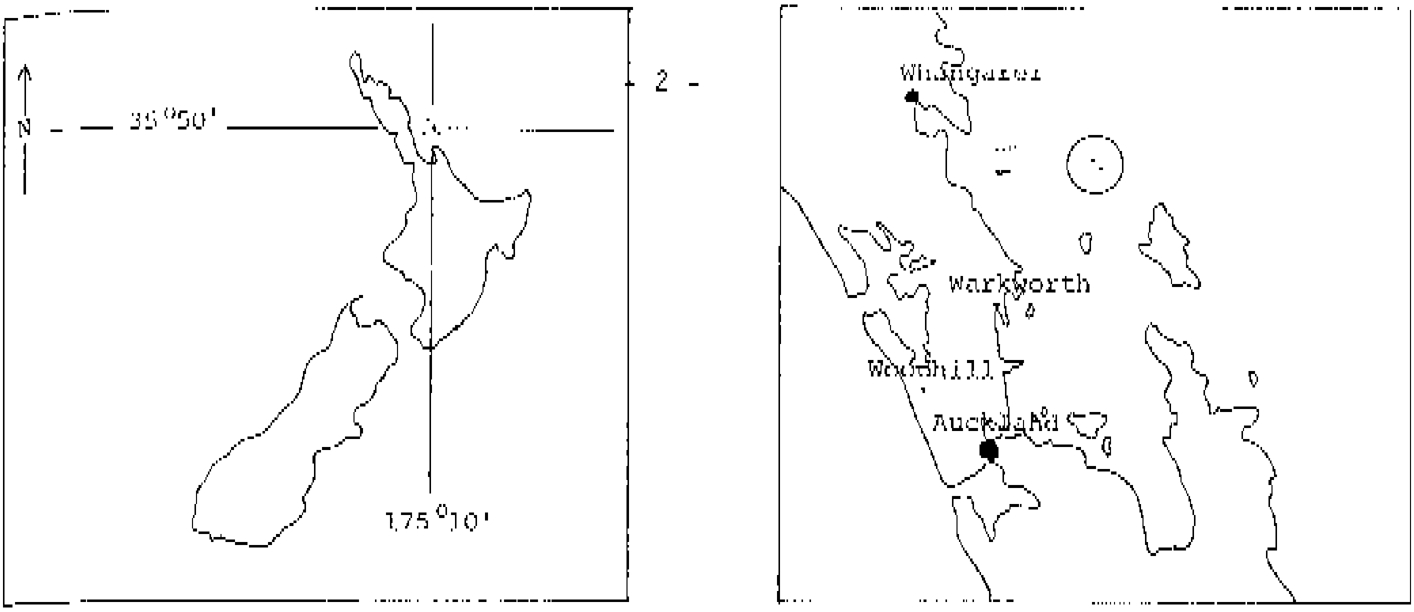
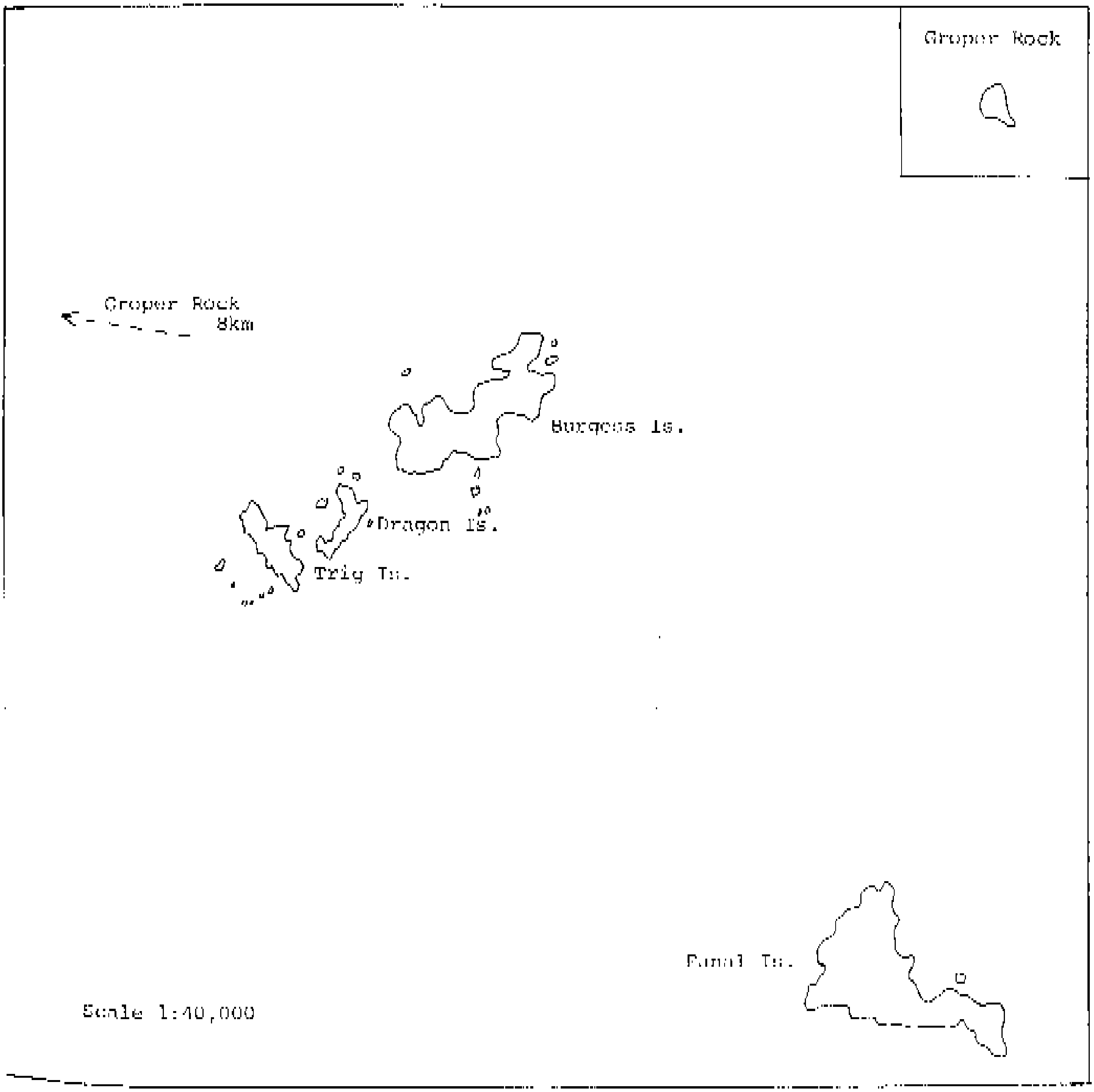


Fig. 1 Location of the Mokohinau Island Group.



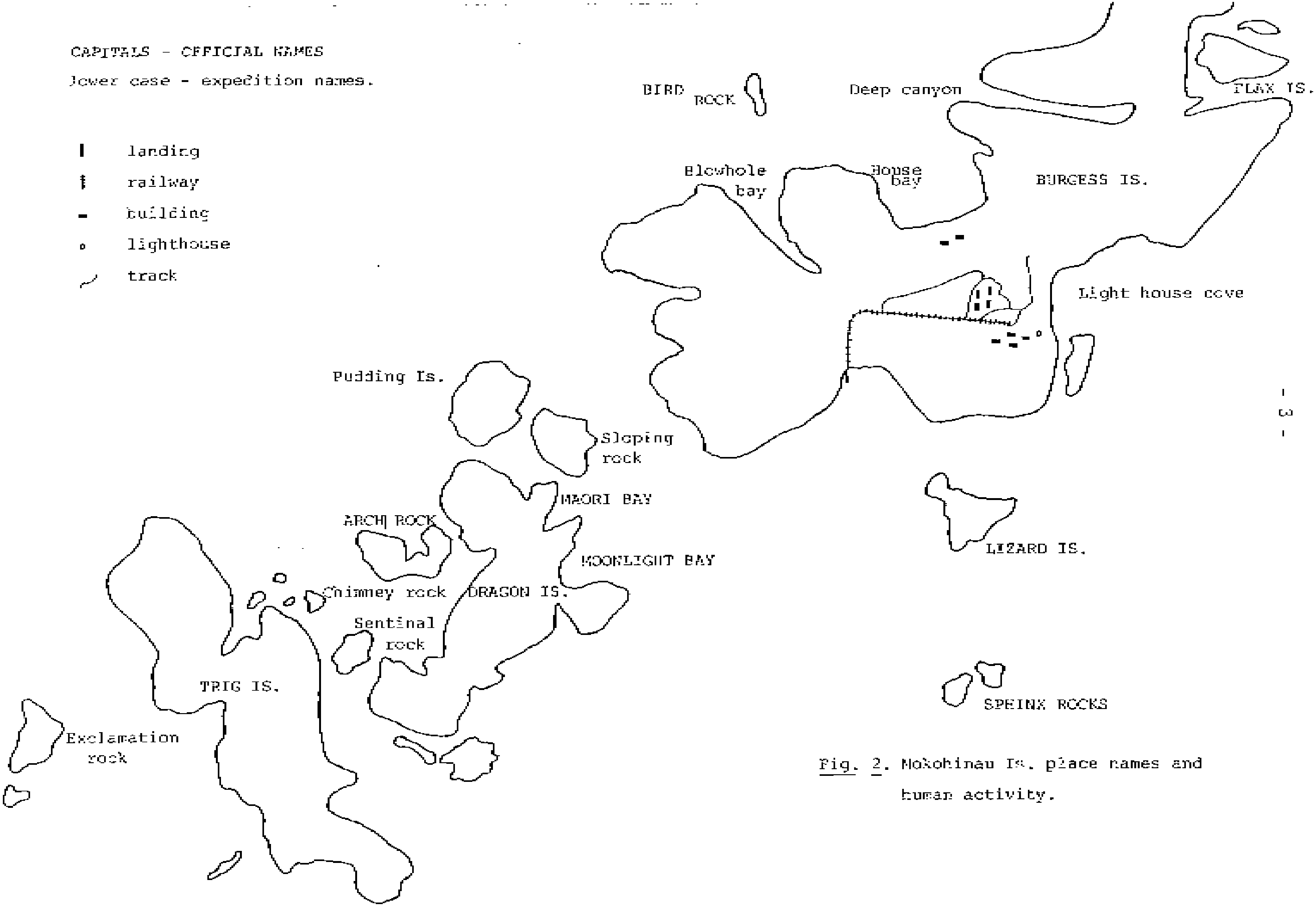


Fig. 2. Mokohinau Is. place names and human activity.

thus providing a basis from which future comparative studies can be made. This information is presented in section II. In order to set these results in a meaningful context, it was decided to also present some background information on the Mokohinau Islands. This information is contained in section I, and was compiled from material scattered throughout various publications. A more complete bibliography of the reference material availible for the Islands may be found in Wright (1980).

SECTION I - BACKGROUND INFORMATION

GEOLOGY

The Mokohinau islands rise steeply from the sea bottom some 75 m below sea level. They form part of a long discontinuous chain of rhyolitic volcanoes that outcrop from the Coromandel volcanic zone. This volcanic zone is a deep fracture that runs from Coromandel to the east coast of Northland. This northerly tending belt includes islands from the Aldermen Islands (in the south) to the Poor Knights (in the North) and stretches a distance of 210 km.

The Mokohinaus probably became active four million years ago and continued erupting for two million years. The centre of activity is thought to have been Home Bay on Burgess island. The islands are formed from Pliocene acid to intermediate volcanic rocks (Whitianga Group). The only exception occurs on Burgess Island where this formation is cut by a small plug of dark glassy andesite (Light house Andesite), probably late Wanganui in age. Fossilized blow holes and mud pools are found in two places on the North-east Burgess Island reef. Geodes are found on the edge of the crater and at Landing bay.

In the last ice age 50,000 years ago, the coastline of north-eastern New Zealand lay beyond Great Barrier, and the whole of the Hauraki Gulf Maritime Park was land. Rivers occupied the Firth of Thames, Waitemata Harbour, Tamaki estuary and flowed across the modern sea level.

Then, 12,000 years ago, temperatures began to rise. The last line of glaciers retreated and the sea advanced (actively eroding by the action of waves, salt and wind), and selectively cut away the weaker substrata thus creating the present coastline of deeply indented bays, narrow steep-walled gulches and numerous reefs and stacks.

Specific geological studies have been carried out on Burgess (Fleming,1950) and Fanal Island (Browne,1980).

The Sea Floor around the Mokohinau Islands

The Hauraki Gulf is a large and relatively shallow bay extending from the fertile tidal mudflats of the Firth of Thames and sheltered Auckland harbours. The Gulf deepens seawards to the North-east and East. Most of the inner islands are surrounded by fairly shallow water, less then 20 m deep. The 60 m depth contour passes just north of Little Barrier and Great Barrier island, and depths well in excess of 60 m surround the Poor Knights, Mokohinaus, Cuvier and Aldermen islands.

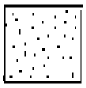
Between Cape Rodney and the Mokohinau islands the seafloor drops away rapidly from the shore to approximately 2 km offshore, with a gradient of 1 in 40, then flattens out to 1 in 900 at about 47 m. Further seawards the shelf gradient increases to 1 in 250 and slopes uniformly seawards. The continental shelf edge is marked by a sharp change in gradient, occuring at depths of 130 to 148 m (Thompson, 1975). The Mokohinaus lie approximately 14 km South-west of the continental shelf edge.

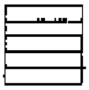
Most of the sea floor of the Hauraki Gulf is covered with loose sediments. Except for a few small isolated rocks and reefs, a hard rocky bottom generally occurs only close to islands and the mainland coast. The sediments of the Gulf are highly variable, their texture being determined by the supply of sedimentary material and the degree and nature of water movement,(Fig.3).

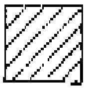
Much of the shelf in this area is mantled by relict Pleistocene sands

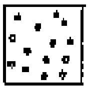
Fig. 3. Hauraki Gulf Sediments and Bathymetry (Carter, Eade 1980).

Gravel =  <50% Calcium carbonate in gravel fraction.

Sand =  <50% Calcium carbonate in sand fraction.

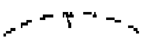
Mud =  <50% Calcium carbonate in mud fraction.

Calc.gravel =  >50% Calcium carbonate in gravel fraction.

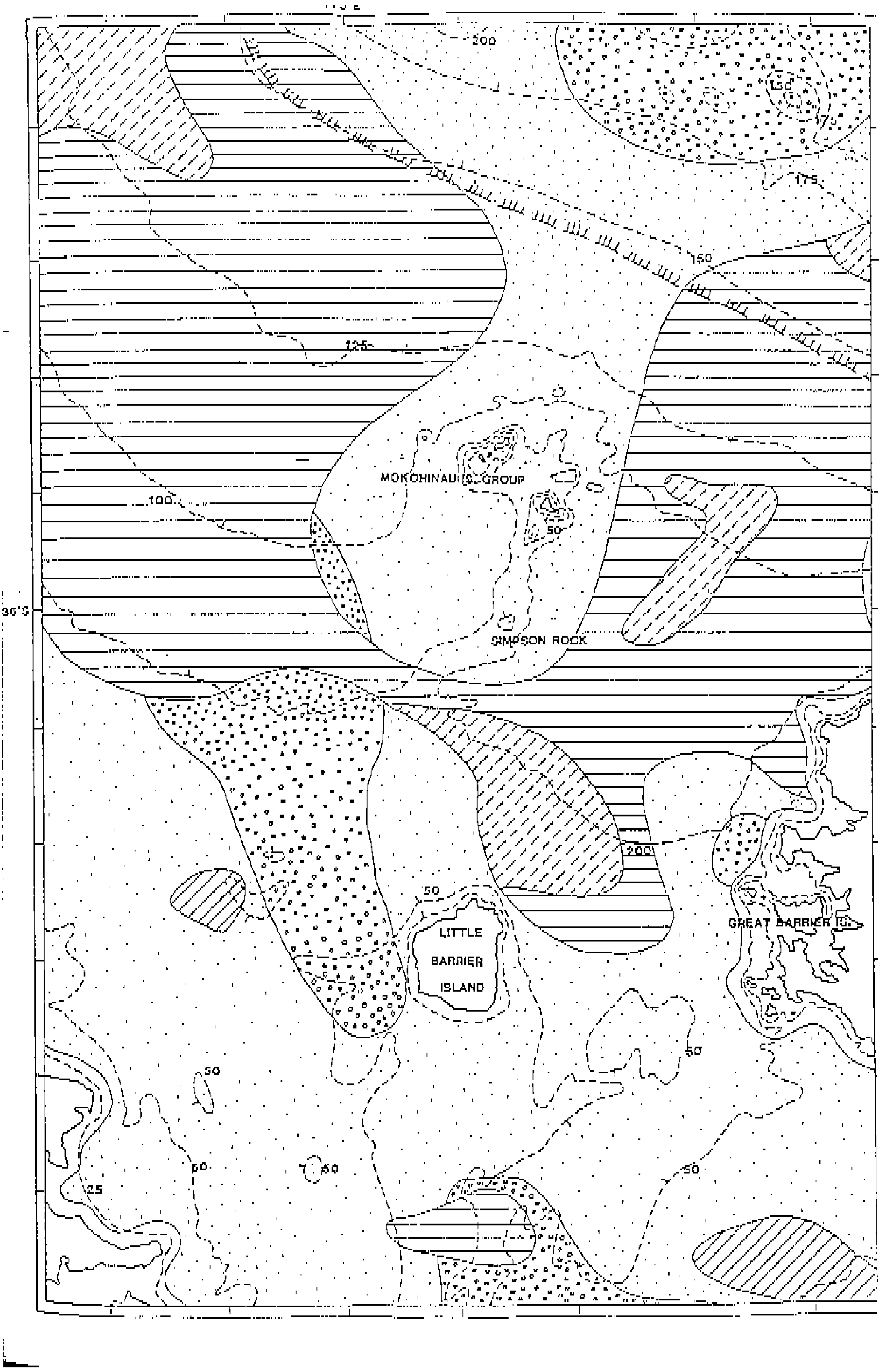
Calc.sand =  >50% Calcium carbonate in sand fraction.

 = Continental shelf edge.

---200--- = Contour lines in meters.

 = Down slope direction

Scale 1:400,000



200
150
175
175
150
125
MOKOHINAU IS. GROUP
100
50
36°S
SIMPSON ROCK
200
50
LITTLE
BARRIER
ISLAND
GREAT BARRIER IS.
50
50
50
50
25
50

derived from the acid volcanic rocks of the Central Volcanic Plateau. These were carried into the Gulf by the Waikato river through the Firth of Thames. Sediments between the inner Gulf islands and the mainland shore are generally muddy because they are protected from heavy wave action by the islands. Over most of the deeper parts of the Hauraki Gulf mud or sandy-mud sediments predominate. The Mokohinau islands are surrounded primarily by sandy sediments with a subdominant muddy constituent (Fig. 3).

WATER CURRENT PATTERNS

The Mokohinau Islands are influenced by three types of currents; oceanic, wind and tidal.

Of the largest extent, forming a worldwide system , is the dynamic ocean current pattern. This is very closely tied to global atmospheric circulation, as major ocean currents are wind driven. The whole of north eastern New Zealand is strongly influenced by the southward flowing oceanic (deep water) East Auckland current. This subtropical current originates in eastern Australia and carries with it larval forms of subtropical marine life. Over a period of many thousands of years a number of subtropical marine species have become established in north-eastern New Zealand so that the fauna of the area now has some subtropical affinities (these will be discussed in section II) The East Auckland current is strongest in the north of the north east coast, gradually losing velocity as it moves southward. From data on sea surface temperatures, it appears that this current is intermittently indrafted from deeper water off the continental shelf and into the Hauraki Gulf (Fig.4, Harris pers. comm.). Although this view is at odds with the traditional concept of the current moving down the coast impinging directly onto the offshore islands, it does however, still provide a mechanisim for the establishment of subtropical marine species, namely, the indrafting of this deep water current into the shallow coastal areas.

Perhaps the most readily apparent movement of water around the

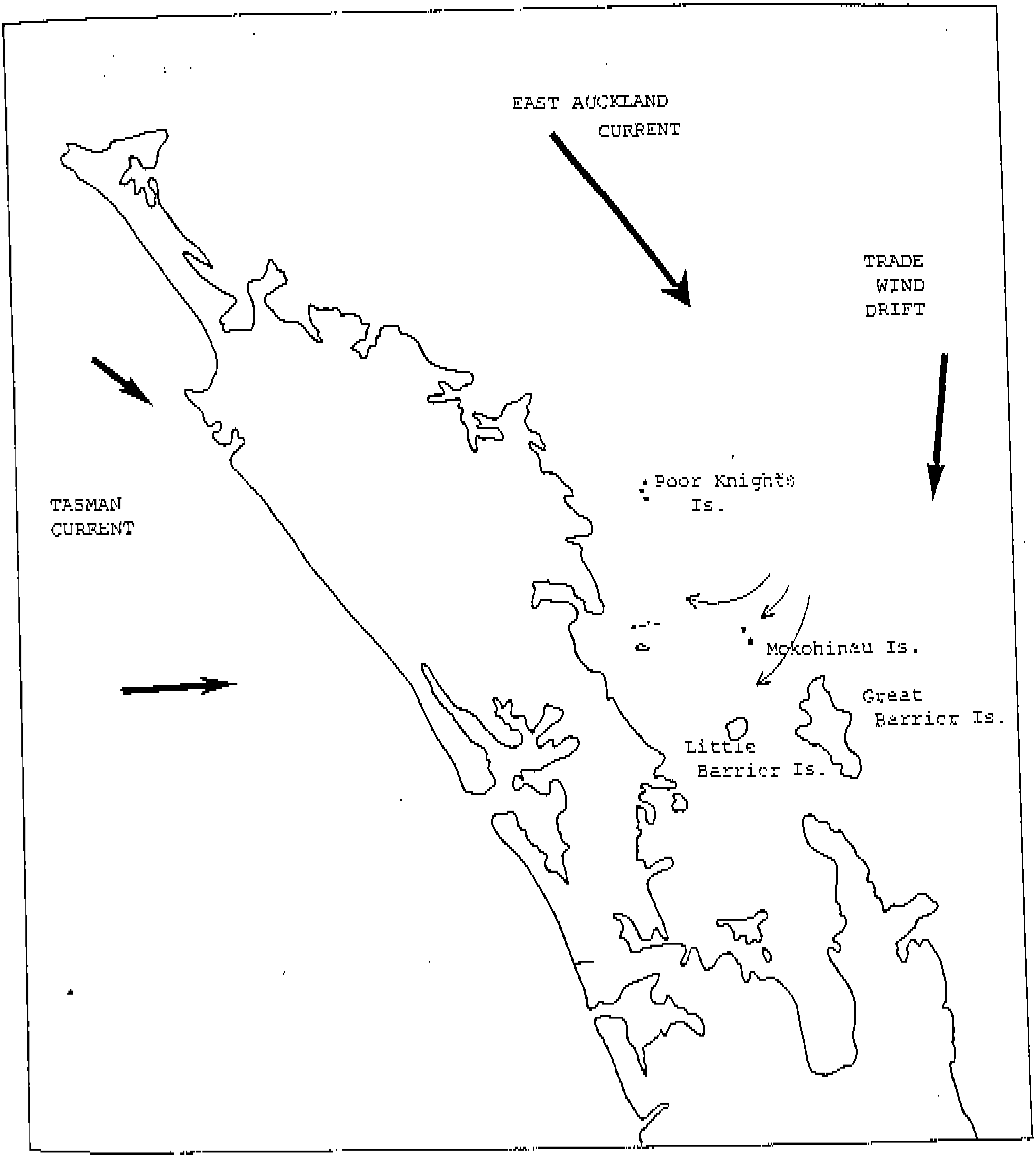


Fig. 4. Surface currents of northern New Zealand and postion of indraft of East Auckland current past the Mokohinau Islands.

Mokohinaus is that resulting from the generation of gravity waves by the wind blowing over the ocean surface. The waves are the direct result of transfer of energy from the moving air to the water across which it is flowing. The exposed situation of the Mokohinaus makes them particularly susceptible to this type of water movement.

The most regular and dominant water movement in the area is that caused by the tides. Movement at the Mokohinaus is in a north-south direction.

Mokohinau Climate

A synoptic weather station was set up in 1934 on the Mokohinaus, which provided weather forecasting information. The station was situated on Burgess island near the lighthouse at a height of 102 m above sea level. A complete weather station was not set up until May 1972. The weather was observed and recorded by light house keepers until the light house was automated on 8 Mar 1980. Therefore, the station provided only twelve complete years of standard climate data.

