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Manaaki Whenua
Landcare Research

Waituna Lagoon Wetland

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