Little is known about the climatic conditions out to sea. Most weather stations are set up for agricultural purposes and are therefore situated inland. Hence the Mokohinaus provide valuable information about a little known subject.

Being such a small land mass, the islands do not have the same modifying effect on the weather as larger land masses, and so they effectively act as a weather station out to sea. Information derived from the Mokohinau weather station is applicable to the outer Hauraki Gulf. Conditions over the sea differ in various ways from those on land. Air temperatures are less variable, there is less cloud cover and rainfall, and wind speed is usually greater. The data from the Mokohinaus allow a comparision to be made between the climates at sea and those on land.

Three other climate stations have been selected to compare with the Mokohinau station ; Leigh - a station on Northland's east coast ; Warkworth - a station inland from Leigh, and Woodhill - a station near Northland's west coast (See Table 1 and Fig.1). All stations occur at a similar latitude and are spread across Northland, from coast to coast. They have been chosen in order to emphasize differences in climate along a gradient from maritime through coastal to inland sites.

Only a short period of climate data has been analysed due to the short terms the stations have been operating. The climatic factors looked at are Wind Flow, Wind Speed, Gales, Temperatures and Rainfall. Table 2 gives a summary of the Mokohinau climate obtained from the Meteorological service.

Wind flow

Air flow is predominately SW over the whole of Northland. In the Hauraki Gulf winds are variable and the strongest winds come from the north-east.

Winds at the Mokohinau Group tend to bring weather from two main directions, SW and NE. Both come over the open oceans and are, therefore, moisture bearing winds. The north-easterlies are warm, moist winds, usually with more wind and rain than the cold, less moist south-westerlies.

The wind direction, summarized in Table 3, and wind rose diagrams, Fig.5, show specific differences in surface wind directions at the four climate stations.

South-east winds are the least common at all stations, with northerlies being the next least frequent wind. Warkworth and Leigh climate stations both have topographical features which may account for the pronounced east-west components. Warkworth climate station is situated in a wide valley running east-west, and Leigh climate station has a large hill approximately 100 m high behind it, blocking off the southerly wind flow.

The inland stations have a higher percentage of calm days than at Leigh or the Mokohinaus, where sea breezes are evident.

Wind speed

The wind speed is greatest at the Mokohinaus, which can be expected as the islands are not protected by surrounding landforms. The average hourly

Table 1. Location and general features of four selected climate stations in Northland.

Station	Latitude	Longtitude	H.S.L.	General situation
Mokohinau	35°54'	175°07'	102	50km N.E. of Cape Rodney; open water with no protection from major land masses.
Leigh	36°16'	174°48'	27	Coastal station (east coast); large hill (100m) behind station.
Warkworth	36°26'	174°40'	72	Inland (75km from east coast); in wide valley running east to west.
Woodhill	36°45'	174°26'	30	Inland (6km from west coast).

H.S.L. = Height above mean sea level in metres.

	PERIOD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
RAINFALL, MILLIMETRES														
HIGHEST MONTHLY/ANNUAL TOTAL	1934-1980	361	252	243	396	402	389	368	300	201	159	182	149	1779
90 PERCENTILE VALUE	1934-1980	178	175	183	163	153	214	194	178	189	140	129	123	1489
MEAN	1934-1980	73	69	86	108	100	127	119	114	77	75	69	65	1082
10 PERCENTILE VALUE	1934-1980	8	8	23	36	32	36	40	53	41	26	24	24	814
LOWEST MONTHLY/ANNUAL TOTAL	1934-1980	2	4	2	5	22	23	22	37	18	3	11	9	798
AVERAGE RAIN DAYS, 1.0MM OR MORE	1967-1980	6	6	9	9	10	11	12	12	10	8	7	7	107
MAXIMUM 1-DAY RAINFALL	1934-1980	167	126	115	269	210	167	78	66	71	60	72	105	269
MAXIMUM 2-DAY RAINFALL	1934-1980	176	230	152	294	218	190	121	103	106	70	95	117	294
TEMPERATURE OF THE AIR, DEGREES CELSIUS														
HIGHEST RECORDED	1972-1979	29.0	8.4	27.4	24.7	21.4	19.5	16.3	18.4	20.1	23.2	23.5	25.4	29.0
AVERAGE MONTHLY/ANNUAL MAXIMUM	1972-1979	26.3	26.6	25.8	23.7	20.2	18.3	17.3	18.0	18.4	20.3	22.9	23.8	27.3
AVERAGE DAILY MAXIMUM	1972-1979	23.3	23.8	22.9	20.2	17.6	15.6	14.9	15.3	15.8	17.3	19.2	21.2	16.9
MEAN	1972-1979	20.1	20.6	20.1	17.9	15.4	13.5	12.6	13.0	13.3	14.6	16.5	18.1	16.3
AVERAGE DAILY RANGE	1972-1980	6.5	6.4	5.7	4.7	4.5	4.2	4.5	4.8	5.0	5.4	5.5	6.3	5.3
AVERAGE DAILY MINIMUM	1972-1980	16.7	17.4	17.2	15.5	13.1	11.4	10.4	10.5	10.8	11.9	13.7	14.9	13.6
AVERAGE MONTHLY/ANNUAL MINIMUM	1972-1980	11.5	14.1	13.8	11.3	6.3	6.9	6.3	7.0	6.8	7.8	10.7	11.3	5.1
LOWEST RECORDED	1972-1980	6.5	12.2	10.8	7.6	4.6	1.8	4.5	5.5	3.2	5.5	8.4	7.4	1.8
RELATIVE HUMIDITY, (%) AVERAGE AT 9 A.M.	1972-1980	82	91	81	81	91	82	82	84	85	83	85	82	82
VAPOUR PRESSURE, MILLIBARS AVERAGE AT 9 A.M.	1972-1980	17.9	16.0	17.9	15.9	13.8	12.4	11.7	12.1	12.5	13.3	15.1	15.9	14.7
WIND, MEAN HOURLY WINDSPEED, KM/HR	1961-1979	27	28	29	32	33	36	37	35	33	30	29	29	31
SPECIAL PHENOMENA, AVERAGE DAYS OF														
THUNDER	1955-1980	0.1	0.2	0.1	0.5	0.2	0.2	0.2	0.3	0.3	0.4	0.2	0.2	2.9
GALE	1972-1980	2.9	2.0	3.9	5.7	6.4	7.4	8.8	6.9	4.8	4.9	3.6	3.5	59.8
FOG	1972-1980	2.9	1.1	0.6	.	0.3	0.1	0.1	0.9	1.3	2.1	2.4	2.3	14.0

Table 2. Mokohinau climate summary.

Table 3. Summary of annual wind directions at four climate stations in Northland, expressed as % frequency of surface wind directions 1973-1979.

Stations		N	NE	E	SE	S	SW	W	NW	Calm
Mokohinau	$\bar{X}$	9.4	12.8	12.8	4.5	14.5	15.6	15.3	13.4	2.3
	SD	2.7	3.7	3.8	0.6	2.9	4.9	1.5	2.0	1.0
Leigh	$\bar{X}$	2.3	11.7	17.7	2.8	6.6	14.9	24.3	17.0	2.4
	SD	1.3	2.5	2.8	0.5	1.4	1.7	5.2	3.0	1.8
Warkworth	$\bar{X}$	4.5	5.8	15.3	3.4	6.7	12.3	23.6	6.7	21.4
	SD	0.7	1.8	3.7	0.5	0.9	2.9	3.1	1.5	2.9
Woodhill	$\bar{X}$	5.5	11.9	13.5	6.7	10.9	13.3	12.6	9.2	15.8
	SD	1.8	3.7	3.9	4.1	5.9	3.6	5.5	3.6	4.5

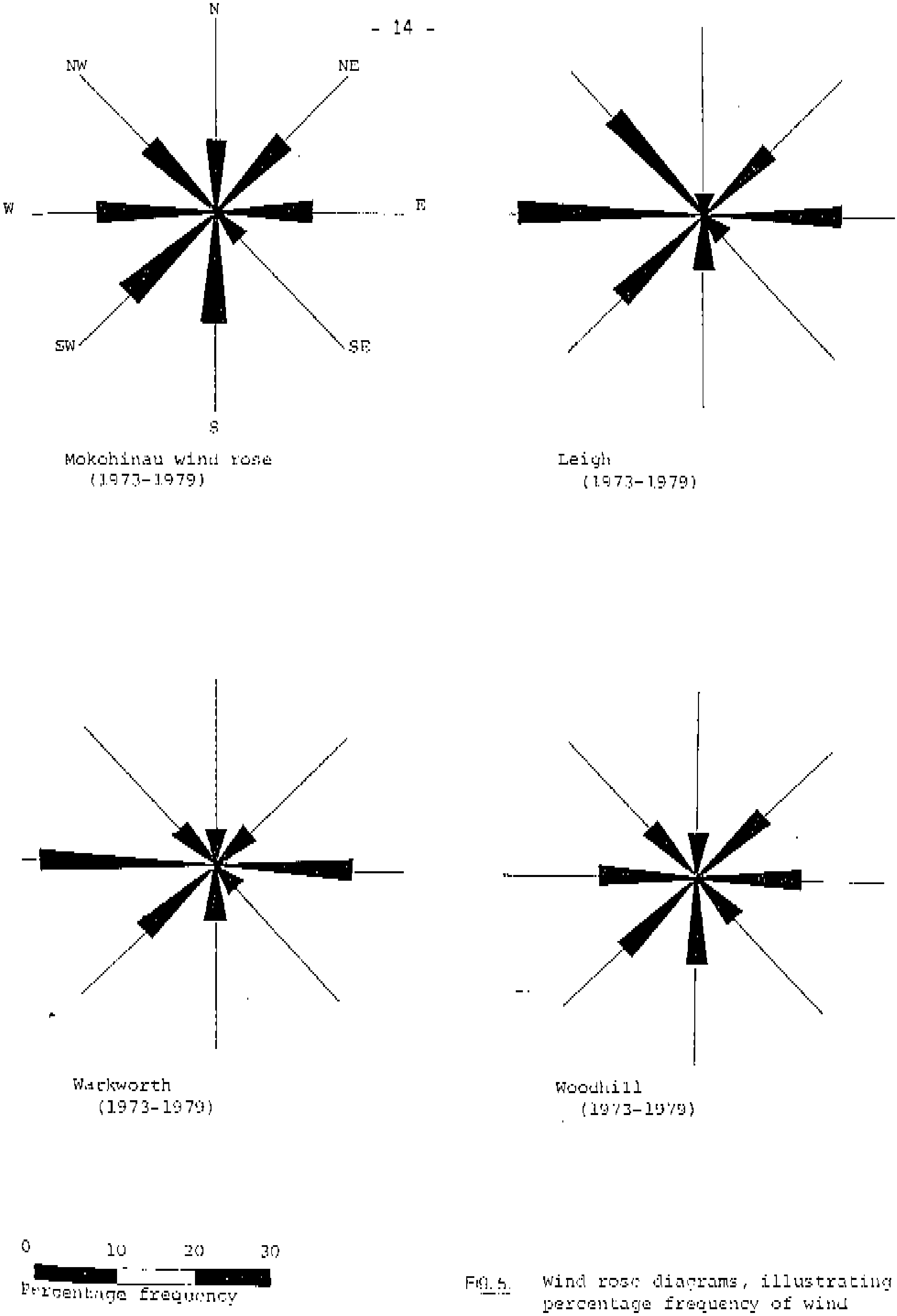


Fig. 5. Wind rose diagrams, illustrating percentage frequency of wind directions shown in table 3.

wind speed at the Mokohinaus is 32.7 km/hr which is equivalent to force five on the Beaufort wind scale. Force five is defined as a mean wind speed between 29 - 38 km/hr and classed as a 'fresh breeze'. By comparison, Leigh has an average wind speed of 13.2km/hr and Woodhill 6.2km/hr (there is no data available for Warkworth).

Gales

Due to different methods of recording gales (defined as x wind speed > 34 knots for ten minutes) at the different stations, it is difficult to make direct comparisons. The Mokohinaus have on average 59.8 days of gales per year. A large number compared with Leigh (2.3) or Warkworth (2.1). There is no data available for Woodhill. The difference could be at least partially explained by the recording methods.

At Leigh a gale is recorded only if a gale is indicated by the instruments during the daily weather check recorded at 9am. At the Mokohinaus however, recordings are made at 6 stages during the day. Therefore, if there were gale force winds for an entire day, Leigh would record only one gale while the Mokohinaus would record six. However, we can not simply divide the Mokohinau data by six as only one or two gale readings may have been obtained on some days. Still, even if the Mokohinau data is divided by a maximum of 6, the resulting value (9.7) is still higher then gale readings for the other stations.

Rainfall

There is a high degree of variability in rainfall from month to month and year to year. Table 4 summarizes rainfall for the Mokohinau Islands and illustrates the degree of variability which occurs during the year and over several years.

The average annual rainfall of the four climate stations is summarised in Fig.6. For the period between 1972 and 1977, Mokohinau had the lowest average annual rainfall. Although figures are derived from a short data base, annual averages over longer periods show that the Mokohinaus do have a

NZ METEOROLOGICAL SERVICE

STATION A55921 MOKOHINAU LH LAT 35 54S LONG 175 07E HT 102M

RAINFALL MILLIMETRES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1934											52	46	
1935	70	56	243	69	121	137	368	79	81	70	42	139	1496
1936	194	132	96	75	24	24	88	103	50	61	182	68	1097
1937	162	16	124	176	156	194	127	89	53	41	62	66	1285
1938	61	164	19	142	181	221	259	192	57	70	81	89	1534
1939	136	13	25	63	73	134	91	100	54	66	85	41	923
1940	284	42	58	27	59	29	147	79	46	59	58	9	897
1941	49	13	74	53	49	173	69	100	48	143	46	34	832
1942	33	6	26	81	66	104	142	124	52	83	26	68	913
1943	8	27	38	54	31	121*	94*	126	176	128	78	31	912
1944	42	76	141	136	92	119	80						
1945													
1946													
1947													
1948													
1949					156	125	42	88	83	26	126	116	
1950	22	6	16	109	158	129	40	75	51	91	178	33	908
1951	66	45	22	120	105	82	97	122	52	30	102	49	902
1952	34	352	29	66	52	139	39	117	74	77	131	61	1171
1953	117	34	40	104	148	164	136	167	55	76	116	15	1172
1954	10	19	141	162	157	100	109	133	89	29	11	30	990
1955	8	4	208	54	59	183	110	62	129	159	85	132	1222
1956	78	94	67	251	402	241	184	188	56	136	94	87	1778
1957	2	60	98	99	74	35	59	165	85	54	26	27	786
1958	18	214	23	5	137	23	212	43	96	118	24	93	1083
1959	124	54	132	167	65	63	145	160	55	84	24	114	1207
1960	7	185	70	65	182	216	139	53	174	76	100	107	1374
1961	73	24	23	131	69	135	199	96	75	25	53	128	1019
1962	38	46	139	107	149	49	39	161	65	93	66	149	1106
1963	25	76	84	172	73	147	181	107	79	3	69	19	1034
1964	16	29	120	61	91	307	112	148	74	121	28	50	1187
1965	361	95	78	35	88	74	169	300	19	57	55	57	1386
1966	91	114	42	49	153	109	177	37	73	29	96	80	1040
1967	76	69	154	89	69	36	72	64	105	39	98	87	949
1968	7	7	69	144	86	133	96	90	31	53	29	40	790
1969	44	257	2	37	112	91	57	61	66	13	58	70	659
1970	76	71	79	60	58	123	55	130	36	93	70	61	912
1971	26	59	168	196	68	83	112	162	87	144	35	25	1354
1972	133	20	222	227	186	39	40	126	32	29	42	29	1055
1973	15	8	54	164	22	139	198	175	201	84	22	31	1053
1974	30	55	70	189	89	128	46	55	74	46	23	102	985
1975	60	61	50	39	107	175	22	71	134	145	58	27	937
1976	219	31	45	109	22	44	91	157	143	121	121	31	1134

Table 4. Mokohinau rainfall.

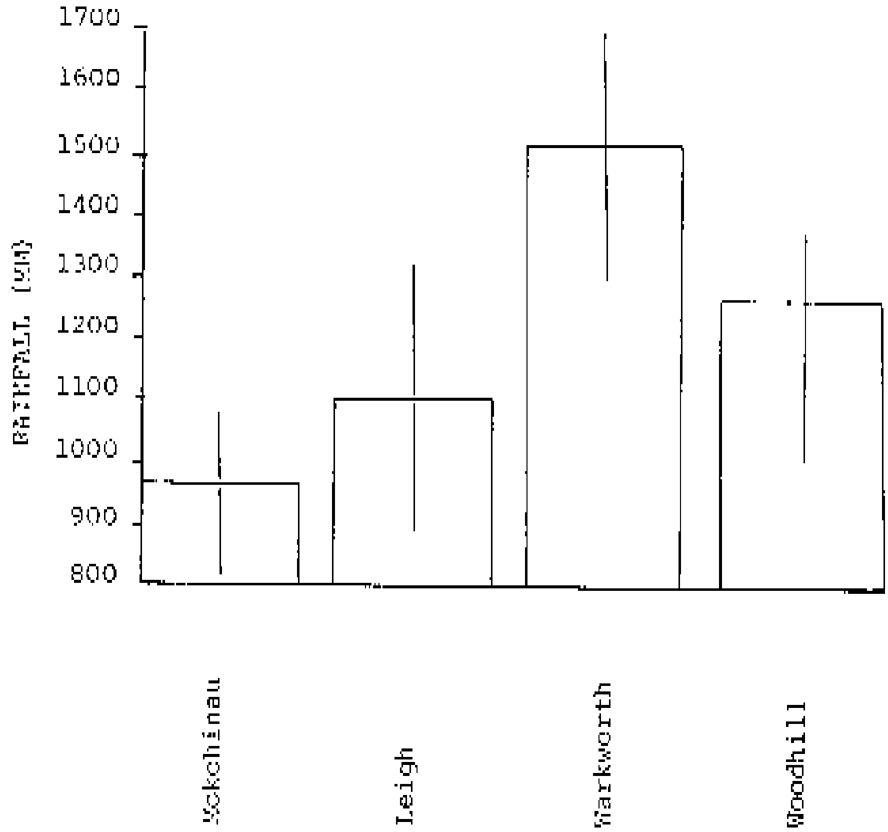


Fig. 6 Average annual rainfall (± SD) at four climate stations in Northland (1972-1977).

lower average annual rainfall than the other localities.

Temperature

Northland climate is milder and warmer than the rest of New Zealand. The average annual temperatures range from 15.5 in the far north to 13.5 on the south west coast of the region. These are the highest mean annual temperatures in New Zealand.

At Mokohinau the average annual temperature is 16.3, which is higher than the other stations (Table 5). Overall the average maximum temperatures are similar for all stations, but the average minimum temperatures decrease as one moves further inland.

HISTORY

The following is a brief account of the Maori and European occupation of the islands. A fuller account is given in Appendix 1.

It is unlikely that there was ever any permanent occupation of any of the Mokohinau Islands. Maori occupation appears to have been limited to short term annual muttonbirding parties by members of the Aotea tribe from Great Barrier Island (Spring-Rice, 1980). Parties came to the islands to take the fledgling muttonbirds during the middle and latter part of December. However, the season is now confined by statute from the second Saturday in November to the seventh day of December. Muttonbirding in the Mokohinau Group is now confined to the smaller Maori Bay and Trig Islands and is prohibited on Fanal Island.

On the 16 January 1845 eight Maoris who styled themselves as "we the chiefs of the Ngatiwai", consented and sold "the entire Group called Pokoinu (Pokohinu) consisting of one large island, three smaller islands and some rocks", to a Mr. Joel Samuel Polack. In October and November 1849 certain Maoris alleging to have claims to the islands gave notice of their objections to Polack's purchases on the basis that the Maoris who signed the Deed had no right. A notice was thereupon inserted in the Maori Messenger calling on all

Table 5. Summary of average annual temperatures and average maximum and minimum temperatures (°C) at four climate stations in Northland.

Station		Average annual temp. (°C) 1972-1978	Average max. temp. (°C) 1973-1978	Average min. temp. (°C) 1973-1978	Range °C
Mokohinau	X̄	16.3	18.9	13.6	5.3
	SD	0.6	0.5	0.5	
Leigh	X̄	15.7	18.7	12.6	6.1
	SD	0.4	0.5	0.5	
Warkworth	X̄	14.5	18.8	10.3	8.5
	SD	0.5	0.5	0.6	
Woodhill	X̄	14.5	19.0	10.2	8.8
	SD	0.4	0.6	0.4	

parties to prefer their claims before the Resident Magistrate at Kororareka (Russell) on the 12 December 1849. The matter lapsed until 1864 when the extinction of Maori Title was proved to the satisfaction of Commissioner Domett. The islands were reserved for Lighthouse purposes in 1883, and Fanal Island was declared a bird sanctuary in 1923. In March 1928 the Maori Land Court heard an application dealing with the claim of certain Maoris to Motukino (Fanal) Island, but, nothing resulted from this claim. The islands were declared prohibited places under the name Moko Hinau during World War II. All the islands in the group, with the exception of Burgess Island, were declared a Wildlife Sanctuary in 1958.

The last keeper Mr Ray Walters progressively pulled down the keepers houses prior to automation of the lighthouse on 8 March 1980. The only accomodation now remaining is on an 'A' frame building near the lighthouse which is used to house visiting workers.

Present Status

The Islands are at present classified as Nature Reserves Class B (sanctuaries/restricted areas:- access limited to scientific purposes) and are administered by the Hauraki Gulf Maritime Park Board. The central portion of Burgess Island remains reserved for lighthouse purposes and is administered by the Ministry of Works and Development although the Ministry of Transport carries out the day to day maintenance.

FLORA

The vegetation on all the islands has been grossly modified by burning and grazing. From at least 1920 the lighthouse keepers grazed stock on Burgess Island and burned the vegetation at intervals of approximately three years to keep the sedges in check. In 1932 Trig Island and Dragon Island were burned by fishermen. A list of plant species reported from the Mokohinaus is given in Appendix 2.

Burgess Island

Following the description of Esler (1978) Burgess Island can be divided into 4 regions according to its vegetation (Fig.7).

1. Is predominantly bracken (Scirpus nodosus) and Muehlenbeckia complexa with some patches of buffalo grass (Stenotaphrum secundatum). This region contains most of the pohutukawa (Metorosideros excelsa) on the island. This region has been grazed for many years.

2. This area is almost covered in buffalo grass, with a rank, mixed pasture of cocksfoot (Dactylis glomerata), ratstail (Sporobolus africanus), Muehlenbeckia complexa and Scirpus nodosus . On a scarp above the boulder beach there is a very minor patch of bush containing Coprosma macrocarpa , ngaio (Myoporum laetum), kawakawa (Macropiper excelsum), Parsonia heterophylla , Sicyos angulata and a few ferns. This is the only community of this nature on Burgess or the adjoining islets.

3. The third region has a mixed sward with some patches of buffalo grass. Scirpus nodosus and Cyperus ustulatus become more important on the irregular topography. The main pasture species are paspalum, cocksfoot , prairie grass, rye grass (Lolium perenne), Yorkshire fog (Holcus lanatus) and sweet vernal (Anthoxanthum odoratum). On the drought prone rocky outcrops there are greater quantities of Notodanthonia spp; the annual grasses (Vulpia , Brizia , Aria), together with other annuals and a few natives such as Rhagodia triandra and ice plant (Disphyma australe).

4. Region four possesses Scirpus nodosus with abundant Poa anceps , Adiantum aethiopicum some cocksfoot and Doodia media . Cassinia retorta is prominent in a few places and there are limited patches with Notodanthonia racemosa and annual grasses.

The Western Islets

These are capped with flax with some pohutukawa. On Trig Island there are only a few pohutukawa trees. Pudding Island has more flax than pohutukawa and is well on the way to a complete cover.

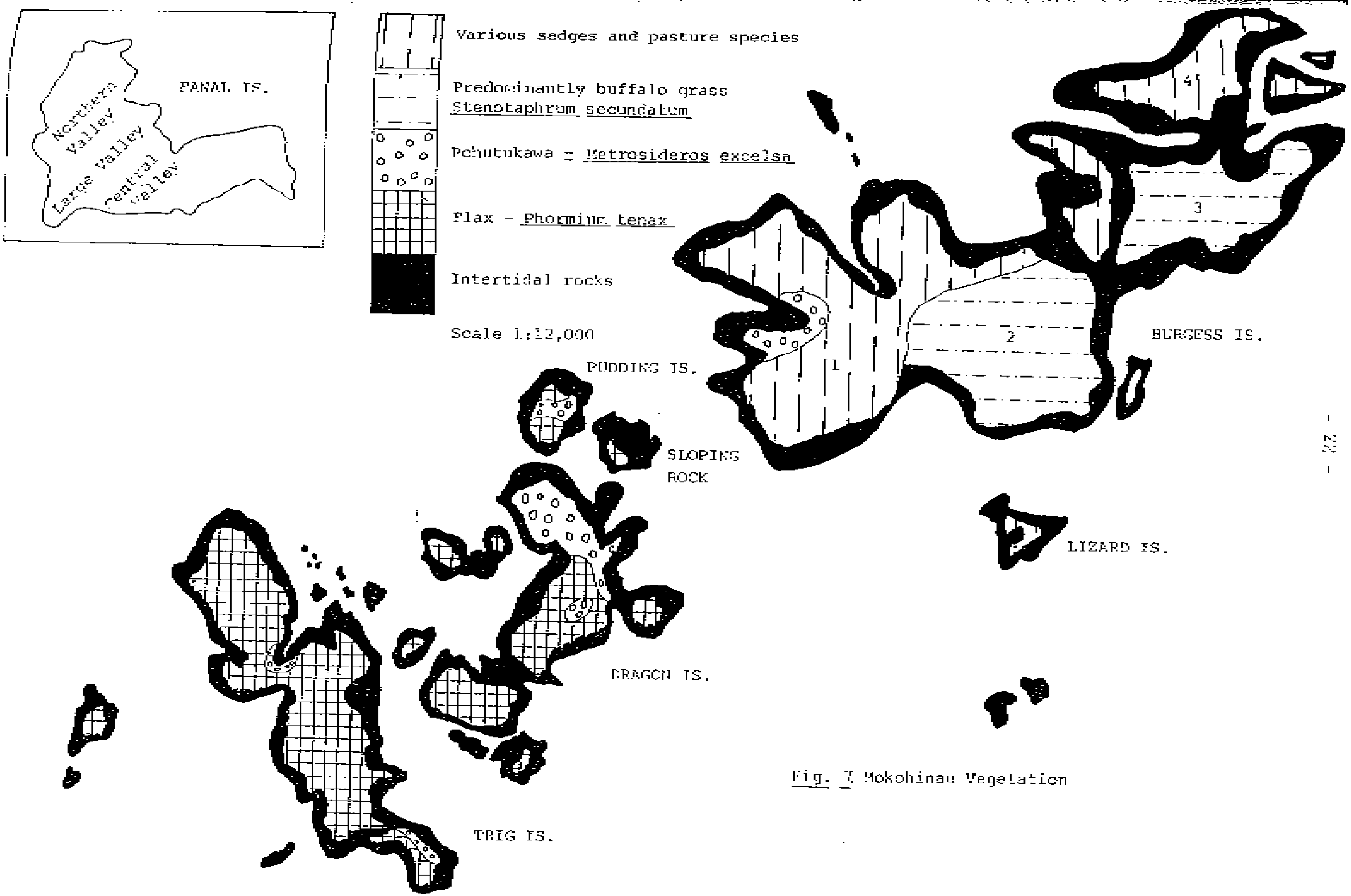


Fig. 7 Mokohinau Vegetation

On all these islets stunted *Scirpus nodosus*, with some *Cassina retorta*, forms small patches where the soil is too shallow for flax to flourish.

Lizard Island

Has a windswept community of taupata, ngaio and *Hymenanthera novae-zelandiae* to 1.5m tall, surrounding a patch of *Cyperus ustulatus*. In some places the islet has a turfy fringe of *Salicornia australis* and ice plant grading into shrubland.

Fanal Island

The Island may have been grassy at one time with some bush persisting in the large gully. Shrubland and young forest have developed in some parts, and communities of flax in others. There is flax in the central valley and on the sides of the large valley near the coast. Flax also dominates the northern valley. The flax communities on Fanal Island are not all pure stands, most have *Cortaderia splendens* and shrubs (Fig.7 inset).

There are patches of manuka on both sides of the large valley. The stands on the eastern side of the valley seem to be the oldest.

The young forest is remarkable for the number of prominent species in the canopy - houpura (*Pseudopanax lessonii*), *Nestigis apetala*, karaka (*Corynocarpus laevigatus*), kohekohe (*Dysoxylum spectabile*), tawapou (*Planchonella novo-zelandica*), puriri (*Vitex lucens*) and pohutukawa. The canopy is 4-6m high in most places with no understorey but with a profusion of *Asplenium lucidum* and *Dichondra repens* on the ground.

The patch of older forest in the mid reaches of the large valley is composed of the same dominant species as the young forest. The canopy is about 10m tall and there is a sparse understorey of nikau (*Rhopalostylis sapida*) and kawakawa and young individuals of mahoe (*Melicytus ramiflorus*), kohekohe and karaka. This forest is not primary forest but is probably the oldest vegetation on the island, and the source of seed for the establishing forest which will soon cover the island.

With the automation of the lighthouse in March 1980 all stock has been removed and this should lead to a rapid change in the character of the vegetation on Burgess Island (Marine Division Ministry of Transport, 7/83, reports that buffalo grass regrowth is very strong but there has been no visible regrowth of shrubs or trees although plants such as hibiscus etc. are still in the keepers gardens).

FAUNA

New Zealand has about 500 islands and island groups. Many of New Zealand's plants and animals which were once found on the mainland now survive only on these offshore islands. Islands are also important as breeding grounds for many bird species, which may not breed successfully on the mainland. Some species of New Zealand wildlife have such a restricted habitat that they are only found on one or two island groups. Islands, therefore, play a significant part in protecting New Zealand wildlife.

Most of the outer islands of the Hauraki Gulf are known to possess unique or rare geological, botanical, zoological and archaeological features. The Mokohinau Islands are no exception. They provide a breeding ground for many bird species with some animals and plants being unique to the islands.

The Mokohinau Island Group is the most distant from the mainland in the Hauraki Gulf. The islands are small and relatively low lying. As a result, the Islands suffer from low annual rainfall and severe droughts in summer. There is no standing water on the Burgess or Knight Groups of the Mokohinaus. Fanal Island has a creek but the permanency of it is unknown. These harsh conditions limit the opportunities for vegetative growth. All the islands have suffered from man-made and naturally occurring fires, and the resulting vegetation is fairly stunted. Regenerating bush has to survive droughts, wind and salt spray.

The Islands are bounded by steep cliffs and have many small stacks and islets surrounding them. The stunted vegetation and convoluted topography provide a variety of habitats for animal species, and the regeneration of the bush may provide additional habitats in the future.

The scope of this report does not permit a detailed treatment of all the fauna of the islands. Some of the more noteworthy aspects, however, are mentioned in the following paragraphs to emphasize the uniqueness of this island group.

Insects

Little is known about most groups of insects from the Mokohinaus, and the sparse information that exists is scattered throughout the biological literature. One of the best studied groups is the Coleoptera. Broun (1886,1893) described a number of beetles from the islands.

Odonta sandageri (Fam. Scarabaeidae), and Dorcus inthaginis (Fam. Lucanidae) a large flightless stag beetle, are known to be confined to the Mokohinau group. The latter species is now thought to be extinct as a result of predation by Kiore. A few specimens were collected by Sandager in1902, but the stag beetle has not been sighted since then and a search in 1973 failed to find any trace of the species. Omedes nitidus and Xylochus spinifer are otherwise known only from the Poor Knights. These latter two belong to the family Tenebrionidae.

The status of some of the Mokohinau beetles is uncertain. Some are definitly synonymous with species known from elsewhere (eg. Phaeophanus similis = Anagotus rugosus), and others have since been found on other northern islands (e.g., Holoparamacus castaneus), and usually also on the mainland.

Lizards

Ten species of reptile have been recorded for the Mokohinau Group (Table 6), some of which have now disappeared from the Islands. The continued existence of the remaining species of reptile may be threatened by Kiore, as the present day distribution of Kiore overlaps that of many of the lizard species.

Table 6. Mokohinau Lizard List

Sphenodon punctatus

Gehyra oceanica

Lepidodactylus lugubris

Hoplodactylus duvauceli

H. pacificus

Leiolopisma moco

L. smithi

L. suteri

Cyclodina aenea

C. oliveri

Surveys by Whitaker (1974) and McCallum (1980a) failed to locate any tuataras (Sphenodon punctatus) and it is likely that they have become locally extinct. The last sightings were in 1922 on Fanal island (Crook 1970) and on the Knight Group during the 1930's (Ray Walters, pers.comm). Sandager reported tuataras to be abundant on two islands, probably Maori Bay and either Fanal or Trig Island. Frequent burning and subsequent modification of the vegetation as well as the introduction of Kiore probably had a deleterious influence on existing tuatara populations (McCullum 1980). Gehyra oceanica and Lepidodactylus lugubris have been recorded for the Mokohinaus but have not been seen on subsequent visits.

Birds

Fifty bird species have been identified from the Mokohinau Islands. The list of species is broad and interesting for a number of reasons.

- the suitability of the islands as a breeding ground for seabirds,
- their position as a first landfall for some artic migrants,
- their proximity to large and well forested islands, such as Great Barrier, Hen and Little Barrier,
- accurate observations by competent naturalists over many years, especially those made by Sandager in the 1880's. (McCullum 1980).

Many sea birds breed on the Mokohinaus but there are low numbers of passerines, especially native species which breed on the islands (Appendix 3). This may be due to lack of suitable habitat.

Red-billed gulls, however, are reported to have increased over recent years, from only a small breeding colony (Sandager 1890) to a colony of over 5,000 pairs in 1930 (Gurr and Kinsky 1965).

North Island Saddlebacks (Philesturnus carunculatus rufusater) were introduced onto Fanal island from the Hen island population in February 1968. In 1973 only three males were located and now the liberated birds are thought to have died out.

Muttonbirding activities and subsequent flora modification due to associated burnings, affected the abundance of bird species on the islands. Future regeneration and establishment of the vegetation may create the potential for a greater variety of species to occupy the islands.

Mammals

Cows and goats were kept on Burgess Island, where the lighthouse keepers lived, but all domestic stock was removed from the Mokohinaus by 1980. There are no bats, possums, cats, rabbits, black or brown rats on the islands and the presence of mice has not been recorded in the literature surveyed in this report.

The only mammals now surviving on some of the islands are Kiore (*Rattus exulans*). These rats are agile climbers, hunting for food among trees. They may eat other animals such as young birds, eggs and lizards, or compete for food sources with them, or both. Many workers have observed Kiore on offshore islands and suggest that their presence may be deleterious to bird and lizard populations on the smaller islands (Whitaker 1974).

Amphibians and fresh water fish

No amphibians are recorded from the Mokohinau Islands. The Hochstetters frog is found on some islands in the Hauraki Gulf, but is not on the Mokohinau islands, possibly because there are no suitable habitats. These frogs like water and permanent damp areas, but these are not found on the Mokohinaus.

No fresh water fish species have been reported for the islands, again probably due to lack of habitat. What water there is on the islands is unlikely to be present during the summer months.

SECTION II - MARINE SURVEY

From 28 October - 8 November 1978, 16 R.N.Z.A.F. divers spent 10 days on Burgess Island and carried out 60 dives during remarkably calm weather for the area.

Original work and results obtained from the expedition include: production of a subtidal survey map around Burgess Island, a scientific film and shore surveys. Also included in this section is a review of the marine organisims occurring at the Mokohinau Islands.

Preliminary Base Map

The first step of the marine survey was to obtain a map from which to plan the expedition. As there was no detailed map existing, a Lands and Survey aerial photograph was enlarged (scale 1:3700), from which a base map was drawn. This map was supplemented by lower level stereo runs taken specially by the R.N.Z.A.F. These showed some underwater detail as well as giving cliff topography etc.

On this base map was plotted the main depth contours obtained from Navy fair charts. In this survey the 30m depth contour marked the edge of the survey. The map was then divided into a north-south grid pattern and all place names and features marked.

Map Production

The Mokohinau marine survey marked the third marine survey to be carried out in New Zealand. Previous surveys at Mimiwhangata (1973) and Leigh Marine Reserve (1978) attempted to organise the basis for habitat definition (i.e., depth, topography, gross biology), and then to order the methods for describing the biology, define habitats and map those habitats in detail.

The Mokohinau marine survey drew on experience gained from the preceeding surveys enabling pre-trained non-experts to recognise and describe the major habitats quickly and efficiently.

Dive Transects

The survey transects were kept simple. Divers swam along lines (called transects) extending from known landmarks on the shore. A transect line with markers attached every 10 metres was laid out between two anchored buoys to assist in swimming a straight course and to measure distance accurately (see Fig. 8). These transects were arranged around the whole of the Island Group (Fig. 9). An attempt was made to cover all major types of topography and habitat.

Along each transect at 10m, or wherever the environment changed, the depth, substratum, and major seaweed cover were recorded. It was decided to concentrate on the large seaweeds because these represent a stable and long-lived life forms of the marine environment. These provide food, shelter and attachment for many of the animals. So, by mapping the main types of seaweed, the living conditions and habitats of the mobile organisms can be recorded.

Immediately after each dive the information was copied from erasable slates onto paper and illustrated with what the divers could remember.

Habitat Types

The rocky subtidal region is not homogeneous either from a topographic point of view or biologically. To survey this region sensibly it is, therefore, necessary to divide the rocky substrata into a number of different habitat types. The definition of these habitats is to some extent a subjective exercise and can be based either on physical environmental factors such as depth, rock type, and the nature of the terrain, or on biological features such as the presence of certain animals and plants. In this survey,

Fig. 8. Procedure for establishing transects;

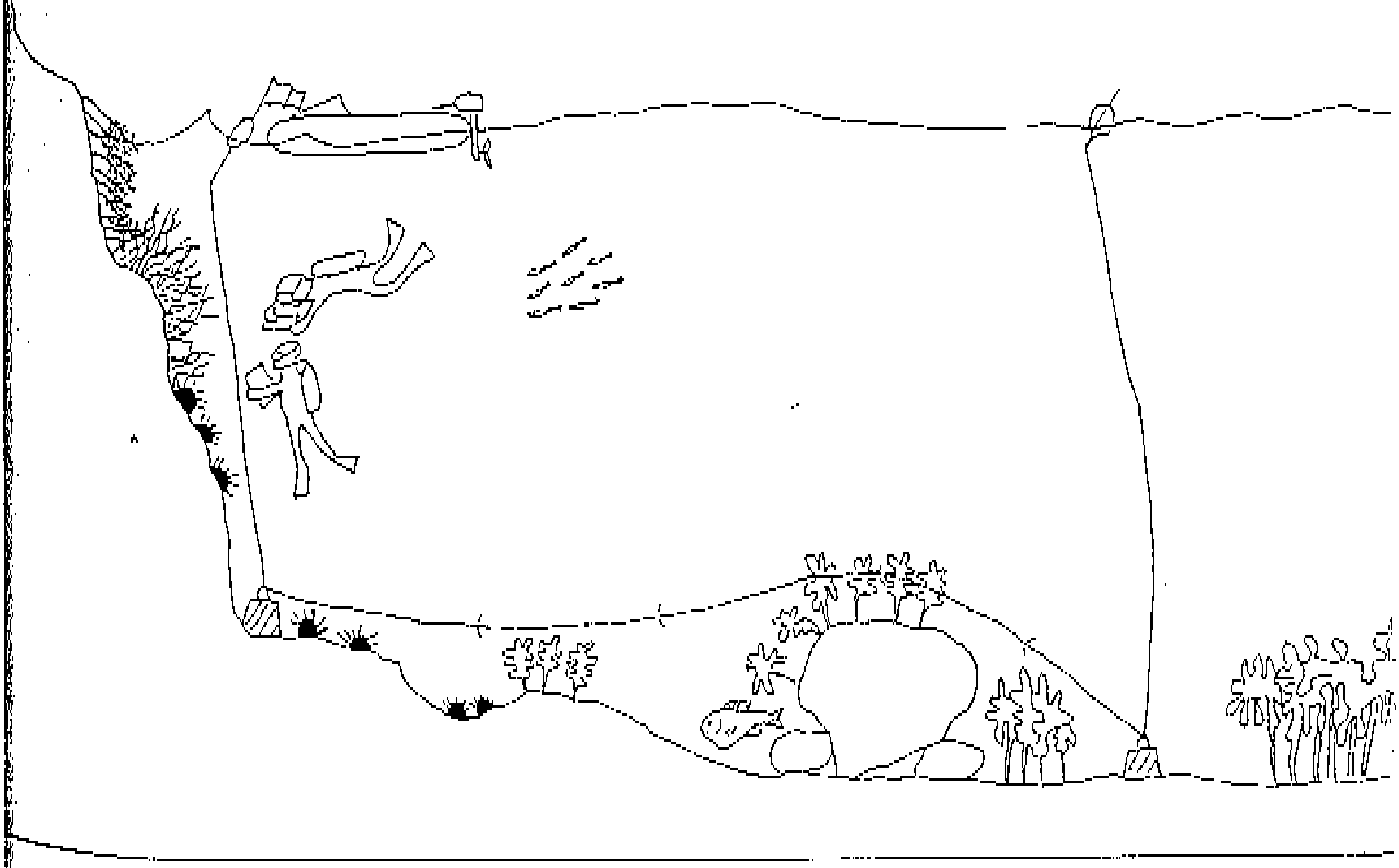
1) An inshore buoy is anchored as close as possible to the shore.

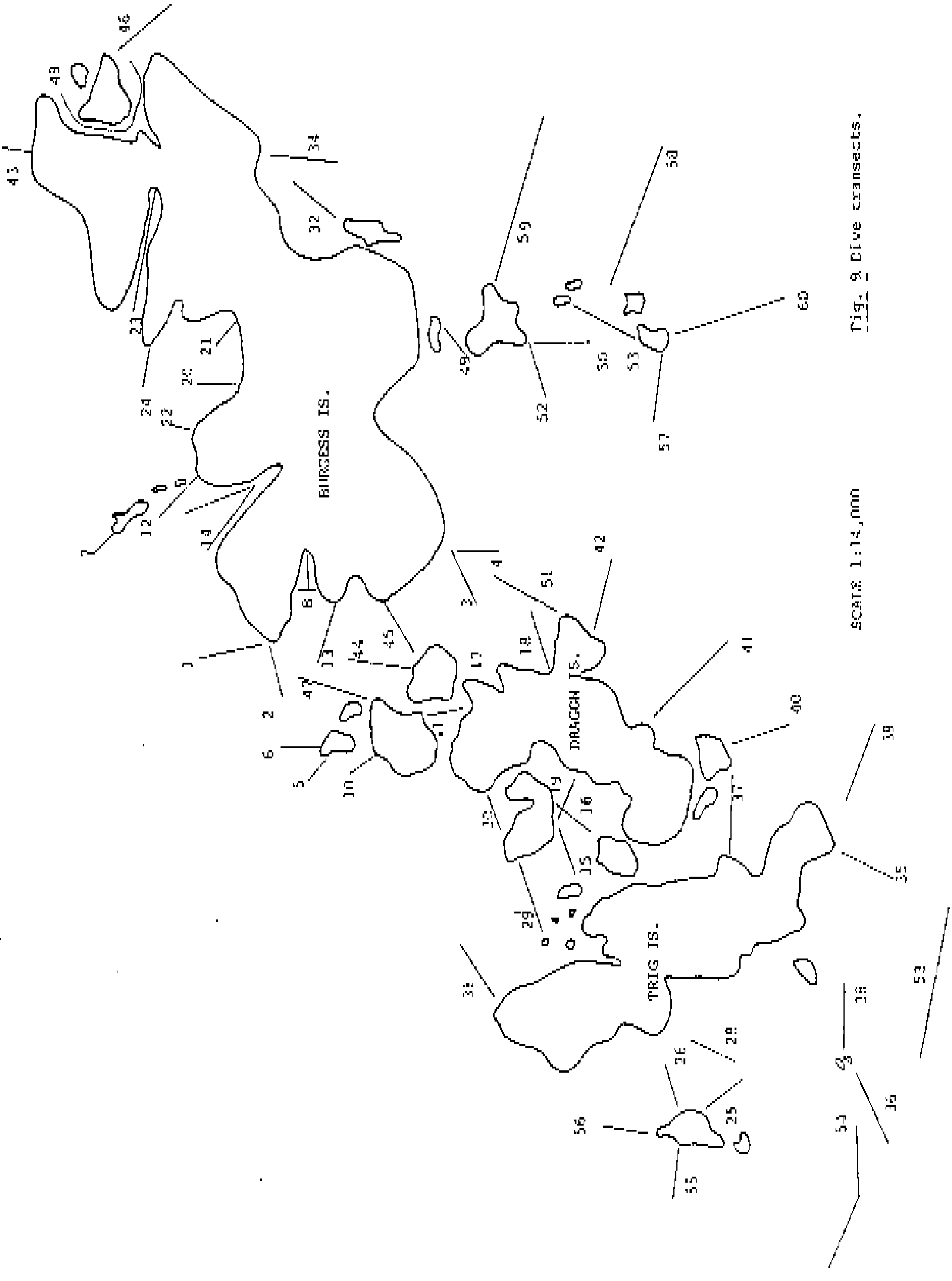
2) Tape measure/cord laid on a predetermined compass bearing.

3) Second buoy positioned.

4) Boat returns to first buoy.

5) Divers swim along the line recording the depth, substratum and habitat type. Transect ends at 30m contour.





SCALE 1:14,000

Fig. 9 Dive transects.

following the method of Ayling (1978), a combination of physical and biological features have been used to define five basic habitat types, but the emphasis has been placed on biological attributes. In addition, a single physical habitat type has been defined to facilitate the subtidal mapping exercise.

In north-eastern New Zealand, on a steeply shelving rocky bottom in moderate wave exposure, the following zones usually occur in order of increasing depth: (see Fig.10).

Basic Habitat Types

1. Intertidal Rocks .The plants and animals that live here must be tolerant of regular periods of submersion and exposure to the air. On the generally wave-exposed shores found at the Mokohinaus, intertidal rocks are mainly covered by barnacles, Novastoa and brown algae (see section below).

2. Shallow Weed Zone - Immediately below low tide level, the rock surface is usually completely covered by large brown and red algae (eg. Carpophyllum , Sargassum , Pterocladia). The lower limit of these algae is at about 10m depth, and is usually considered to be set by the grazing activities of sea urchins (Evechinus).

3. Sea Urchin Grazed Rock - Sea urchins probably cannot tolerate the disturbance of breaking waves close to the surface, but, slightly deeper, they can potentially clear the rock of all large algae. Along with other grazers (eg. limpets and topshells), they can graze over the encrusting pink coralline algae and, by eating the young sporelings, prevent the re-establishment of large sea weeds.

4. Kelp Forest .Below about 15m depth, the densities of urchins are low, and kelp grows in dense stands forming an extensive canopy which may be several meters high. At the Mokohinaus two main species occupy this zone: Ecklonia radiata and Carpophyllum flexuosum . Beneath the canopy of the

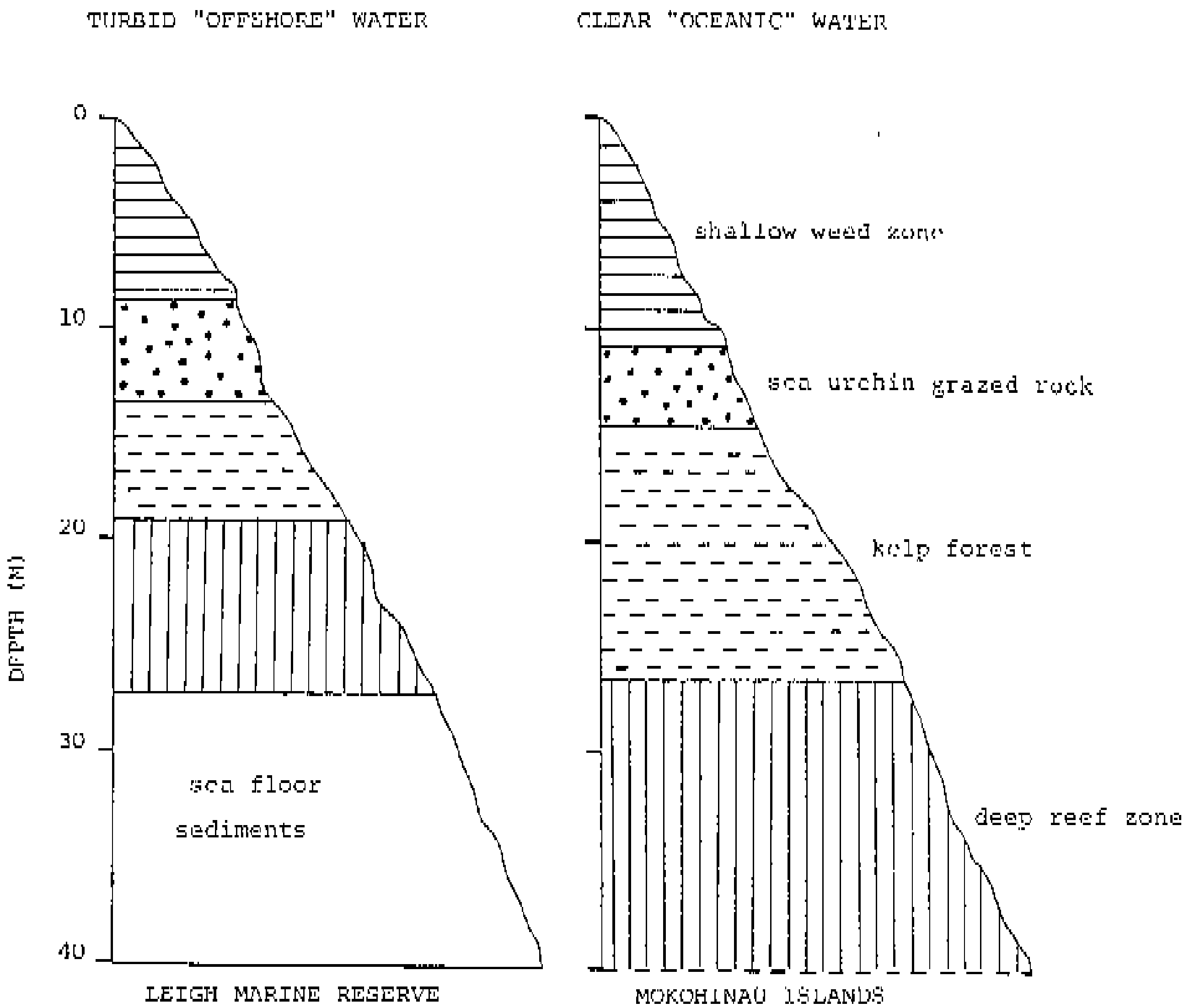


Fig. 10. Diagrammatic representation of the major changes in zonation of underwater rocky bottom marine life as contrasted between the Leigh Marine Reserve and the Mokohinau Island Group (Leigh data from Grace, 1983).

kelp, a diverse flora of encrusting and foliose red algae normally occurs.

5. Deep Reef Zone . In deep water, light levels are probably too low to support the vigorous growth of large seaweeds. Here, the canopy of foliose algae is very sparse or totally absent. Encrusting coralline algae cover the substratum, along with the diverse assemblage of sessile, filter-feeding invertebrates (sponges, ascidians, bryozoa, etc.).

6. Sand : (All soft substrates have been grouped under this heading). At depths in excess of 30 to 40 m, the bottom often levels out, allowing sand to accumulate over the rocky substratum. Such situations are usually devoid of much fauna, except for large, massive sponges.

Although the pattern of zonation outlined above is generally typical for northeastern New Zealand (eg. Choat and Schiel,1982), it should be noted that the zones are often not well-defined, and a mosaic of different habitat types often co-occur at approximately the same depth. For instance, the grazing activities resulting from a local increase in the abundance of sea urchins can result in the destruction of large patches of *Ecklonia* , and so convert kelp forest to sea urchin-grazed rock.

Subtidal Survey maps

The rocky subtidal area of the Mokohinau islands was mapped in some detail using a combination of aerial photographs and transects surveyed by divers (as outlined in Fig.8). The maps showing habitat types and depth contours have been printed at two different scales (Series I & II; see following pages).

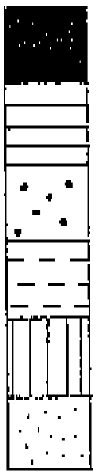
Habitat Zones

The dive transects show the relationship between habitats and depth on the different slopes. These general relationships were used to draw in the habitat boundaries between transects. The accuracy of this method depends on the spread of transects and on slope variability between transects.

SUBTIDAL SURVEY MAPS

Series I 1:12000 map of the entire survey area of the Mokohinau Islands.

KEY - MARINE HABITATS



Intertidal rocks

Shallow weed zone

Sea urchin grazed rock

Kelp forest

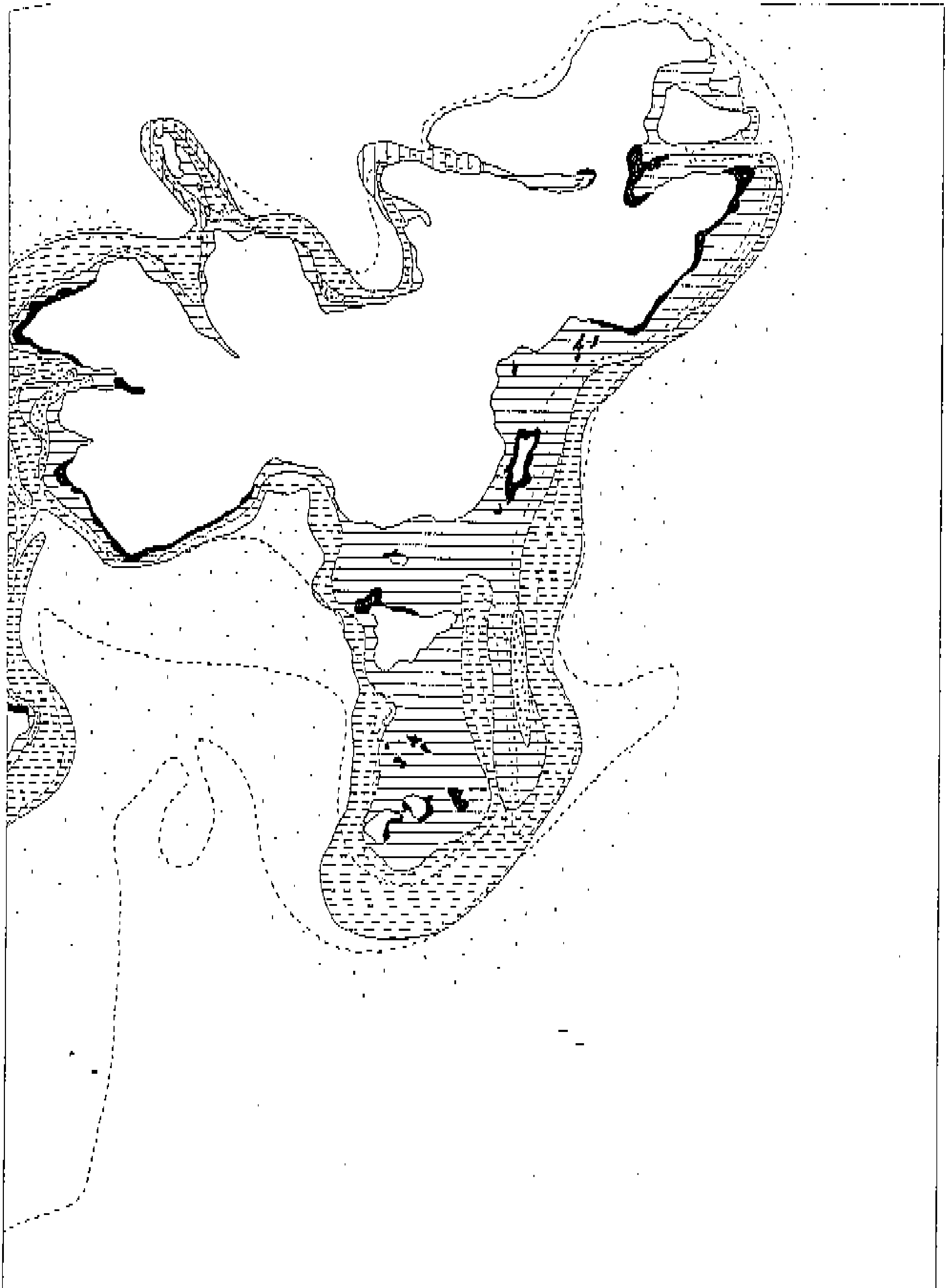
Deep reef zone

Sand

- BOUNDARIES

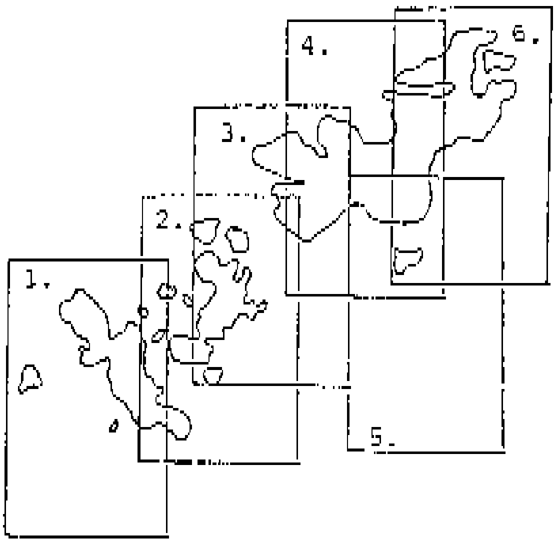
———————	Topographic features
- - - - 5 - - -	Depth contours (m)
———————	Habitat demarcations

SERIES I



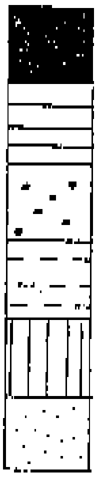
SUBTIDAL SURVEY

Series II 1:4000



1. TRIG IS.
2. DRAGON IS.
3. WESTERN BURGESS IS.
4. CENTRAL BURGESS IS.
5. LIZARD IS.
6. EASTERN BURGESS IS.

KEY - MARINE HABITATS



Intertidal rocks

Shallow weed zone

Sea urchin grazed rock

Kelp forest

Deep reef zone

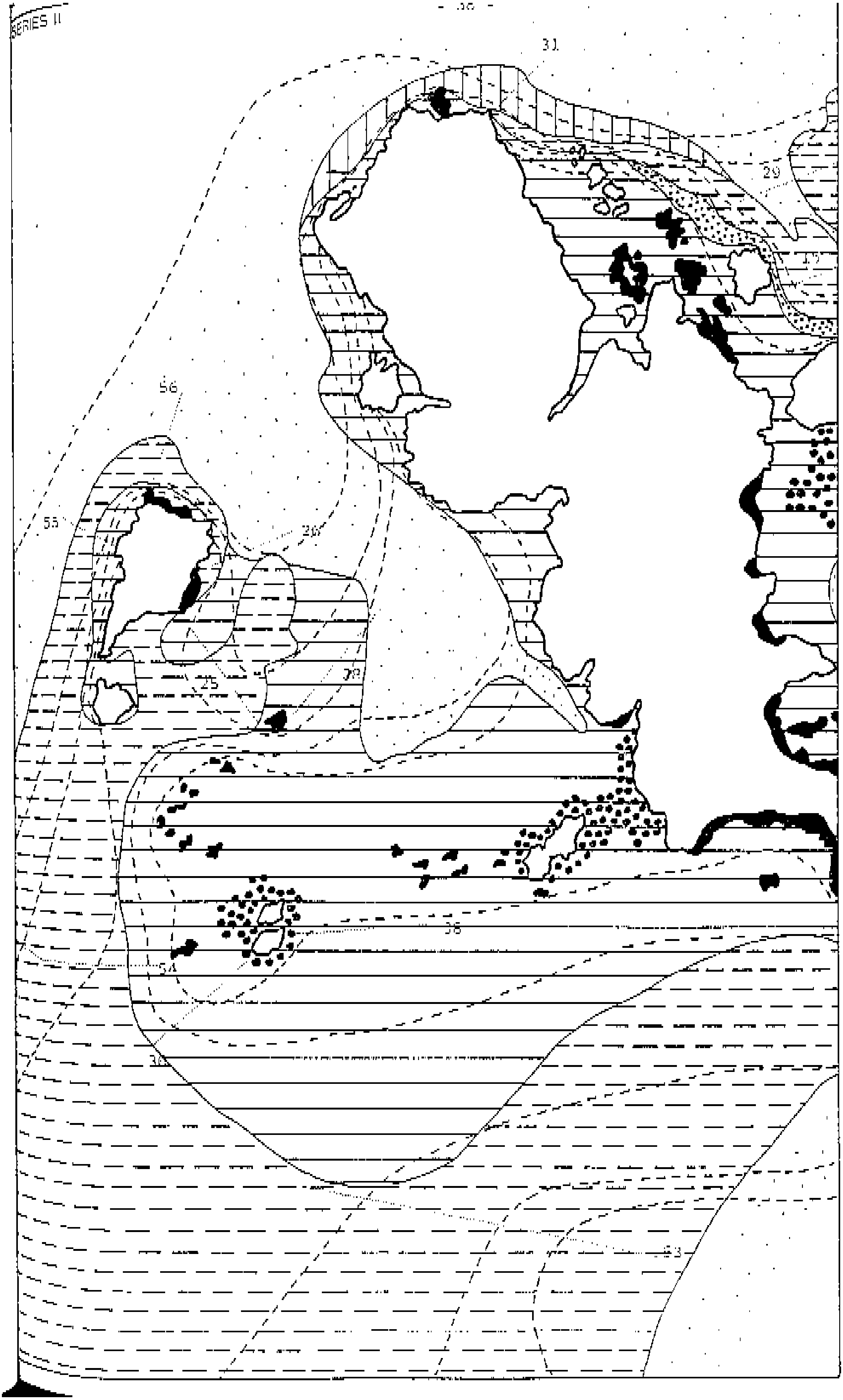
Sand

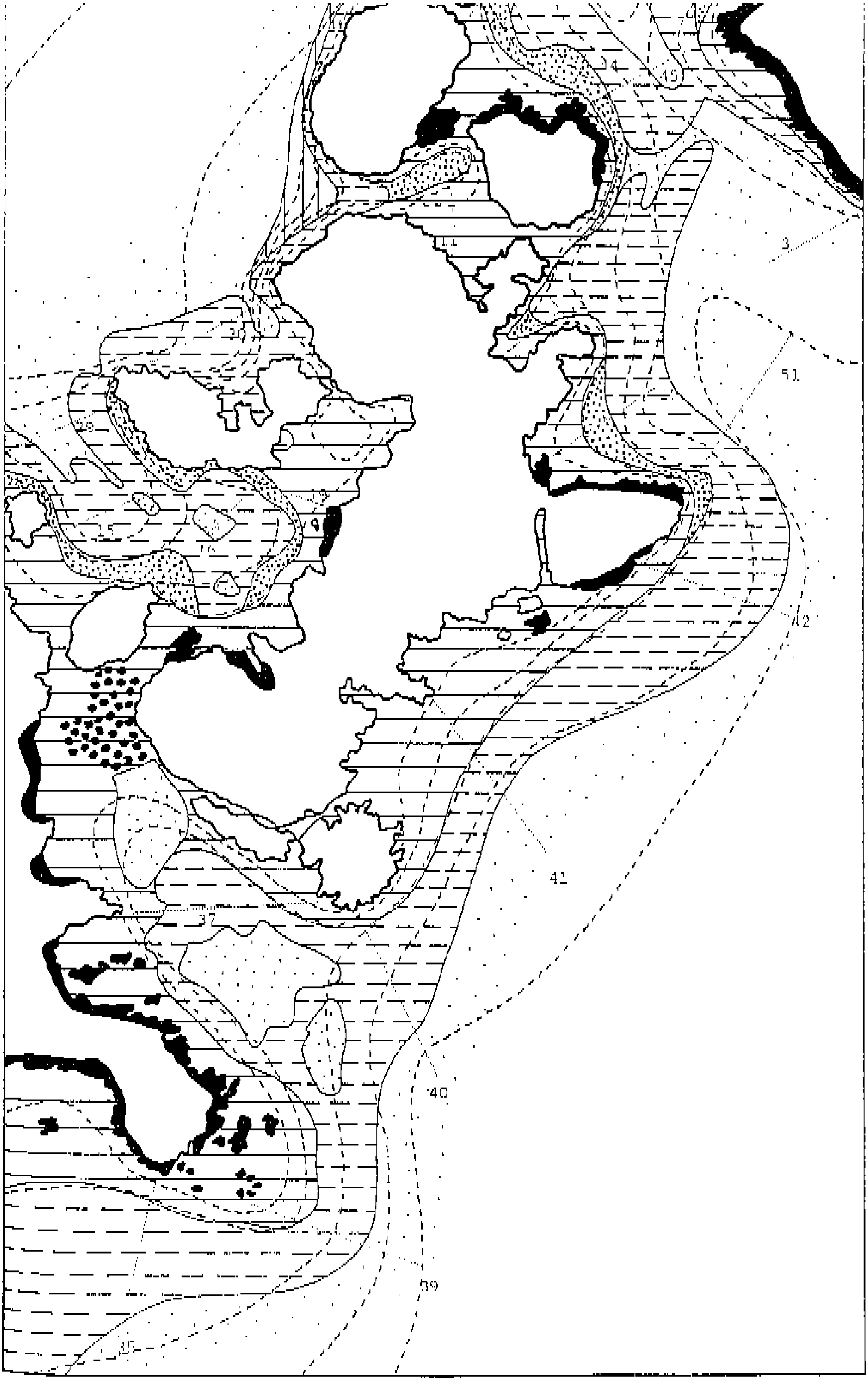
- BOUNDARIES

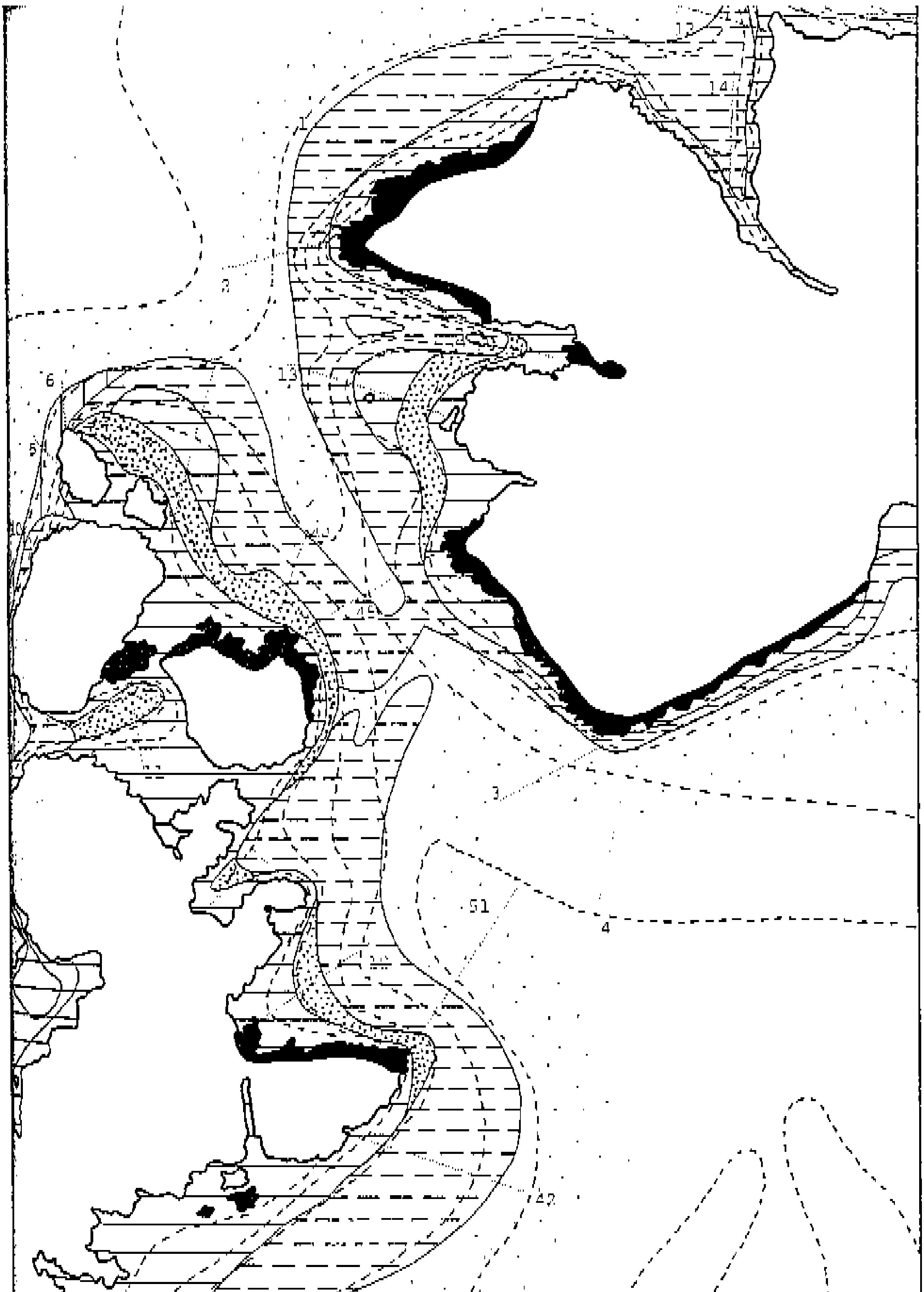
Topographic features

– – – – 5 – – – Depth contours (m)

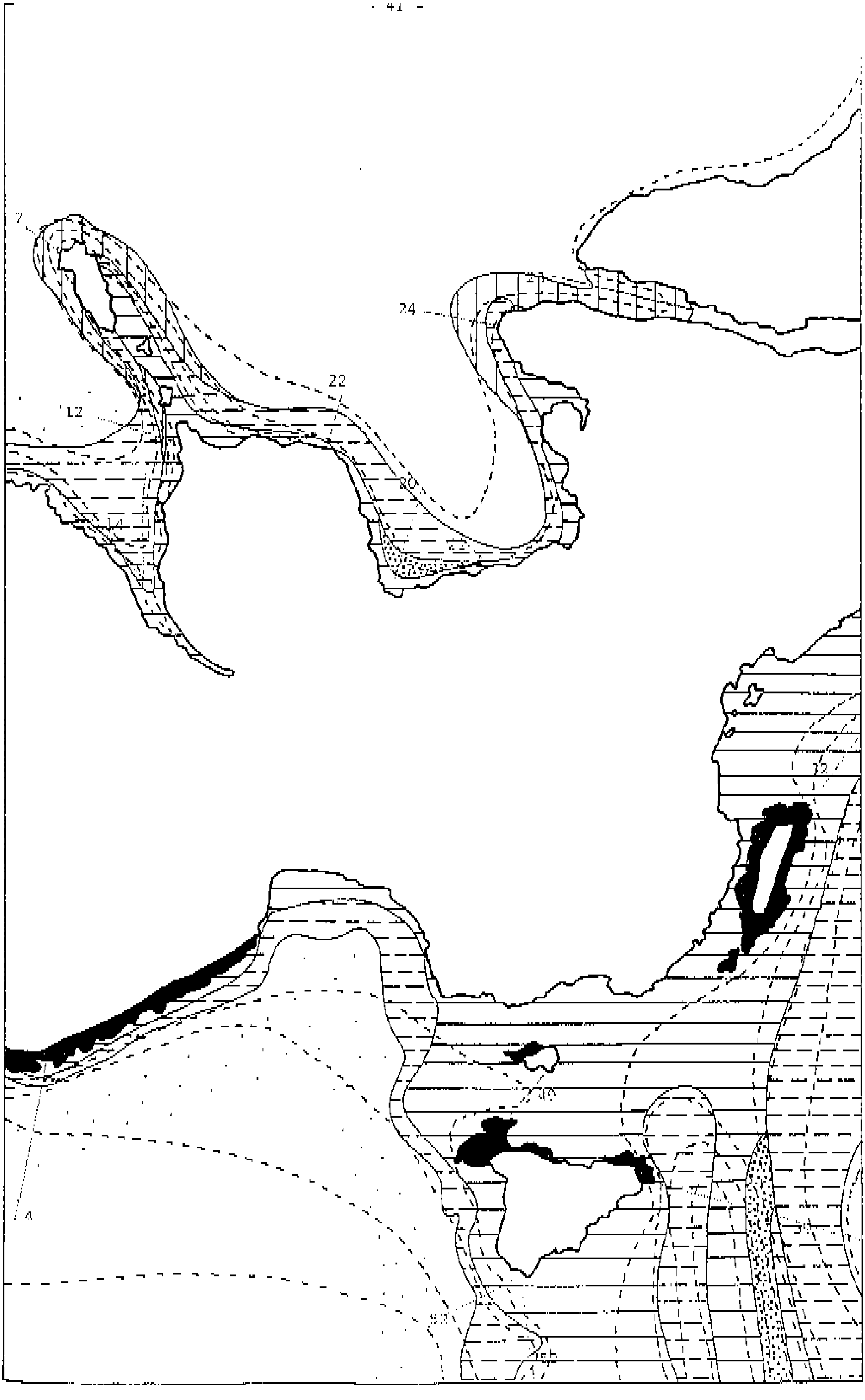
Habitat demarcations

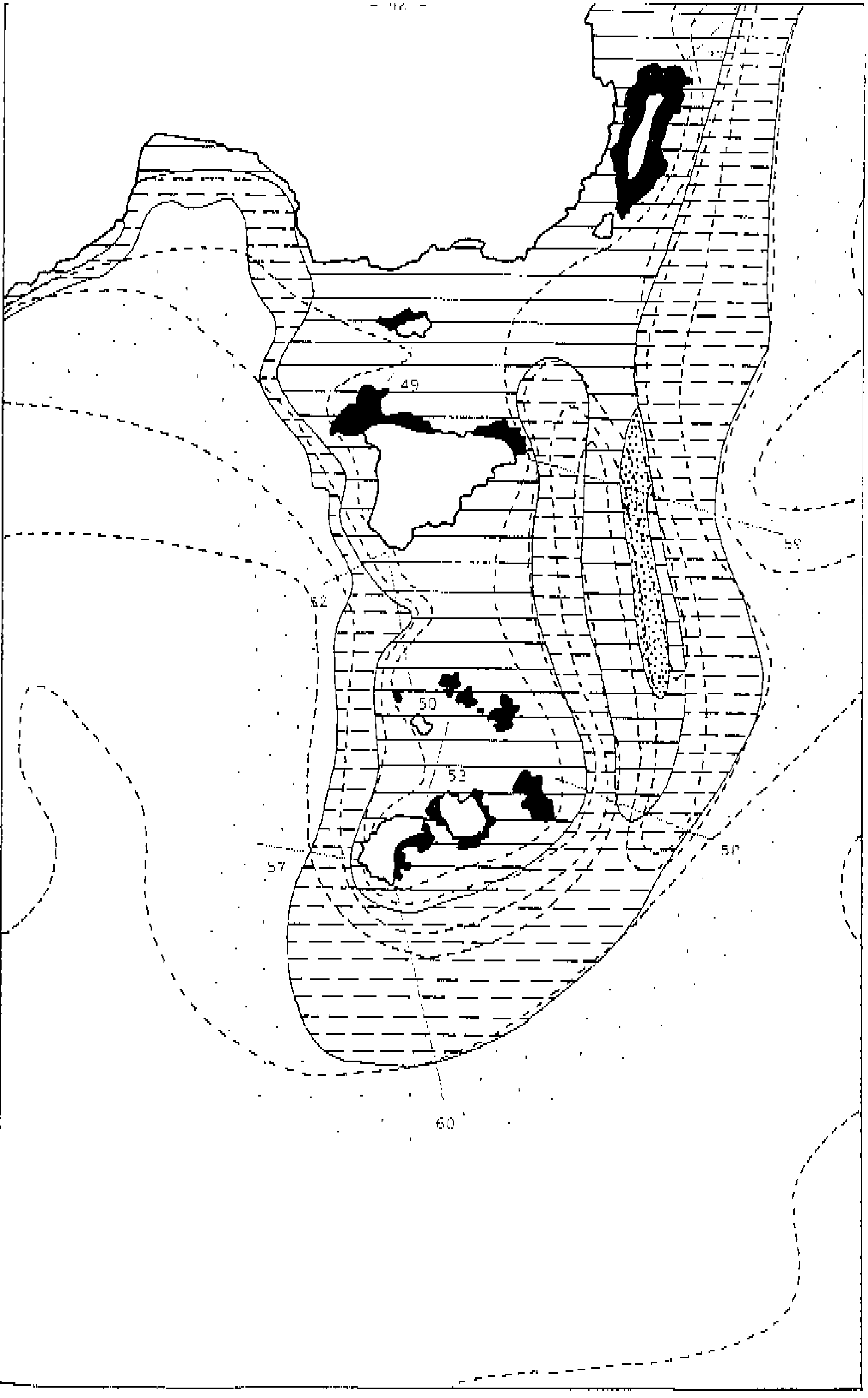

SERIES II
31
29
56
55
25
38
30
53

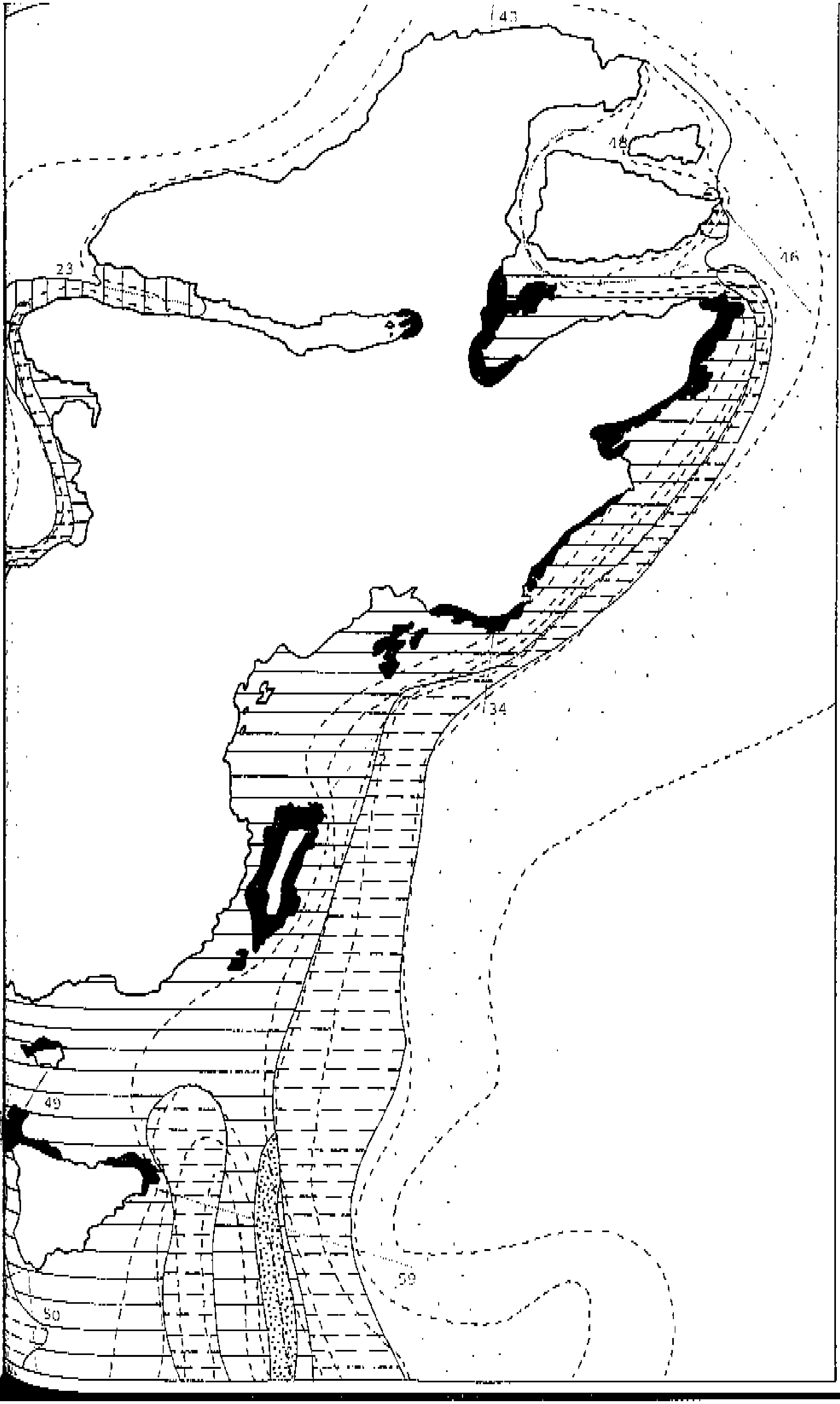

3
51
42
41
40
39
37
15
16
29
11
14
15



14
1
2
13
6
5
45
3
51
4
42
41


7
24
22
12
20
14
22
4
240
52
55
22


49
59
62
50
53
57
52
60


43
48
46
23
34
49
50
59

Habitat change with depth can be illustrated as idealized sections (Fig.11A & B) Fig.11A is taken from the "exposed" side of Burgess Island. Transects 12 and 59 were chosen as examples to illustrate this zoning pattern (Fig.12A & B respectively).

Transect 12 shows a rapid increase of depth with distance from shore, grazing by *Evechinus* has resulted in a sparse growth *Carpophyllum maschalocarpum* and *Ulva* down to about 10m. This gives way to *Ecklonia* , which gradually thins out with increasing depth.

Transect 59 gives a clear picture of a dense forest of *Ecklonia* being modified though grazing by the urchins *Evechinus* and *Centrostephanus* .

SHORE SURVEYS

The rocky shores of the Mokohinau Islands are all exposed to considerable wave action, principally as a result of the large expanses of open ocean to the north and east of the group (see Fig.13). Partial shelter from such wave action is attained in only a few places, and is due to very local topographical features (eg. site G in the vicinity of Sentinal rock, see Fig. 14). The tidal range experienced by shores at the Mokohinaus is approximately 2m (see Fig.15), which is similar to that encountered on open coastal shores on the mainland. This range is small compared with the large rise and fall of surge that often occurs, however, many of the zone-forming organisms present show an extended range of vertical distribution as a result. In an effort to describe the effects of wave action on the vertical distibution of intertidal organisms, a relative "wave exposure" scale has been developed for shores in norhtern New Zealand (Ballantine et al.1973). This scale describes a continuous range of habitats for organisms from extremely sheltered with very little wave action (0-1) to extremely exposed shores with violent wave action (6-7).

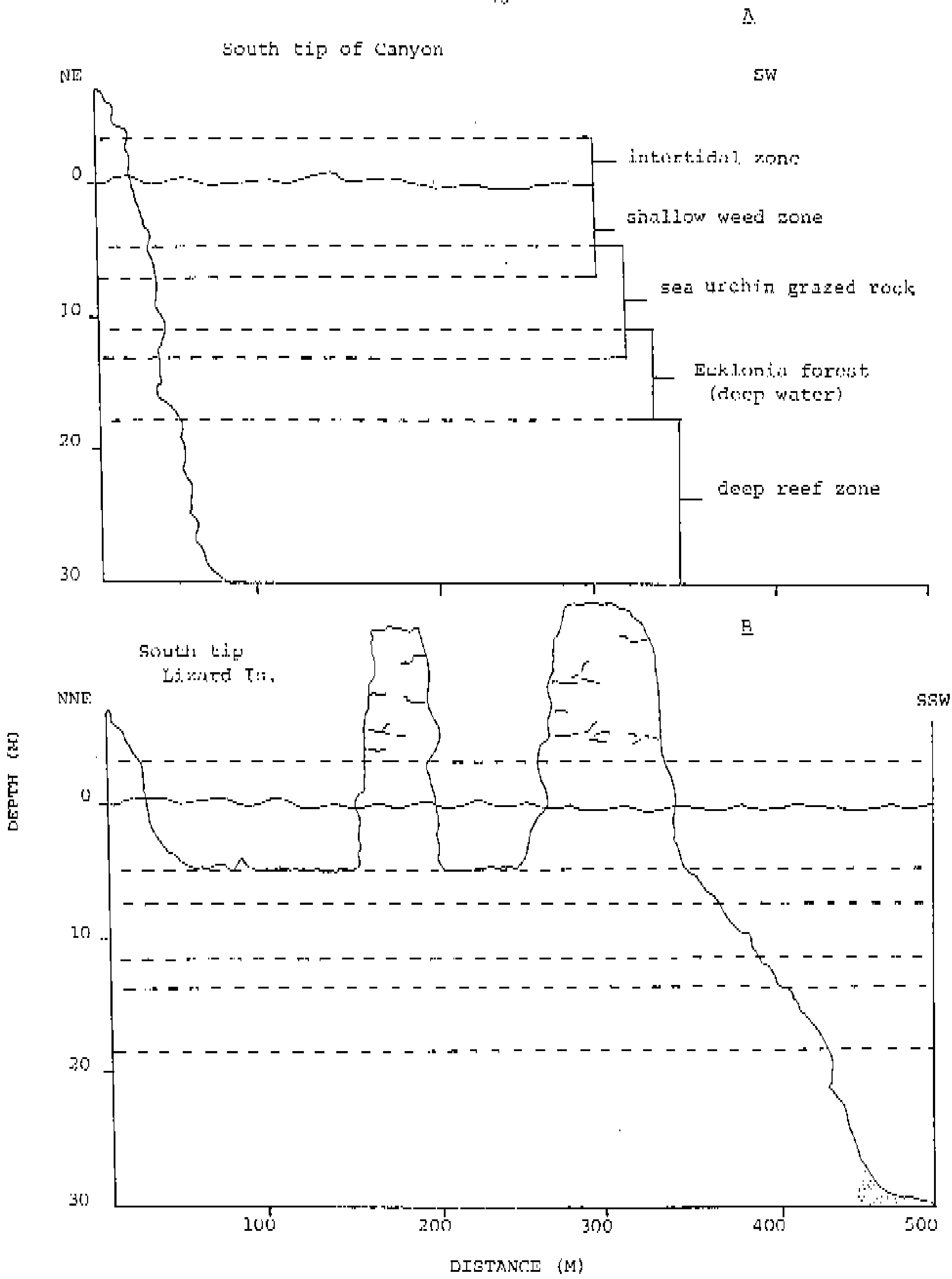
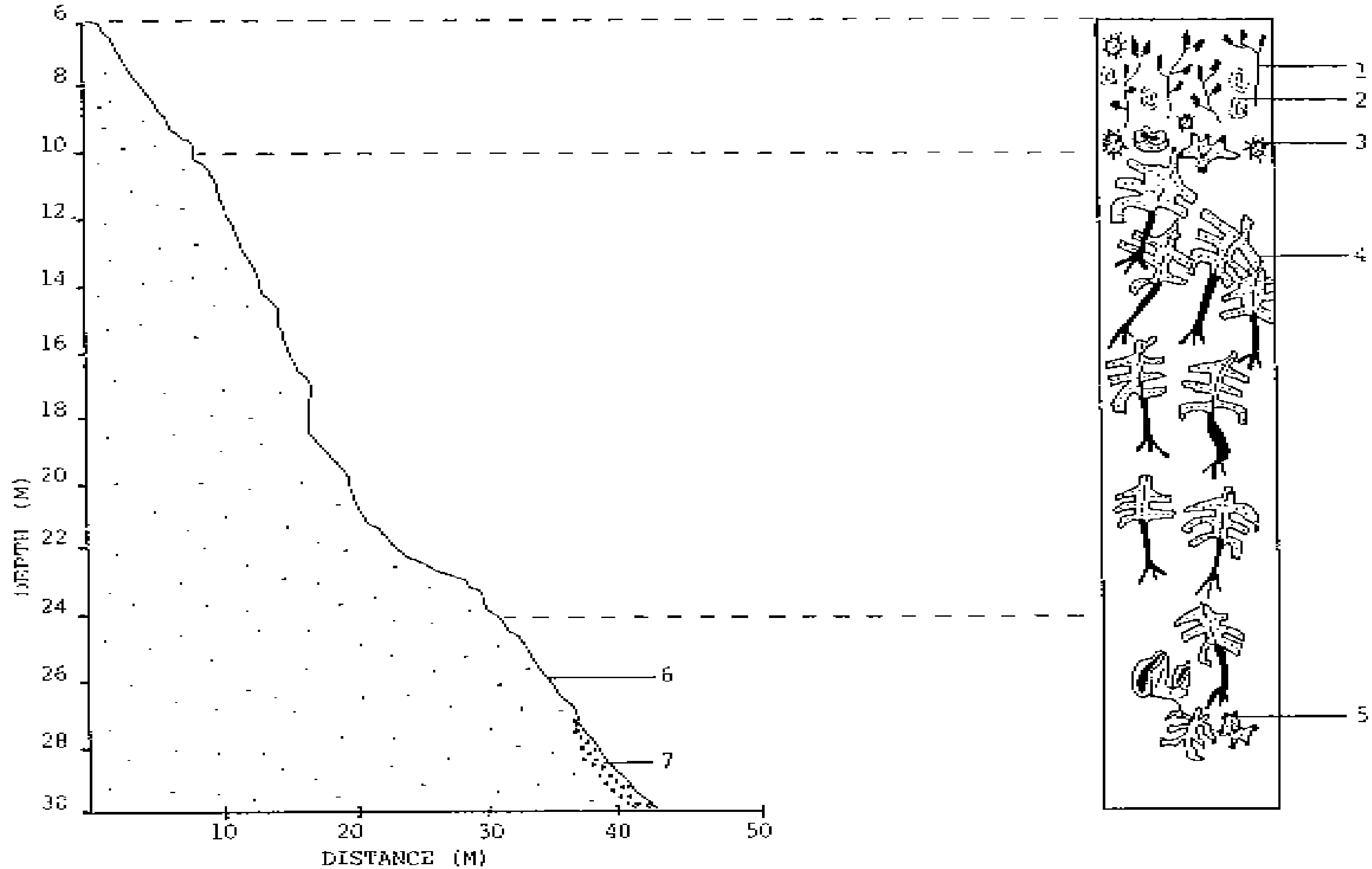


Fig. 11 A & B Idealized sections depicting cross sections from NE-SW south tip of Canyon and NNE-SSW south tip of Lizard Is.

TRANSECT 12



1. Carcophyllum maschalocarpum 2. Ulva lactuca 3. Evechinus chloroticus 4. Ecklonia radiata 5. various sponge species 6. hard rock 7. sand and gravel

Fig. 12A Dive profile of transect 12

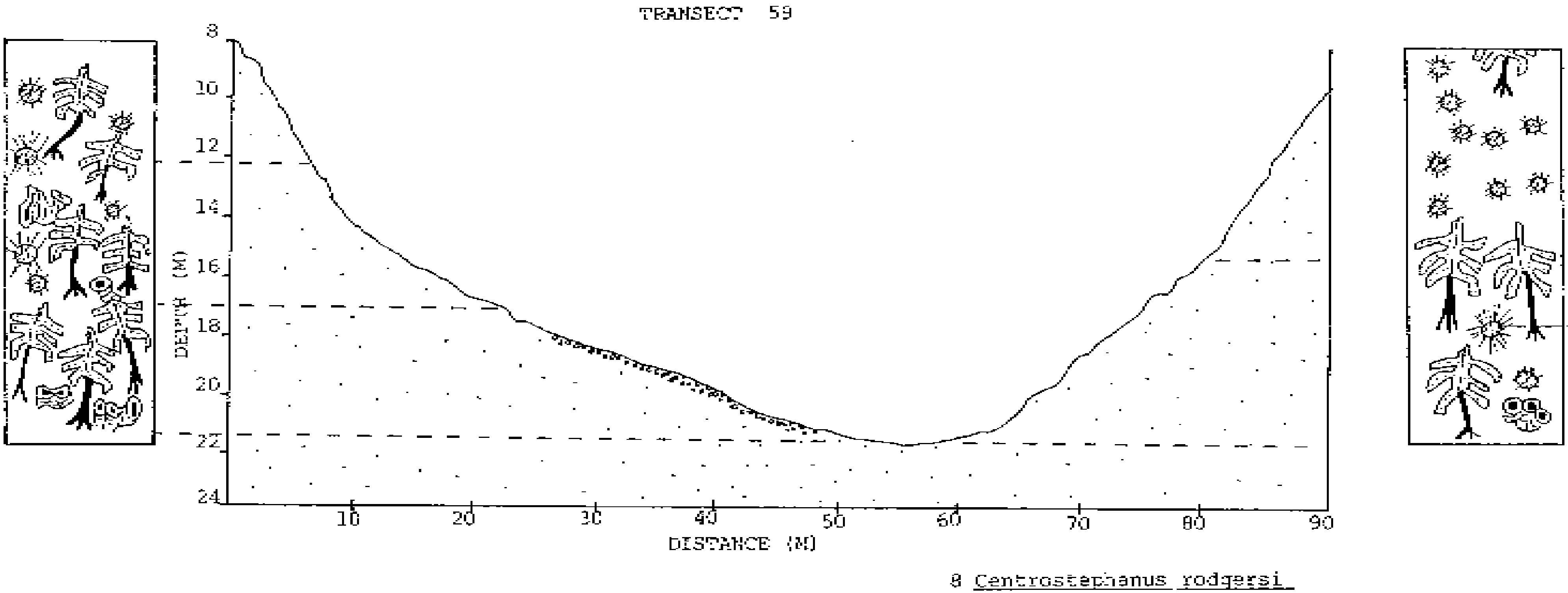


Fig. 12B Dive profile of transect 59

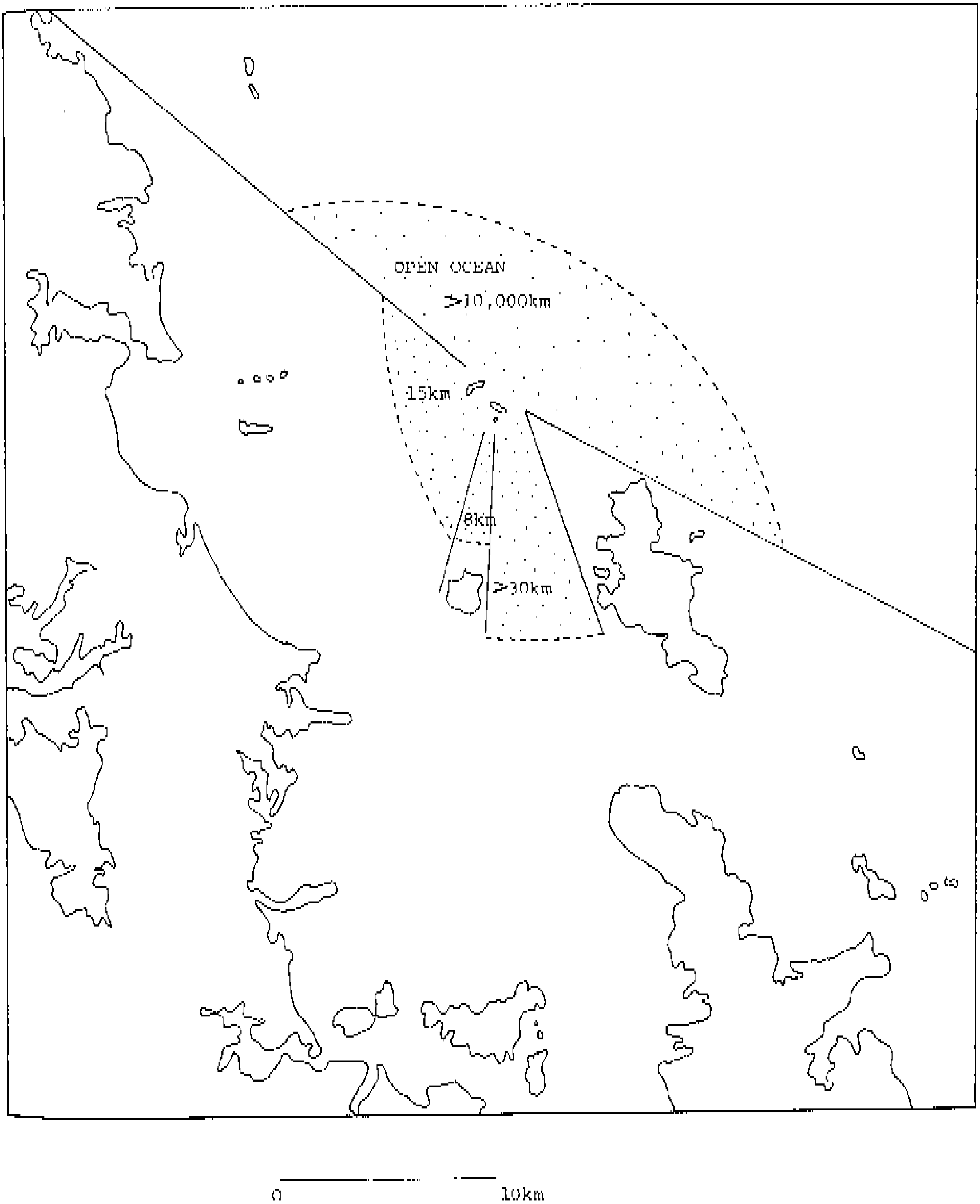


Fig.13. Indication of distance waves must travel over open ocean to reach the Mokohinau Islands.

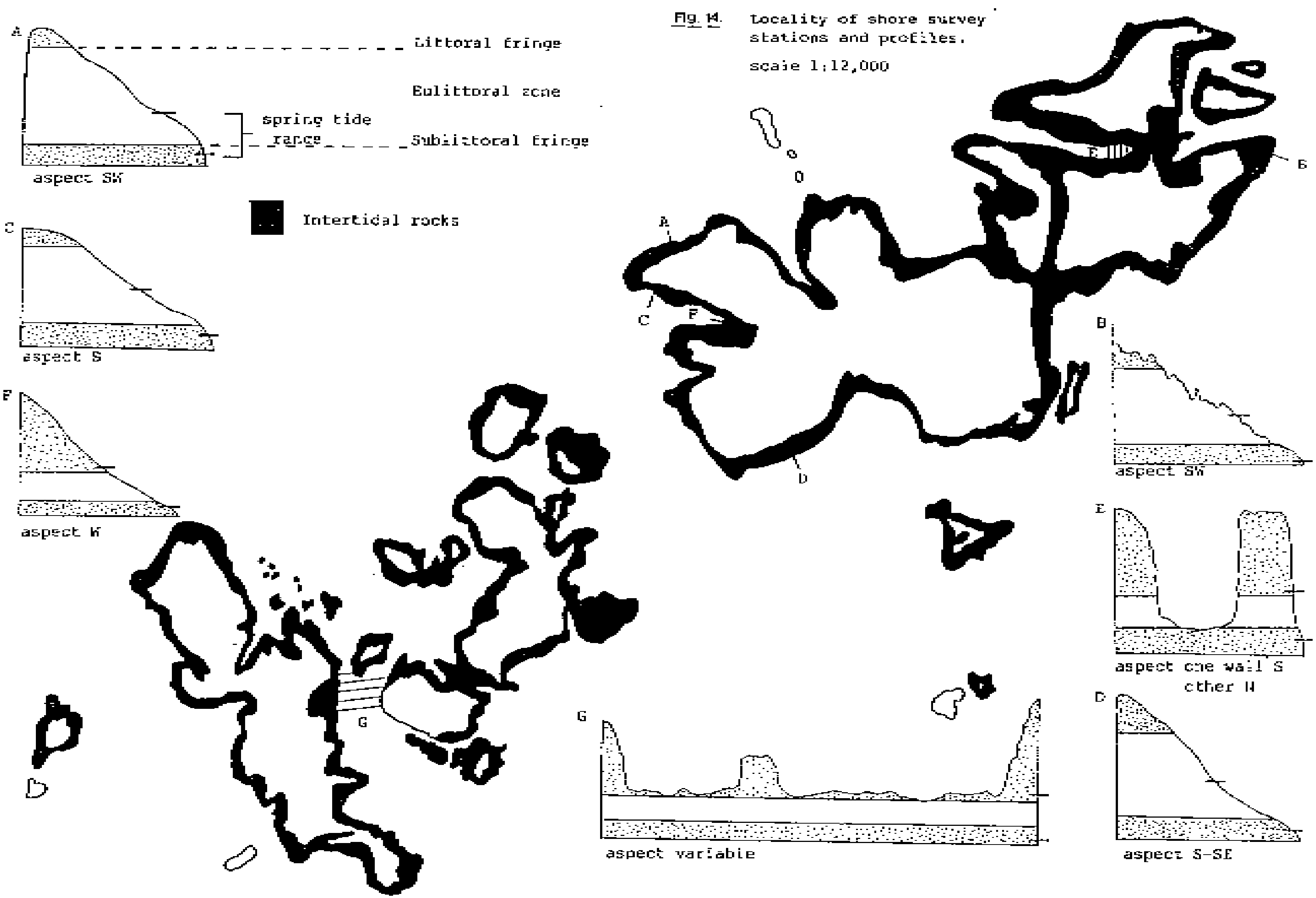
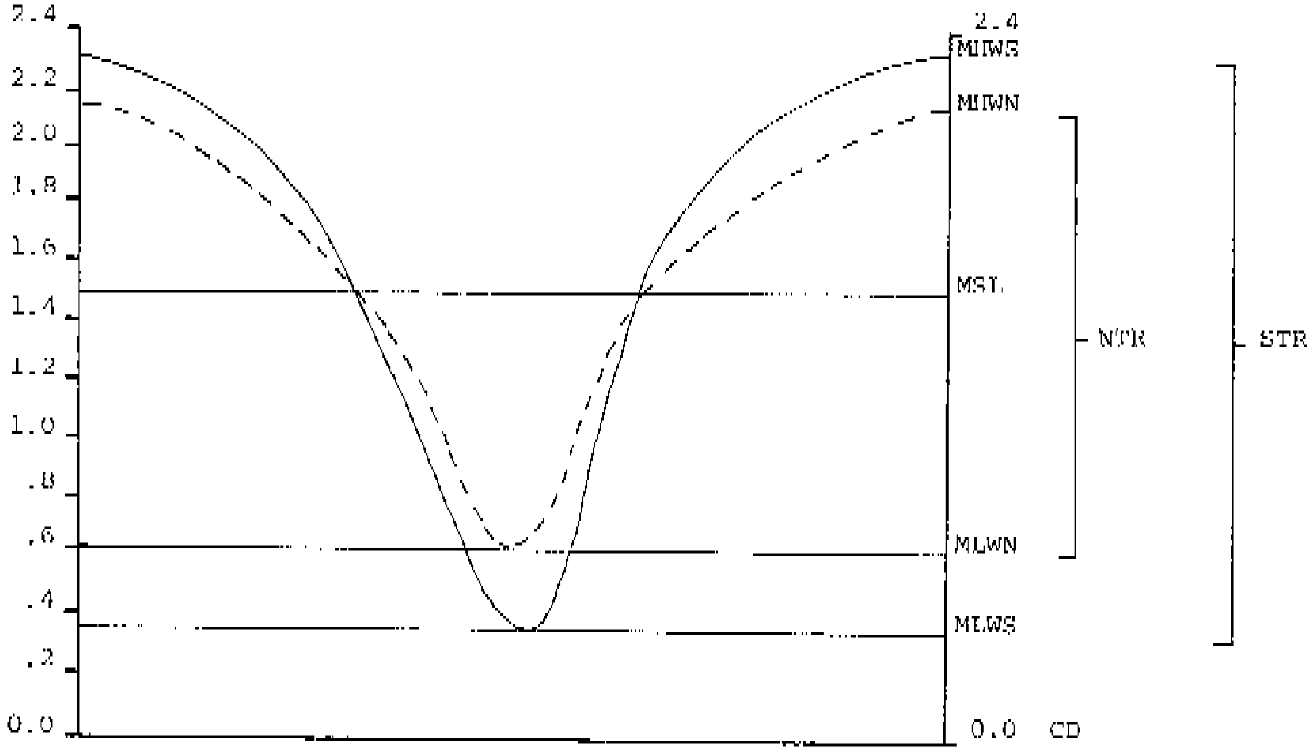


Fig. 14. Locality of shore survey stations and profiles.
scale 1:12,000

Fig. 15 Tide levels for the Mokohinau Islands.



MEAN SEA LEVEL (MSL): The average level of the sea surface over a long period, preferably 18.6 years, or the average level which would exist in the absence of tides.

MEAN HIGH WATER SPRINGS (MHWS) AND MEAN LOW WATER SPRINGS (MLWS): The average of the levels of each pair of successive high waters, and of each pair of successive low waters, during that period of about 24 hours in each semi-lunation (approximately every 14 days), when the range of the tide is greatest.

MEAN HIGH WATER NEAPS (MHWN) AND MEAN LOW WATER NEAPS (MLWN): The average of the levels of each pair of successive low waters, during that period of about 24 hours in each semi-lunation, when the range of the tide is least.

CHART DATUM (CD): A water level so low that the tide will but seldom fall below it. When meteorological conditions are such that sea level is lowered , the tide will fall below the predicated low water heights, and at a place where Chart Datum is at or near low water may be considerably less than charted.

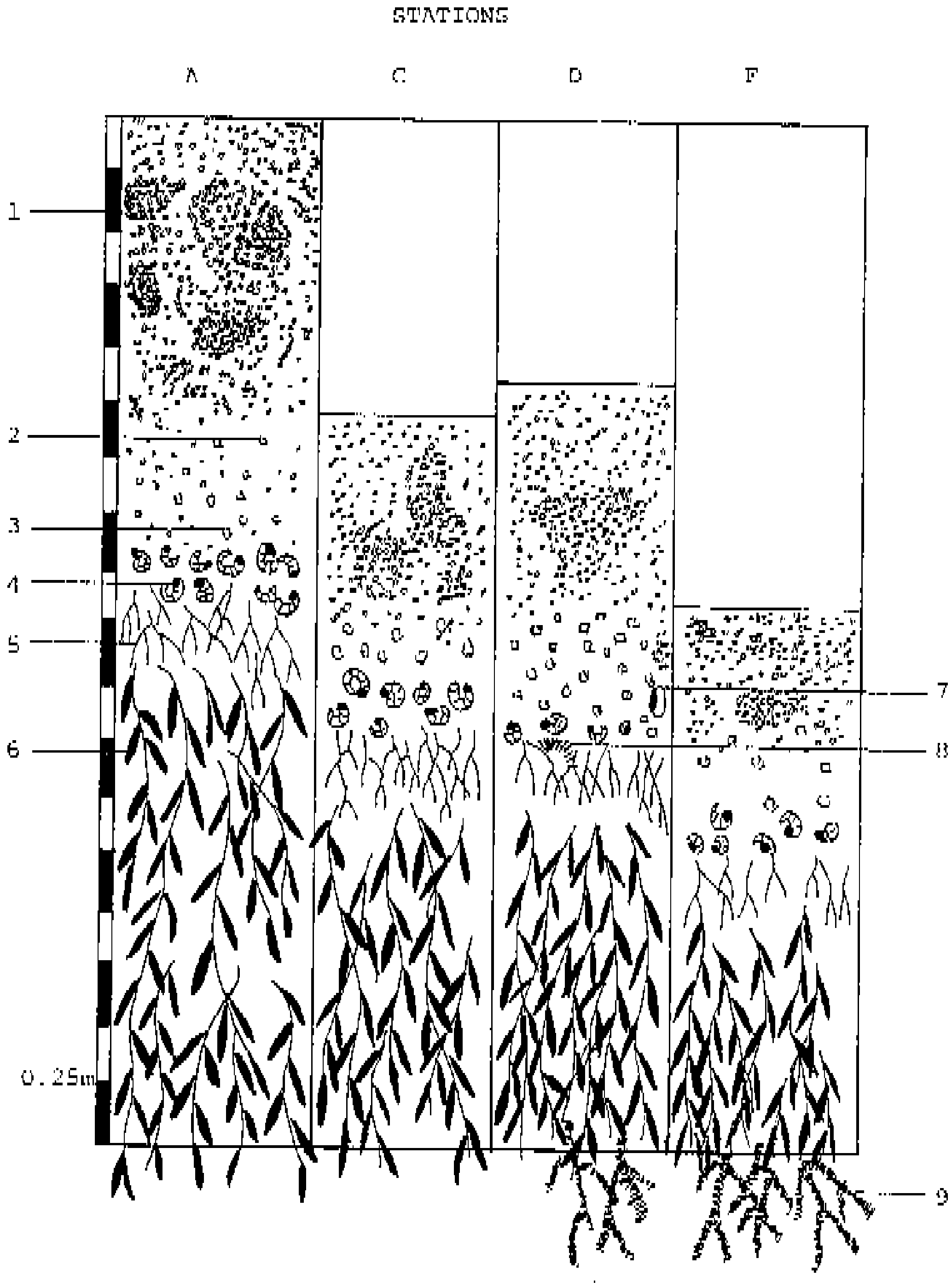
NTR: Neap tide range.

STR: Spring tide range.

Seven shore stations were surveyed on the Mokohinaus during the 1978 expedition (see Fig. 14). These stations were chosen to represent the full range of conditions found on Burgess Island, with shores ranging in exposure from 3 to 7 on the standard scale (Table 7). Most shores on the islands are either extremely or very exposed (6-7 on the scale), and most are inaccessible due to the near vertical nature of the intertidal rock faces. The relative abundance of all intertidal organisms was recorded at each of the seven sites, and the extent of their vertical distribution noted. Full data on abundances are given in Appendix 4, but a summary is presented in Table 8 for what are generally considered to be the indicator species. The range of vertical distribution of these species is shown pictorially in Fig.16.

It is notable that only a few of the indicator species show directional variation across the range of shores sampled. Chamaesipho brunnea is abundant to common at all stations, even at the most sheltered station (G). This gives an indication of just how exposed to wave action are all the shores at the Mokohinaus, as C.brunnea would not normally be found in such high numbers across a corresponding range of shores on the mainland. Chamaesipho columna is also present on all shores, but shows a marked reduction in abundance at the most exposed sites. Carpophyllum angustifolium is the most conspicuous alga at low levels on all shores, but decreases slighty in abundance at the more sheltered sites. Here, C.maschalocarpon begins to take its place, a pattern that is consistent with similar mainland comparisons.Slightly higher on the shore, Xiphophora is abundant at all sites, while Hormosira and Corallina are generally absent. The oyster, Crassostrea , is virtually absent from exposed offshore islands, as are the snails Melagraphia and Turbo . These species are generally confined to the sheltered and the wave exposure spectrum on mainland shores, so their rarity

Fig.16. Zoning patterns of shore survey stations at the Mokohinau Islands.



1. Chamaesipho brunnea
2. Elminius plicatus
3. Chamaesipho columna
4. Novastoa lamellosa
5. Xiphophora chondrophylla
6. Carpophyllum angustifolium
7. Crassostrea glomerata
8. Corallina officinalis
9. Carpophyllum maschalocarpum

TABLE 7 : Characteristics of shore survey stations (A-G)

Station	Situation	Slope	Surface Topography	Substratum	Scale
A	SW exposed	>45°	even	bedrock	7
B	SW exposed	>45°	uneven	bedrock	7
C	S submax. exposure	>45°	even	bedrock	7-6
D	SSE sheltered	>45°	even	bedrock	5
	N&S end of canyon	>45°	even	bedrock	5
F	W sheltered	30°	uneven	mixed sand and boulders	4-3
G	variable most sheltered	flat	uneven	most diverse, sand/boulders	3

INDICATOR SPECIES:	STATIONS:			
	A Extremely Exposed	C Very Exposed	D Exposed	E Sheltered
Novastoa lamellosa	Abundant	Abundant	Common	Frequent
Chamaesipho brunnea	Abundant	Abundant	Abundant	Common
Carpophyllum angustifolium	Abundant	Abundant	Abundant	Common
Xiphophora chondrophylla	Abundant	Abundant	Abundant	Common
Epopella plicata	Occasional	Occasional	Rare	Rare
Littorina unifasciata	Common	Abundant	Common	Frequent
C. columna	⊙	Abundant	Common	Common
Nerita atramentosa	Occasional	Occasional	Occasional	Common (circled)
C. maschalocarpum			Common	Common
Corallina officinalis			Rare	Occasional
Hormosira banksii				Occasional
Crassostrea glomerata			Rare	
Melagraphia aethiops				Rare
Sypharochiton pelliserpentis				Rare
Turbo smaragda				

Abundant	⬤ (largest)	Rare	•
Common	⬤	Absent	
Frequent	●		
Occasional	● (small)		

TABLE 8 : Relative abundances of indicators species occurring at 4 representative stations at the Mokohinaus.

on offshore islands is not unexpected. Very large isolated individuals of the two snail species can sometimes be found in deep, sheltered pools.

The pattern of distribution and abundance of three indicator species differ from those expected under the more general scheme of Ballantine et al (1973). The first of these is Novastoa lamellosa. This tube-dwelling vermetid gastropod is common on several offshore islands, where it usually forms a distinct zone above the level of the fucoid algae, but it has not been recorded from any mainland location. The fact that it broods its young, may partially account for its severely restricted distribution, but the full reason for its total absence from the mainland is not yet known. Second, the common snakeskin chiton, Sypharochiton pelliserpentis is virtually absent from all shores on the Mokohinaus, although many of these sites appear equivalent to shores on the mainland on which Sypharochiton is common. Sypharochiton is equally successful at all parts of the wave exposure scale on the mainland, and its absence from exposed offshore islands can probably best be explained in terms of lack of recruitment to isolated shores. Finally, the snail, Nerita atramentosa is of interest. Nerita is not usually found, except as occasional individuals in deep crevices, on exposed shores on the mainland. In most places at the Mokohinaus, and to an even greater extent at the Poor Knights, N. atramentosa is surprisingly common, of a large size, and is often second only to Littorina in abundance. This is probably not a direct response to increased wave action, and there is, as yet, no evidence as to the cause. The unusual patterns exhibited by these three organisms, together with some related anomalies, are discussed in more detail by Creese and Ballantine (1984).

MARINE ORGANISIMS

Fish

The exposure of the Mokohinaus to the oceanic sub-tropical East Auckland current (Fig.4) has led to the establishment of a number of sub-tropical marine fish species. Most of the knowledge gained about the fish fauna of the Mokohinaus has been gathered from accumulated observations made by various workers, from dive trip records and casual observations. From these sources a species list of the fish fauna has been compiled (appendix 5). This is by no means an exhaustive list, but the number of species listed reflects the diversity of fish life associated with the Islands.

Several sub-tropical species of fish abundant at the Mokohinaus are either absent or rare from coastal localities. Some of the more noteworthy of these are the grey, mottled, speckled and mosaic morays, occasionally found on the Northland coast, are common around the offshore islands. The same is true for the many sub-tropical species of Wrasse (parrotfish) which, although occurring at many localities in Northland, appear to be more abundant around offshore islands.

A quantitative survey of the larger reef fish was carried out during the RNZAF expedition under the direction of Dr. A. Ayling. This survey allows a comparison between different areas at the Mokohinau Islands (Fig.17), and between the Mokohinaus and an adjacent mainland coastal location (Table 10). Fishes were surveyed by visual counting within specific habitats (ie. shallow broken rock, sediment flats, Ecklonia forest) and an estimate made of the number of fish per $250m^2$.

Information gathered so far on the fish fauna of offshore islands, suggests that the Mokohinau and Poor Knights Islands show a similar representation of sub-tropical fish species (Grace,pers.comm.). The relative density and distribution of these species may, however, be quite different.

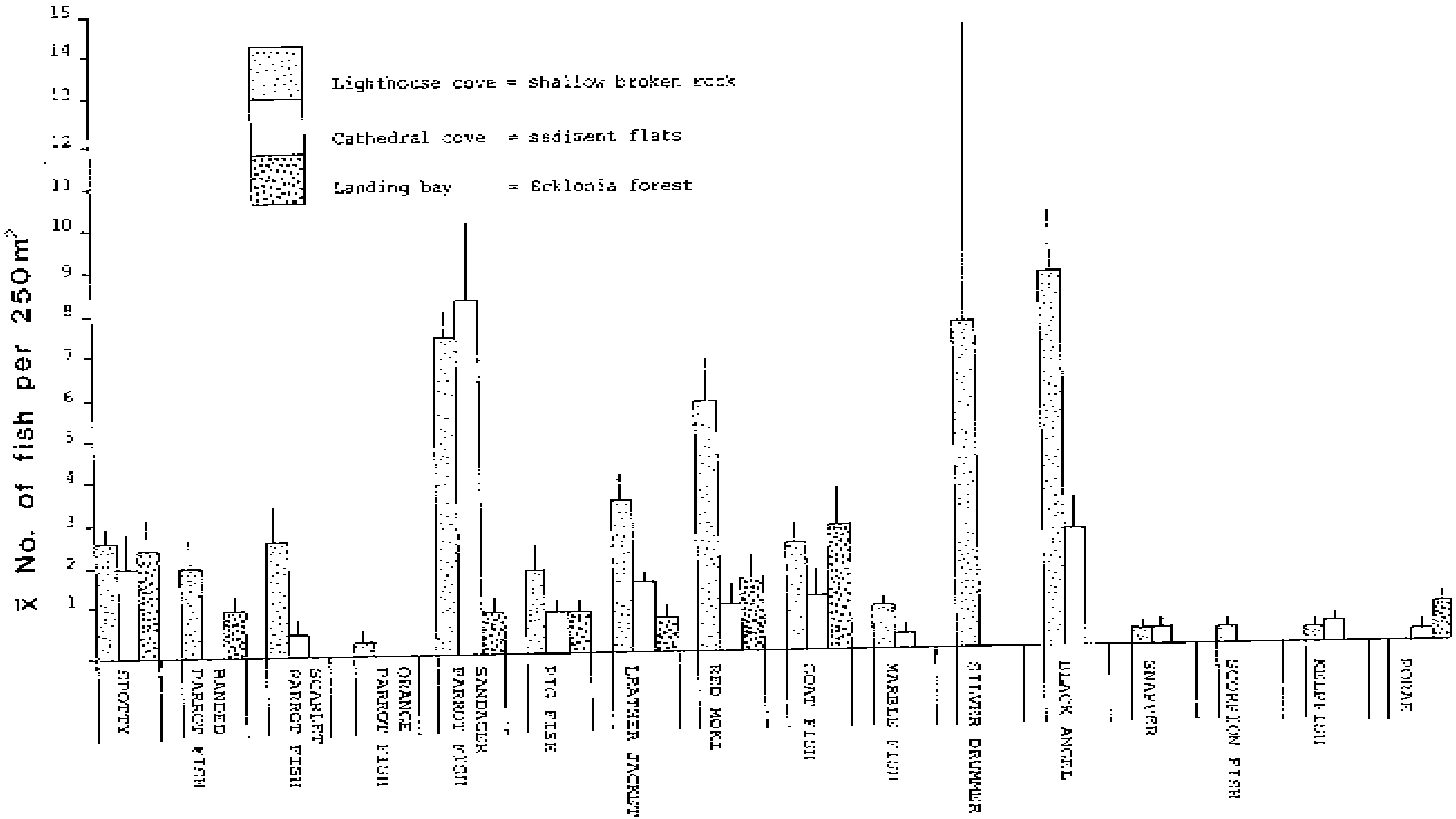


Fig. 7 Comparison of mean number of fish per 250m² at different areas of the Mokohinau Islands.

Table 10. Fish abundance : recorded as average number of individuals per $500m^2$ in three major habitats at the Mokohinaus and Leigh.

	ECKLONIA FOREST		SEDIMENT FLATS		SHALLOW BROKEN ROCK	
	Leigh	Mok.	Leigh	Mok.	Leigh	Mok.
Spotties	11.5	4.8	1.9	4.0	28.2	5.2
Banded Parrot fish	0.7	2.0	1.0	1.0	3.8	4.0
Scarlet P.fish	0.2	1.0	1.0	0.8	1.0	5.2
Orange P. fish	1.0	1.0	1.0	1.0	0.04	0.4
Green P. fish	1.0	1.0	1.0	1.0	0.1	1.0
Sandager P. fish	1.0	1.6	0.6	17.6	0.1	14.8
Pig fish	1.0	1.6	1.0	1.6	1.0	3.6
Leather jacket	5.7	1.2	1.0	2.8	2.8	6.8
Red Moki	3.8	3.2	0.4	2.0	8.3	11.6
Goat fish	15.8	5.6	23.9	2.4	5.2	4.8
Marble fish	1.0	1.0	1.0	0.4	1.4	1.6
Silver drummer	1.0	1.0	1.0	1.0	1.0	15.2
Snapper	5.5	1.0	58.7	0.4	2.6	0.4
Porae	0.3	1.6	0.4	0.2	1.0	1.0
Black angel	1.0	1.0	1.0	5.2	1.0	12.6

Further quantitative surveys will allow a more detailed comparison to be made of other offshore islands and the Northland east coast. Such a quantitative survey is currently being planned by the University of Auckland's Marine Laboratory.

. Sedentary and Sessile Benthic Animals

Although the RNZAF survey has provided a broad assessment of the marine habitats of the Burgess and Knight Groups, little is known about the specific benthic fauna of the Mokohinau Islands. The only published benthic study to date is a survey by Riddle (1980). Information gathered from this study provides descriptions of the benthic communities on rocky substrata around the Mokohinau Islands. The list of species provided by this account (appendix 6) is far from complete, but the information does suggest that the islands have a large variety of benthic species similar to other offshore islands such as the Poor Knights. The Mokohinaus have a high diversity of benthic forms, many with tropical affinities. For example, four largely tropical species of sea urchin have been sighted in addition to the more common Evechinus chloroticus. These are Diadema palmeri (which is uncommon in New Zealand and is known from only a few localities from Cape Brett to White Island), Heliocidaris tuberculata, Tripneustes gratilla and Centrostephanus rodgersi.

Algae

Although there have been no specific studies on the algae of the Mokohinaus an indication of their great diversity is provided appendices 4a,4b and 6.

REFERENCES

Ayling,A.M. (1978) Cape Rodney to Okakari Point Marine Reserve Survey. Report of the University of Auckland Marine Laboratory.

Ballantine,W.J., Grace,R.V., Doak,W.T. (1973) Mimiwhangata Marine Report Report on behalf of New Zealand Breweries Limited.

Broun, T. (1886) Manual of New Zealand Coleoptera. Parts 3-4.

Broun, T. (1893) Manual of New Zealand Coleoptera. Parts 5-7.

Browne,G.H. (1980) Geomorphic features of Fanal Island. Tane 26: 21-24.

Choat,J.H.,Schiel,D.R. (1982) Patterns of distribution and abundance of large brown algae and invertibrate herbivores in subtidal regions of northern New Zealand. J.Exp.Mar.Biol.Ecol. 60:129-162.

Creese,R.G., Ballantine,W.J. (1984 in press) Rocky shores of exposed islands in north-eastern New Zealand. In :The Offshore Islands of Northern New Zealand (ed A.E.Wright), N.Z. Dept of Lands and Survey, Wellington.

Crook,I.G. (1970) Tuatara. Wildlife - a review 1970 :16-19.

Esler,A.E. (1978) Bontanical features of the Mokohinau Islands. Tane 24:187-197.

Fleming,C.A. (1950) The geology of the Mokohinau Islands, North Auckland. Part I General Geology. Transactions of the Royal Society of New Zealand .78:255-268.

Gillam,M.E. (1969) Plant communities of the Mokohinau Islands, northern New Zealand. Transactions of the Royal Society of New Zealand 88:79-98.

Grace,R.V. (1983) Zonation of sublittoral rocky bottom marine life and its changes from the outer to inner Hauraki Gulf, north-eastern New Zealand. Tane 29:97-108.

Gurr,L.and Kinsky,F.C. (1965) The distribution of breeding colonies and status of the red billed gull in New Zealand and its outlying Islands. Notornis 12 (4):223-240.

Housley,G.D. (1980) Observations on the fish fauna of the Mokohinau Group. Tane 26:83-89.

McCullum,J. (1980a) Reptiles of the northern Mokohinau Group. Tane 26:53-59.

McCullum,J. (1980b) Birds of the northern Mokohinau Group. Tane 26:69-78.

O'Brien,J.D. (1968) Mokohinau (or Pokohinou) and Fanal Islands. Unpublished letter to M.S.C. Clarke Barrister and Solicitor. Commissioner of Crown Lands Auckland.

Riddle,D.J. (1980) Benthic communities of hard substrates of the Mokohinau Islands. Tane 26:91-98.

Sandager,F.S. (1888) List of fishes found round the Mokohinau Islands;their spawning time; and observations regarding some of the species. Transactions of the New Zealand institute 20:127-133.

Sandager,F.S. (1890) Observations on the Mokohinau Islands and the birds which visit them. Transactions of the New Zealand Institute.

Spring-Rice,W. (1980) Fanal Island (Motukino) archaeological survey and historical account. Tane 26:99-105.

Whitaker,A.H. (1974) Report on a visit to the Mokohinau Islands, Hauraki Gulf 20 November to 4 December 1973. Unpublished report to the Commisioner of Crown Lands, Auckland.

Wright,A.E. (1980) Auckland University Field Club Scientific Trip to the Mokohinau Islands, May 1979. Tane 26:1-6.

APPENDIX 1.

European History

The following is a summary of European History prepared by J. B. O'Brien Commissioner of Crown Lands (1968).

"It is on official record that before European title, the islands were never occupied or used for any length of time by their Maori owners except for spasmodic visits by Maoris from the mainland and Great Barrier Island for fishing, bird-nesting and bird-snaring, and cultivation purposes.

On 14 January 1845 a Mr Joel Samual Polack applied for waiver of the Crown's rights of pre-emption over the islands. This was granted him on 17 January 1845 with the issue of Pre-emptive Certificate No. 152 by the Governor. Meantime Polack had obtained the signatures of 8 Maoris on the 16 January 1845 who were styled in the Deed of Sale as "We Chiefs of the tribe Ngatiwai". In the deed they consented to and sold "the entire Group called Pokoinu (Pokohinu) consisting of one large Island, three smaller Islands and some rocks.

On 1 May 1846 Polack applied to Governor Grey for the issue of a Crown Grant and enclosed a survey of the islands made by Capt. Duperrey in 1827 and added that he had been unable to do his survey because he could not get an anchorage for the vessel. Later, on 11 June 1845 he reiterated his request and sent in an attested copy of the Deed of Sale when it was noted a considerable portion of the payment had been made in arms.

The Governor referred the matter to the Secretary of State and thence to Land Claims Commissioner Matson who reported on 22 May 1848 that Polack had not sent in the required plan of survey. The Governor then formally disallowed the claim in the Government Gazette of 12 June 1848.

Polack still held the thought that he had claim to the islands. However, in a formal minute dated 19 May 1849 the Governor detailed the reasons why he refused Crown Grants to Polack for the Islets, but was willing to repay him what amount he had given the Maoris.

In October and November 1849 certain natives alleging to have claims to the island gave notice of their objection to Polack's purchases on the basis that the Maoris who signed the Deed had no right. A notice was thereupon inserted in the Maori Messenger calling on all parties to prefer their claims before the Resident Magistrate at Kororareka on 12 December 1849.

The matter then lapsed until a review dated 22/3/1864 by Land Claims Commissioner Bell who would not recommend the issue of the Grant until all the objecting Maoris concerned were assembled to put their claims in the presence of each other. Also during this interval Polack's claim appears to have been assigned to Robert S. Thomson and a survey of the islands was made either by him or Polack's agent Clement Partridge who later testified in Court before Land Claims Commissioner Alfred Domett that he "put in a statement of the expenses of the survey of the Poor Knights and the other 2 groups in Mr Polack's claim" and swore it was over $400. The actual amount was $444.08.

At the Court on 20 July 1864 before Commissioner Domett the objectors appeared with Mr Charles O. Davis who was the agent interpreter and witness to the original Deed. Evidently the extinction of Maori Title was proved to the satisfaction of Commissioner Domett who ordered a grant to R.S. Thomson of the Islands on 21 July 1864. This Crown Grant (BIC.731) was issued on 30 August 1864. R.S. Thomson used the islands as security in a mortgage to W.S. Grahame but defaulted payments and Grahame excercised his right to sell the islands in an auction on 6 September 1882. By virtue of a Conveyance dated

28 September 1882 and in consideration of the sum of $1,520, bid at the auction, the Crown acquired title to these islands and the Poor Knights and Marotiri Islands.

By Gazette 1883 pp.375 and 1325 the islands were reserved for Lighthouse purposes. Later Fanal Island was declared a bird sanctuary by Gazette 1923 p.1413.

In March 1928 the Maori Land Court heard an application dealing with the claims of certain Maoris to Fanal Island which is in the Mokohinau Group. The Court could not continue its investigation in the face of the Crown Grant but the Maoris took the matter further and petitioned Parliament (No. 175 of 1924). Little came from this except that Judge Acheson heard the claims at Whangarei on 28 september 1928 and recommended :

(i) The Crown show some consideration to the Maoris during the consolidation proceedings pending, and

(ii) The Maoris be allowed to continue to use Motukino for fishing, bird nesting and bird snaring purposes.

By Gazette 1941 p. 2063 the islands were declared prohibited places under the general name of Moko Hinau (Defence emergency Regs. 1939). Again by Gazette 1958 p. 806 declares all of the islands with the exception of Burgess Island to be a Wildlife Santuary."

. The last keeper Mr Ray Walters progressively pulled down the keepers houses prior to automation of the lighthouse on 8 march 1980. The only accomodation now remaining is an 'A' frame building near the light-house which is used to house visiting workers.

Present Status

The Islands are at present classified as Nature Reserves Class B* and are administered by the Hauraki Gulf Maritime Park Board. The central portion of Burgess Island remains reserved for lighthouse purposes and is administered by the Ministry of Works and Development although the Ministry of Transport carry out the day to day maintenance.

* Class B (sanctuaries - restricted areas) - access limited to scientific purposes.

FLORA

In the species list the significance of species is indicated in a general way by the symbols

p = plentiful
m = many
o = occasional.

Naturalised species are marked with an asterisk.
The islands are distinguished by the symbols

B = Burgess I.
1,2,3 = Pudding Is. ; Sloping Rock; Dragon Is.
T = Trig I.
L = Lizard I.
F = Fanal I.

Species recorded by Gillham are indicated in column headed G.

\+ = as recorded by Gillham,
++ = probably synonymous with plants in the 1978 list but identity uncertain,
† = recorded by Gillham under a different name.

FAMILY	SPECIES/COMMON NAME	B	1	2	3	T	L	F	G
DICOTYLEDONS									
Aizoaceae	*Disphyma australe* ice plant	p	m	o	m	m	p	-	+
	Tetragonia trigyna NZ spinach	o	-	-	-	-	-	-	+
Amaranthaceae	*Amaranthus lividus**	o	-	-	-	-	-	-	+
Apocynaceae	*Parsonsia heterophylla*	o	-	-	-	-	-	m	+
Araliaceae	*Pseudopanax lessonii* houpara	-	-	-	-	-	-	p	-
Caryophyllaceae	*Polycarpon tetraphyllum** allseed	o	-	-	-	o	-	-	+
	Scleranthus biflorus	o	-	-	-	-	-	-	-
	*Silene anglica**	-	-	-	-	-	-	-	+
	*S. gallica** catchfly	-	-	-	-	-	-	-	+
	Spergularia marginata	o	-	o	-	o	o	-	†
	*S. rubra**	-	-	-	-	-	-	-	+
	*Stellaria media**	-	-	-	-	-	-	-	+
Chenopodiaceae	*Atriplex hastata** orache	o	-	-	-	-	-	-	-
	*Cerastium glomeratum** mouse-ear chickweed	-	-	-	-	-	-	-	+
	Chenopodium allanii	-	-	-	-	-	-	-	+
	*C. murale**	o	-	-	-	-	-	-	+
	Rhagodia triandra	o	-	o	-	-	o	-	+
	Salicornia australis	o	o	-	o	-	p	o	+

FAMILY	SPECIES/COMMON NAME	B	1	2	3	T	L	F	G
Compositae	*Aster subulatus** sea aster	o	-	-	-	-	-	-	+
	Cassinia retorta	m	m	m	o	o	-	p	+
	*Cirsium vulgare** Scotch thistle	o	-	-	o	-	-	o	+
	*Cotula australis**	-	-	-	-	-	-	-	+
	C. coronopifolia	o	-	-	-	-	-	-	+
	*Crepis capillaris**	-	-	-	-	-	-	-	†
	*Erigeron floribundus** fleabane	o	o	-	o	o	-	o	+
	Gnaphalium audax	-	-	-	-	-	-	o	-
	G. gymnocephalum	o	o	-	o	-	-	o	-
	G. luteoalbum	o	-	-	-	o	-	o	-
	*G. spicatum**	o	-	-	o	-	-	-	†
	*Hypochoeris radicata** catsear	m	o	-	o	o	-	-	-
	*Sagina procumbens** pearlwort	o	-	-	-	-	-	-	-
	Senecio hispidulus	o	-	-	o	-	-	o	-
	S. lautus	m	o	o	o	o	m	o	+
	*Sonchus oleraceus** sow thistle	m	o	o	-	o	o	o	+
Convolvulaceae	*Calystegia sepium*	o	-	-	-	-	-	-	-
	C. soldanella sand convolvulus	o	-	-	-	-	-	-	-
	C. tuguriorum	-	-	-	-	-	-	-	++
	Dichondra repens	m	-	-	o	o	m	p	+
Corynocarpaceae	*Corynocarpus laevigatus* karaka	-	-	-	-	-	-	p	-
Crassulaceae	*Tillaea sieberiana*	-	-	-	-	-	-	-	+
Cruciferae	*Coronopus didymus** twin cress	o	-	-	-	-	-	-	+
	Lepidium oleraceum Cook's scurvy grass	-	-	o	-	-	-	-	-
	*Sisymbrium officinale** hedge mustard	o	-	-	-	-	-	-	-
Cucurbitaceae	*Sicyos angulata* bur cucumber	o	-	-	-	o	-	-	+
Epacridaceae	*Cyathodes fasciculata* mingimingi	-	-	-	-	-	-	o	-
Euphorbiaceae	*Euphorbia peplus** spurge	-	-	-	-	-	-	-	+
Fumariaceae	*Fumaria muralis** fumitory	-	-	-	-	-	-	-	+
Gentianaceae	*Centaurium erythraea** centaury	o	-	-	o	-	-	-	+
Geraniaceae	*Geranium dissectum var. glabratum?*	-	-	-	-	-	-	-	++
	G. microphyllum?	-	-	-	-	-	-	-	++
	G. solanderi	m	-	-	-	-	-	-	-
	*Pelargonium quercifolium?**	-	-	-	-	-	-	-	+
Goodeniaceae	*Selliera radicans*	o	-	-	-	-	-	-	-
Haloragaceae	*Haloragis erecta*	o	-	-	-	-	-	o	+
Labiatae	*Mentha spicata** spear mint	o	-	-	-	-	-	-	†
Linaceae	*Linum marginale**	o	-	-	-	-	-	-	+
Lobeliaceae	*Lobelia anceps*	o	o	-	o	o	-	-	-
Loganiaceae	*Geniostoma ligustrifolium* hangehange	-	-	-	-	-	-	m	-
Malvaceae	*Lavatera arborea** tree mallow	o	-	-	-	-	-	-	+
	*Modiola caroliniana**	o	-	-	-	-	-	-	+
	*Malva rotundifolia?**	-	-	-	-	-	-	-	+
Meliaceae	*Dysoxylum spectabile* kohekohe	-	-	-	-	-	-	p	-
Monimiaceae	*Hedycarya arborea* pigeonwood	-	-	-	-	-	-	o	-
Moraceae	*Ficus carica**	o	-	-	-	-	-	-	-
Myoporaceae	*Myoporum laetum* ngaio	o	o	o	o	o	p	m	+

FAMILY	SPECIES/COMMON NAME	B	1	2	3	T	L	F	G
Myrsinaceae	*Myrsine australis* mapou	-	-	-	-	-	-	p	-
Myrtaceae	*Leptospermum ericoides* kanuka	-	-	-	-	-	p	-	-
	L. scoparium manuka	-	-	-	-	-	o	-	-
	Metrosideros excelsa pohutukawa	p	p	p	p	o	-	p	+
Nyctaginaceae	*Pisonia umbellifera* parapara	-	-	-	-	-	-	o	-
Oleaceae	*Nestegis apetala*	-	-	-	-	-	-	o	-
Orobanchaceae	*Orobanche minor** broomrape	-	-	-	-	-	-	o	-
Oxalidaceae	*Oxalis articulata**	o	-	-	-	-	-	-	-
	O. corniculata	-	-	-	-	-	-	-	++
	O. c. var. *crassifolia*	m	o	-	o	-	-	-	-
	*O. c.** (red form)	o	-	-	-	-	-	-	-
	O. exilis	o	-	-	-	-	-	-	-
	*O. stricta**	-	-	-	-	-	-	-	++
Papilionaceae	*Carmichaelia aligera*	o	-	-	o	o	-	o	+
	*Lotus angustissimus**	o	-	-	-	-	-	-	-
	*L. corniculatus**	-	-	-	-	-	-	-	++
	*L. pedunculatus**	o	-	-	-	-	-	-	+
	*L. subbiflorus**	p	m	o	o	m	-	-	-
	*Trifolium dubium** suckling clover	o	-	-	-	-	-	-	-
	*T. pratense** red clover	o	-	-	-	-	-	-	+
	*T. repens** white clover	o	-	-	-	-	-	-	+
	*T. subterraneum** subterranean clover	-	-	-	-	-	-	-	+
	*Vicia sativa** vetch	o	-	-	-	-	-	-	+
	*Ulex europaeus** gorse	o	-	-	-	-	-	-	-
Phytolaccaceae	*Phytolacca octandra** inkweed	o	-	-	-	o	-	o	+
Piperaceae	*Macropiper excelsum* kawakawa	o	-	-	-	o	-	m	+
	Peperomia urvilleana	o	-	-	o	-	-	o	+
Plantaginaceae	*Plantago coronopus** buckshorn plantain	o	-	-	-	-	-	-	-
	*P. lanceolata** narrow-leaved plantain	p	-	-	-	-	-	-	+
	*P. major** broad-leaved plantain	o	-	-	-	-	-	-	+
Polygonaceae	*Muehlenbeckia complexa*	p	o	-	o	o	-	m	+
	*Rumex acetosella** sheep's sorrel	o	-	-	-	-	-	-	+
	*R. conglomeratus** clustered dock	o	-	-	-	-	-	-	-
	*R. crispus** curled dock	o	-	-	-	-	-	-	+
	*R. obtusifolius** broad-leaved dock	-	-	-	-	-	-	-	+
	*R. pulcher** fiddle dock	o	-	-	-	-	-	-	-
Portulacaceae	*Portulaca oleracea**	o	-	-	-	o	-	o	+
Primulaceae	*Anagallis arvensis** scarlet pimpernel	o	-	-	o	-	-	-	+
	Samolus repens	o	m	o	-	-	m	-	+
Ranunculaceae	*Clematis paniculata*	-	-	-	-	-	-	o	-
Rhamnaceae	*Pomaderris phylicifolia*	-	-	-	-	-	-	o	-
Rosaceae	*Acaena anserinifolia* bidi-bidi	-	-	-	-	-	-	-	+
	A. novae-zelandiae bidi-bidi	o	-	-	-	-	-	-	-
Rubiaceae	*Coprosma lucida*	-	-	-	-	-	-	o	-
	C. macrocarpa	o	-	-	o	o	-	p	-
	C. repens taupata	o	m	o	o	o	o	m	+
	C. rhamnoides	-	-	-	-	-	-	o	-

FAMILY	SPECIES/COMMON NAME	B	1	2	3	T	L	F	G
	C. robusta	-	-	-	-	-	-	-	++
	*Galium aparine** cleavers	-	-	-	-	-	-	-	+
Rutaceae	*Melicope ternata* wharangi	-	-	-	-	-	-	o	-
Sapotaceae	*Planchonella novo-zelandica* tawapou	-	-	-	-	-	-	o	-
Scrophulariaceae	*Hebe* sp.	-	-	-	o	-	-	o	+
	*Veronica persica**	-	-	-	-	-	-	-	+
Solanaceae	*Solanum linnaeanum**	-	-	-	-	-	-	-	++
	*S. nigrum** black nightshade	o	-	-	-	-	-	-	+
	S. nodiflorum	o	-	o	o	o	-	o	-
Thymelaeaceae	*Pimelea prostrata*	o	o	o	o	o	o	o	+
Tiliaceae	*Entelea arborescens* whau	-	-	-	-	-	-	o	-
Umbelliferae	*Apium australe* NZ celery	o	-	-	o	-	-	o	+
	Lilaeopsis orbicularis	o	-	-	-	-	-	-	-
Urticaceae	*Parietaria debilis*	-	-	-	-	-	-	-	+
Verbenaceae	*Vitex lucens* puriri	-	-	-	-	-	-	o	-
Violaceae	*Hymenanthera novae-zelandiae*	o	-	-	-	o	m	m	-
	Melicytus ramiflorus mahoe	-	-	-	-	-	-	p	-
	*Viola odorata**	-	-	-	-	-	-	-	+
MONOCOTYLEDONS									
Agavaceae	*Cordyline australis* cabbage tree	-	-	-	-	-	-	o	-
	Phormium tenax NZ flax	o	p	p	p	p	-	p	+
Araceae	*Zantedeschia aethiopica** arum lily	o	-	-	-	-	-	-	+
Cyperaceae	*Carex flagellifera*	o	-	-	-	-	-	-	-
	C. spinirostris	-	-	-	-	o	-	o	-
	C. testacea	-	-	-	-	o	-	o	-
	C. virgata	o	-	-	-	-	-	-	-
	Cyperus ustulatus	m	o	-	o	o	p	-	+
	Eleocharis acuta	o	-	-	-	-	-	-	-
	Scirpus cernuus	o	o	-	-	-	o	-	+
	S. nodosus	p	p	m	m	m	p	m	+
Gramineae	*Agropogon littoralis**	o	-	-	-	-	-	-	-
	*Agrostis tenuis** browntop	o	-	-	-	-	-	-	+
	*Aira caryophyllea** hair grass	o	o	o	o	o	-	o	+
	*Anthoxanthum odoratum** sweet vernal	o	-	-	o	-	-	-	-
	*Avena barbata** wild oat	o	o	-	o	o	-	o	-
	*Briza maxima**	m	o	-	-	-	-	-	+
	*B. minor**	o	o	-	o	-	-	-	-
	*Bromus diandrus**	-	-	-	-	o	-	-	-
	*B. mollis**	o	o	-	-	o	-	-	-
	*B. unioloides** prairie grass	p	-	-	-	-	-	o	+
	Chionochloa bromoides	o	o	o	o	m	-	o	-
	Cortaderia splendens toetoe	o	o	o	o	o	-	p	+
	*Dactylis glomerata** cocksfoot	p	-	-	o	o	-	o	+
	Deyeuxia billardieri wind bent	o	o	o	o	o	o	o	+
	Dichelachne crinita plume grass	o	o	-	o	o	-	o	-
	*Eragrostis brownii** bay grass	o	-	-	-	-	-	-	+

FAMILY	SPECIES/COMMON NAME	B	1	2	3	T	L	F	G
	*Festuca arundinacea** tall fescue	-	-	-	o	-	-	-	-
	*F. rubra**	-	-	-	-	-	-	-	+
	*Holcus lanatus** Yorkshire fog	p	-	-	-	o	-	-	+
	Lachnagrostis filiformis	o	o	o	o	o	o	o	†
	*Lolium perenne** perennial ryegrass	m	-	-	-	-	-	-	-
	Microlaena polynoda	-	-	-	-	-	-	o	-
	Notodanthonia biannularis	p	m	o	o	-	-	o	†
	N. caespitosa	o	-	-	-	o	-	-	-
	N. racemosa	p	o	-	o	-	-	-	+
	Oplismenus imbecillis	-	-	-	-	o	-	o	†
	*Paspalum dilatatum** paspalum	p	-	-	-	-	-	-	†
	P. scrobiculatum	-	-	-	-	-	-	-	+
	Poa anceps	o	-	-	o	o	-	m	+
	P. a. var. (fine-leaved)	p	-	-	-	-	-	-	-
	*P. annua**	-	-	-	-	-	-	-	+
	*P. pratensis**	o	-	-	-	-	-	-	-
	*Stenotaphrum secundatum**	g	-	-	-	-	-	-	-
	*Vulpia bromoides**	p	-	-	o	o	-	-	-
	*V. myuros**	-	-	-	o	-	-	-	+
Iridaceae	*Crocosmia crocosmiiflora** montbretia	o	-	-	-	-	-	-	-
Liliaceae	*Dianella nigra*	-	-	-	o	-	-	o	-
	Arthropodium cirratum renga lily	o	-	-	o	-	-	o	+
	Astelia banksii	o	o	-	-	-	-	o	-
Orchidaceae	*Acianthus fornicatus* var. *sinclairii*	-	-	-	-	-	-	-	+
	Thelymitra longifolia	-	-	-	-	-	-	-	+
Palmae	*Rhopalostylis sapida* nikau	-	-	-	-	-	-	o	-
Restionaceae	*Leptocarpus similis*	o	o	-	-	-	o	-	†
Smilacaceae	*Ripogonum scandens* supplejack	-	-	-	-	-	-	-	+
GYMNOSPERM	*Pinus pinaster** maritime pine	l	-	-	-	-	-	-	+
FERNS	*Adiantum aethiopicum*	p	-	-	-	-	-	-	+
	A. cunninghamii	-	-	-	-	-	-	-	†
	A. hispidulum	o	-	-	-	-	-	-	+
	Blechnum norfolkianum	-	-	-	-	-	-	o	+
	Cyathea dealbata silver tree fern	-	-	-	-	-	-	o	+
	Pteridium aquilinum bracken	p	o	-	m	o	-	p	†
	Pteris tremula	o	-	-	-	-	-	o	†
	Histiopteris incisa	-	-	-	-	-	-	-	+
	Doodia media	o	-	-	o	-	-	m	+
	Asplenium flaccidum subsp. *haurakiense*	o	o	o	o	-	-	o	†
	A. lamprophyllum	-	-	-	-	-	-	o	-
	A. lucidum	o	-	-	-	-	-	p	+
	A. obtusatum	o	o	-	-	-	-	-	+
	Polystichum richardii	-	-	-	-	-	-	o	+
	Phymatodes diversifolium	-	-	-	o	-	-	m	-
	Pyrrosia serpens	o	-	-	-	-	-	o	+

SPECIES LIST

Little blue penguin, *Eudyptula minor.*

At night, several were heard calling from possible nest sites on Burgess Island. They probably breed on many of the larger islands in the group.

Grey-faced petrel, *Pterodroma macroptera.*

A significant concentration of burrows occurred on all islands visited except Lizard Island and "Stack H". No eggs had been laid, but adults were returning at night to clean burrows and partake in courtship activities. A single bird was found in an empty burrow during daylight on Motupapa Island and a corpse located on a beach at Maori Bay Island.

Cook's petrel, **Pterodroma cooki.*

The only record for the group is by Sandager (1890). This species is fairly common in the surrounding waters during the summer months (T.G. Lovegrove pers. comm.).

Fairy prion, **Pachyptila turtur.*

Sandager (1890) records a single specimen of *Prion banksii* (=*Pachyptila desolata*), the Antarctic prion. However, it may have been misidentified. Fairy prion is more likely to turn up in this area as there is a breeding colony on the nearby Poor Knights Islands.

Black petrel, **Procellaria parkinsoni.*

Recorded by Sandager (1890). Some are occasionally seen at sea near the islands (T.G. Lovegrove pers. comm.).

Flesh-footed shearwater, *Puffinus carneipes.*

A dead specimen was found at the Landing Bay on Burgess Island. Although it has not been reported on these islands before, it is abundant offshore during summer.

Buller's shearwater, **Puffinus bulleri.*

Recorded by Sandager (1890), who handled specimens before the species was named by Salvin in 1888. Large flocks are common offshore during summer.

Sooty shearwater, *Puffinus griseus.*

Recorded breeding on "Stack D" and Maori Bay Island by Veitch (1973), but this visit did not coincide with its summer breeding season.

Fluttering shearwater, *Puffinus gavia.*

Recorded breeding in low numbers on Trig, Maori Bay, "Stack H", Lizard and Motupapa Islands by Veitch (1973). This bird is a summer breeder and was not seen during this visit.

Allied shearwater, *Puffinus assimilis.*

Empty burrows were found on "Stack H" and Lizard Island. On the latter, adults were in their burrows during the day. Veitch (1973) also reported this species on "Stack D".

White-faced storm petrel, *Pelagodroma marina.*

A harrier-eaten body was found on "Stack H", from which this species has not previously been recorded. Much of Lizard Island was honey-combed with storm petrel burrows and an occasional corpse was found under the low vegetation.

Black-bellied storm petrel, **Fregetta tropica.*

Recorded by Sandager (1890).

Diving petrel, *Pelecanoides urinatrix.*

Veitch (1973) recorded this species on all islands visited. This is interesting, as the islands on which it was rare also have kiore and the two are rarely associated together. Unoccupied burrows, most probably belonging to diving petrels, were located on "Stack H".

Australian gannet, *Sula bassana.*

Fleming and Wodzicki (1952) mention gannetries on Groper Rock and the Cathedral Rocks. Neither island was visited. This species was relatively common in the surrounding waters.

Pied shag, *Phalacrocorax varius.*

Two seen off Lizard Island and around the Knights Group. They appeared to fly to Fanal Island to roost at night.

Little shag, *Phalacrocorax melanoleucos.*

One bird seen regularly around the Knights Group. This is a new record for the Mokohinaus.

Reef Heron, *Egretta sacra.*

Both Sandager (1890) and Veitch (1973) record this bird as a rare vagrant to the group. None were seen on this visit.

Harrier, *Circus approximans.*

Several harriers were regularly seen. Kiore appeared to form a major portion of their diet at this time of the year, judging by the eaten corpses found. Sandager (1890) had counted up to 30 individuals inhabiting the group.

Brown quail, *Synoicus ypsilophorus.*

Sandager (1890) states that occasional individuals visited the islands.

Golden plover, *Pluvialis dominica.*

Sandager (1890) reported that several birds visited the group every year during September.

Wry bill, *Anarhynchus frontalis.*

Sandager (1890) records several pairs as visiting the islands for a short period one October.

Bar-tailed godwit, *Limosa lapponica.*

Another migrant species reported by Sandager (1890). He stated that individuals would briefly stop during October each year for several days.

Wandering tattler, *Tringa incana.*

One recorded on "Stack H" during November, 1973 (Veitch 1973).

Arctic skua, *Stercorarius parasiticus.*

Occasional birds visit the group (Roberts 1953, McCallum 1979). The lack of a suitable host species in sufficient numbers (e.g. white-fronted terns) may explain this skuas scarcity.

Black-backed gull, *Larus dominicanus*.

Several pairs inhabit the islands and probably nest during the summer.

Red-billed gull, *Larus novaehollandiae*.

Only a few stay around the Mokohinaus after the breeding season. In summer, the colony has been estimated at over 5 000 pairs (Gurr and Kinsky 1965). This figure contrasts with Sandager's (1890) observations of only one small colony on an outlying rock.

White-fronted tern, *Sterna striata*.

Breeds in low numbers during the summer. (Veitch 1973).

Rock pigeon, *Columba livia*.

The only record is by Veitch (1973) who reported one on Burgess Island.

Kaka, *Nestor meridionalis*.

Sandager (1890), Roberts (1953) and Emmens (1954) list this species as an infrequent visitor to the Mokohinau Group. One appeared on Burgess Island during this visit and stayed for two days.

Red-crowned parakeet, *Cyanoramphus novaezelandiae*.

Recorded on five islands during this visit. The reports for Lizard Island and "Stack H" are new records.

Shining cuckoo, *Chalcites lucidus*.

The only record is by Sandager (1890). The scarcity of host species, such as grey warblers, may discourage this cuckoo from staying.

Long-tailed cuckoo, *Eudynamis taitensis*.

The present light-house keeper, R. Walters, has seen this bird on Burgess Island, while Sandager (1890) states that two over-wintered in 1886.

Morepork, *Ninox novaeseelandiae*.

Two seen in pohutukawa bush on Burgess Island. This species is a rare vagrant to the Mokohinau Group.

Kingfisher, *Halcyon sancta*.

Several pairs inhabited the group. They were noted on all islands except "Stack H" and Lizard Island.

Skylark, *Alauda arvensis*.

One seen on Burgess Island.

Welcome swallow, *Hirundo tahitica*.

At least three individuals were present. This is a new record for the Mokohinau Group.

Pipit, *Anthus novaeseelandiae*.

Sandager (1890) states that this bird was common and bred on all islands, while Veitch (1973) reported it as rare on Burgess Island. None were seen during this visit.

Hedge sparrow, *Prunella modularis*.

The only report is by Veitch (1973) who noted several on Maori Bay and Trig Islands.

Grey warbler, *Gerygone igata*.

One seen on Trig Island. This is a new record for the group.

Fantail, *Rhipidura fuliginosa*.

Present on Motupapa, Maori Bay and Trig Islands.

Song thrush, *Turdus philomelos*.

One seen on Burgess Island. Not previously recorded from the Mokohinau Group, although it occurs on several islands within a 30 km radius.

Blackbird, *Turdus merula*.

Found on "Stack H", Burgess, Lizard and Maori Bay Islands.

Silvereye, *Zosterops lateralis*.

Small flocks were located on Motupapa and Lizard Islands, while larger groups, up to ten birds, were noted on Maori Bay, Trig and Burgess Islands.

Bellbird, *Anthornis melanura*.

Emmens (1954) and Sandager (1890) list this species as a visitor to the group.

Tui, *Prosthemadera novaeseelandiae*.

Buddle (1947 a), Emmens (1954) and Sandager (1890) record this species as a visitor, which may arrive when the flax is in flower.

Yellow hammer, *Emberiza citrinella*.

Sandager (1890) records this species as an occasional visitor.

Goldfinch, *Carduelis carduelis*.

A flock of twenty birds were seen on one occasion on Burgess Island.

House sparrow, *Passer domesticus*.

Found on Burgess and Lizard Islands. Veitch (1973) also recorded small numbers on Maori Bay and Trig Islands.

Starling, *Sturnus vulgaris*.

Birds were located on "Stack D", Motupapa, Burgess and Lizard Islands.

Myna, *Acridotheres tristis*.

A flock of twelve birds frequented Burgess Island and ranged to nearby Lizard Island. Kiore were observed feeding on a fresh, dead specimen on Burgess Island.

* denotes species which have only been recorded striking the lantern last century.

APPENDIX 4a.

The distribution of animals on rocky shores at the Mokohinaus.

A = abundant F = frequent R = rare - = no data

C = common O = occasional X = absent

	SURVEY STATIONS:						
	A	B	C	D	E	F	G
BARNACLES							
Chamaesipho brunnea	A	A	A	A	C	F-C	A
Chamaesipho columna	R-O	O	C-A	F-C	O	C	A
Epopella (Elminius) plicata	R-O	O	R-O	R	R	R-X	C
BIVALVES/SESSILE GASTROPODS							
Crassostrea glomerata	X	X	X	X	X	X	R-O
Xenostrobus pulex	R	X	X	X	X	X	X
Novastoa lamellosa	A	A	C	C	C	C	-
CHITONS							
Sypharochiton pelliserpentis	X	X	X	X	X	R	R
LIMPETS							
Cellana radians	R-O	R	C	O	F	F-C	F-C
Cellana ornata	O-F	F-C	A	C	O-F	C-A	F-C
Patelloida corticata	A	A	A	A	C-A	A-C	A
Notoacmea pileopsis	A	A	F	C	F	C	O-R
Notoacmea parviconoidea	O-R	O-F	O	F	X	F	F
Notoacmea scopulina	C-A	C	R	X	X	X	X
Siphonaria australis/zealandica	A	C	C-A	-	O-F	F	X
SNAILS							
Turbo smaragda	X	X	X	X	X	X	O

Melagraphia aethiops	X	X	X	X	X	R	O
Other trochids	X	X	X	X	X	F	O
Nerita atramentosa	O	F	O	O	O	A	A
Littorina unifasciata	C	F	A	F-C	O	X	C
Lepsiella scobina	X	X	C	O	X	F	F
Haustrum haustorium	X	X	X	X	X	F	R-O
Thais orbita	R	O	F	O-F	O	F-C	O
SEA URCHINS							
Evechinus chloroticus	R	O	X	X	O	A	C
CRABS							
Leptograpsus variegatus	O-F	O	O	C	O	O	C
Petrolisthes elongatus	X	X	X	X	X	X	X
Sponges	R	X	R	X	O	-	X

APPENDIX 4b.

The distribution of plants on rocky shores at the Mokohinaus.

SURVEY STATIONS:

	A	B	C	D	E	F	G
SUB-LITTORAL ZONE							
Ecklonia radiata	X	-	X	-	C-A	F	F-C
Lessonia variegata	X	-	X	-	X	F-C	O
SUB-LITTORAL FRINGE							
Carpophyllum maschalocarpum	X	-	X	-	C	C	O
Carpophyllum angustifolium	A	A	A	-	A	C-A	C
Carpophyllum plumosum	X	-	X	-	X	F	C
Cystophora torulosa	X	-	X	-	X	X	O
Cystophora retroflexa	X	-	X	-	X	X	F
Melanthalia abscissa	-	C	-	-	C	C	C
Sargassum sinclairii	X	-	X	-	X	R	F
Vidalia colensoi	R	X	X	-	F	F	R
Pterocladia lucida	O	O	O	-	C	C	O
LOWER EU-LITTORAL ZONE							
Pterocladia capillacea	X	O	X	-	O	X	O
Corallina officinalis	X	-	X	-	X	R	C
Other jointed corallines	A	-	C	-	X	X	X
Lithothamnia "paint"	A	A	F	-	C	A	C
Lithothamnia "thick platy"	A	A	F	-	A	A	X
Lithothamnia "coral like"	A	A	F	-	A	A	X
Xiphophora chondrophylla	A	X	A	-	A	C-A	A
Hormosira banksii	X	X	X	-	X	R-C	C
Pachymenia himantophora	O	R	X	-	X	X	X

Glossophora kunthii	R	O	A	-	X	F	C
Ceramium & *Polysiphonia*	A	-	O	-	-	X	-
Zonaria angustata	-	-	X	-	C	X	F
Codium adhaerens	X	-	X	-	X	X	O
Nemastoma oligarthra	X	C	X	-	F	C	F
Leathesia & *Colpomenia*	X	-	X	-	F	O	F
Ulva spp.	O-F	O	X	-	R	A	A
Enteromorpha spp.	X	-	X	-	X	O	O
Ralfsia spp.	A	C	-	-	F	O	O
UPPER EU-LITTORAL ZONE							
Apophloea sinclairii	O-R	-	X	-	R	C	F-C
Bostrychia arbuscula	X	-	X	-	A	C	C-A
Porphyra columbina	F	X	X	-	-	O	-
LITTORAL FRINGE (lichens)							
Verrucaria spp.	A	-	X	-	-	-	-
Lichina	X	X	NG	-	X	-	O

APPENDIX 5. (Hensley, 1980)

SPECIES LIST

Key to abundance symbols :

A = abundant (individuals totalling greater than 50)
C = common (more than 15 and less than 50)
F = (more than 5 and less than 15)
S = (fewer than 5 seen).

Family	Species	Common name; habitat; depth; abundance
Muraenidae	*Gymnothorax prionodon* (Ogilby)	Mottled moray; crevices, some free ranging; 24 m: S.
	Gymnothorax prasinus (Richardson)	Yellow moray; same; 18 m; S.
Congridae	*Conger verreauxi*	Conger eel: deep suitable hole; 10 m; S.
Berycidae	*Trachichthodes affinis* (Gunther)	Golden snapper; above kelp, deep water; 23 m; S.
	Hoplostethus elongatus (Gunther)	Slender roughy: darkened overhangs; 5 - 20 m; C.
Serranidae	*Ellerkeldia hunti* (Hector)	Red banded perch: broken bottom; past 15 m; F.
	Caesioperca lepidoptera (Bloch & Schneider)	Butterfly perch; close to *Ecklonia*; past 10 m; C.
	Caprodon longimanus	Pink maomao: open water around reef; 23 m: S.
Carangidae	*Caranx georgianus* (Cuvier)	Trevally; open waters: usually in top 5 m: A.
	Decapterus koheru (Hector)	Koheru; open waters; usually in top 5 m: A.
	Seriola grandis (Castelnau)	Kingfish; open water; 8 m: S.
Arripidae	*Arripis trutta* (Bloch & Schneider)	Kahawai; open water only one seen: 4 m: S.
Sparidae	*Chrysophrys auratus* (Bloch & Schneider)	Snapper; variable (lighthouse keeper pers. comm.).
Mullidae	*Upeneichthys porosus* (Cuvier & Valenciennes)	Goatfish; open bottom feeders; past 6 m: C.
Pempheridae	*Pempheris adspersa* Griffin	Bigeye; clumped in dark areas like boulder piles: 6-23 m:A.
Kyphosidae	*Kyphosus sydneyanus* (Gunther)	Silver drummer; close to cliff face; 7 m; S.
Scorpididae	*Scorpis aequipinnis* Richardson	Blue maomao; open water; 2 - 20 m: A.
	Scorpis violaceus (Hutton)	Sweep; smaller and darker than blue maomao: open water: 2 - 20 m: A..
	Atypichthys strigatus (Gunther)	Mado; on the edge of *Ecklonia*: 20 m: S.
Girellidae	*Girella tricuspidata* (Quoy & Gaimard)	Parore; algal flats; 5 m; S.
	Girella cyanea	Bluefish; rock pool at low tide: 1 m: S.
Pomacentridae	*Chromis dispilus* Griffin	Demoiselle; large schools (140+) off bottom with juveniles on bottom; 7 - 20 m; A.
	Parma microlepis (Gunther)	Black angelfish: open boulder areas; 4 - 12 m: F.
Labridae	*Pseudolabrus miles* (Bloch & Schneider)	Scarlet parrotfish; mixed bottom; 12 m; S.
	Pseudolabrus celidotus (Bloch & Schneider)	Spotties; mixed shallow floors: 3 - 15 m; C.
	Pseudolabrus fucicola (Richardson)	Banded parrotfish; mixed bottom: 10 m: S.
	Pseudolabrus inscriptus (Richardson)	Green parrotfish: mixed bottom: 12 m: S.
	Pseudolabrus luculentus (Richardson)	Orange parrotfish; mixed bottom; 9 m: S.
	Coris sandageri (Hector)	Sandager's parrotfish: lower strata: 8 - 18 m: C.
	Verreo oxycephalus Bleeker	Pigfish; rocky mixed areas; 3 - 18 m; C.
Odacidae	*Coridodax pullus* (Bloch & Schneider)	Butterfish: mixed kelp, *Carpophyllum* spp.: 10 m: F.
Aplodactylidae	*Aplodactylus meandratus* (Richardson)	Marblefish: in *Ecklonia* and broken bottom: 10 m: S.
Cheilodactylida	*Nemadactylus douglasii* (Hector)	Porae; edge of sand, reef fringe: 5 - 18 m: C.
	Cheilodactylus spectabilis (Hutton)	Red moki; mixed bottom; 5 - 18 m: C.
Blenniidae	*Blennius laticlavius* (Griffin)	Crested blenny: within reach of small crevices or holes; 4 - 18 m; C.
	Plagiotremus tapeinosoma (Bleeker)	Mimic blenny; close to bottom; 10 m; S.
Tripterygiidae	*Tripterygion varium* (Bloch & Schneider)	Mottled blenny; complex rock/sand substrate; 2 - 18 m; A.
"	*Tripterygion bucknilli*	Banded blenny; rockbase; 2 - 18 m: A.
	Tripterygion sp. B	Yellow black blenny; rockbase: 2 - 18 m; A.
	Tripterygion sp. D.	Yeldwyn's blenny; mid & lower surge zone; 6 m; F.
	Genus undecided	Scalyhead blenny; rockbase; 8 m; S.
	Tripterygion sp. C.	Oblique swimming blenny; close to bottom: 10 m. A.
	Gilloblennius tripennis (Bloch & Schneider)	Spectacle blenny; rock or detrital areas: 4 - 18 m. C.
Scorpaenidae	*Scorpaena cardinalis* Richardson	Scorpion fish: broken bottom: 6 - 20 m: C.
Balistidae	*Navodon scaber* (Bloch & Schneider)	Leatherjacket: *Ecklonia* fringe: 7 - 16 m; F.
Gobiesocidae	*Trachelochismus sp.*	Clingfish: sublittoral fringe, in *Carpophyllum angustifolium* on a rock: 0.2 m: S.

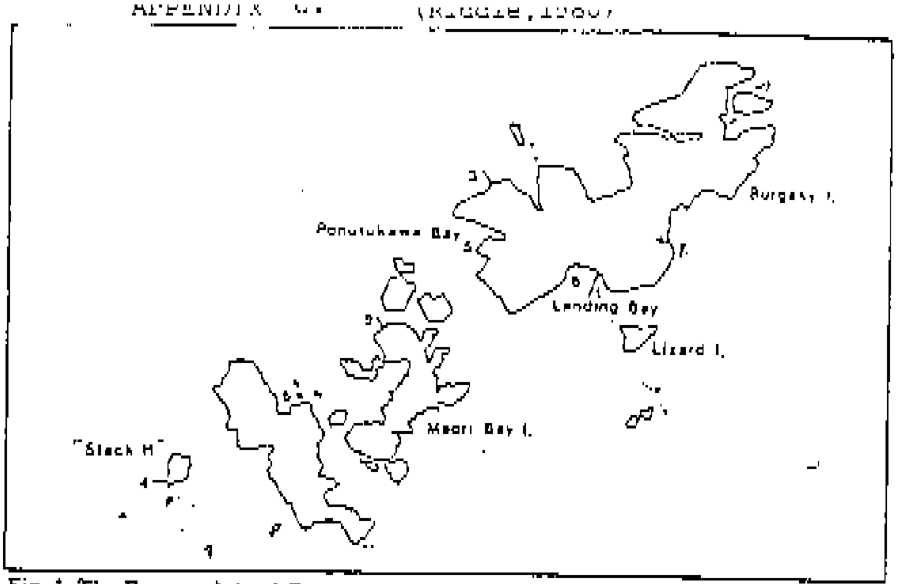


Fig. 1. The Burgess Island Group of the Mokohinau Islands with the transect sites (1-4) and fish count (Housley 1980) sites (1-6) surveyed.

Table 1. Species abundance and distribution at transect 1 (Landing Bay, Burgess Island). A = abundant; C = common; O = occasional; R = rare

Distance from shore (m)	10	20	40	50	60	70	80
Depth (m)	2	2	2.5	3	4	7	8
Small red alga	C	.	.	.	.	.	.
Cookia sulcata (Gmelin)	R	.	.	.	.	.	.
Evechinus chloroticus (Valenciennes)	A	.	.	.	.	.	.
Tethya aurantium (Pallas)	A	.	.	.	.	.	.
Aplidium sp.	A	.	.	.	.	.	.
Ancorina alata Dendy	R	.	.	.	.	.	.
Cellana stellifera (Gmelin)	R	.	.	.	.	.	.
Ulva sp.	R	.	.	.	.	.	.
Sargassum sinclairii Hooker and Harvey	A	.	.	.	.	.	.
Vidalia colensoi Hooker and Harvey	C	.	.	.	.	.	.
Xiphophora chondrophylla (R. Br.)	O	R	R	.	.	.	.
Didemnum sp.	A	O	O	.	.	.	.
Codium adhaerens Dellow	R	C	C	.	.	.	.
Actinothoe albocincta Hutton	.	C	C	.	.	.	.
Carpophyllum maschalocarpum (Turn.)	R	R	C	.	.	.	.
Carpophyllum plumosum (A. Rich.)	.	.	C	.	.	.	.
Ecklonia radiata (Turn.)	O	R	R	A	A	A	.
Jania sp.	.	O	O	.	C	C	.
Corallina officinalis Linnaeus	O	R	R	.	C	C	O
Delisia compressa Levring	.	.	.	.	A	A	.
Flabellum rubrum (Quoy and Gaimard)	.	.	.	.	O	O	.
White vittaticelliform (plumose) Bryozoan	.	.	.	.	C	C	.
Sponges	.	.	.	.	C	C	.
Red algae	.	.	.	.	.	.	O

Table 2. Species abundance and distribution at transect 2 (north Maori Bay Island). A = abundant; C = common; O = occasional; R = rare.

Distance from shore (m)	0	0	0	0	0	3	4.5	7.5	10	17	30	40
Depth (m)	1	2.5	3	8	15	17	17	16	17	17	18	18
Carpophyllum angustifolium J. Ag.	A	.	R	.	.	.	.	.	.	.	.	.
Vidalia colensoi Hooker and Harvey	.	C	O	O	.	.	.	.	.	.	.	.
Pterocladia lucida (R. Br.)	.	C	O	O	.	.	.	.	.	.	.	.
Corynactis haddoni Farquhar	.	O	.	.	.	.	.	.	.	.	.	.
Codium adhaerens Dellow	.	O	.	.	.	.	.	.	.	.	.	.
White hemispherical compound ascidian	.	R	.	.	.	.	.	.	.	.	.	.
Encrusting bryozoans	.	C	.	.	.	.	.	.	.	.	.	.
Lessonia variegata J. Ag.	.	.	A	.	.	.	.	.	.	.	.	.
Cheilosporum wardii (Harvey)	.	.	A	.	.	.	.	.	.	.	.	.
Evechinus chloroticus (Valenciennes)	.	O	O	A	C	O	O	R	.	.	.	.
Jania sp.	.	.	A	.	.	O	C	.	.	.	.	.
Pink vittaticelliform Bryozoan	.	.	C	.	.	.	.	.	.	.	.	.
Aglaophenia sp.	.	.	O	.	.	.	.	.	.	.	.	.
Small pennate hydroids	.	.	C	.	O	.	.	.	.	.	.	.
Ulva sp.	.	.	.	O	.	.	.	.	.	C	.	.
Heliocidaris tuberculata (Lamarck)	.	.	R	.	.	.	.	.	.	.	.	.
Actinothoe albocincta Hutton	.	C	O	O	O	C	.	.	.	.	.	.
Centrostephanus rodgersi (Agassiz)	.	.	R	O	C	C	C	R	.	.	.	.
Ecklonia radiata (Turn.)	.	.	.	R	R	O	.	C	O	.	A	A
Delisia compressa Levring	.	.	.	.	.	.	.	O	A	A	.	.
Small red algae	.	.	.	.	.	.	.	.	C	.	C	C
Tripneustes gratilla (Linnaeus)	.	.	.	.	.	.	.	.	.	.	R	.
Zonaria angustata (Lamour)	.	.	.	.	.	.	.	.	.	.	C	C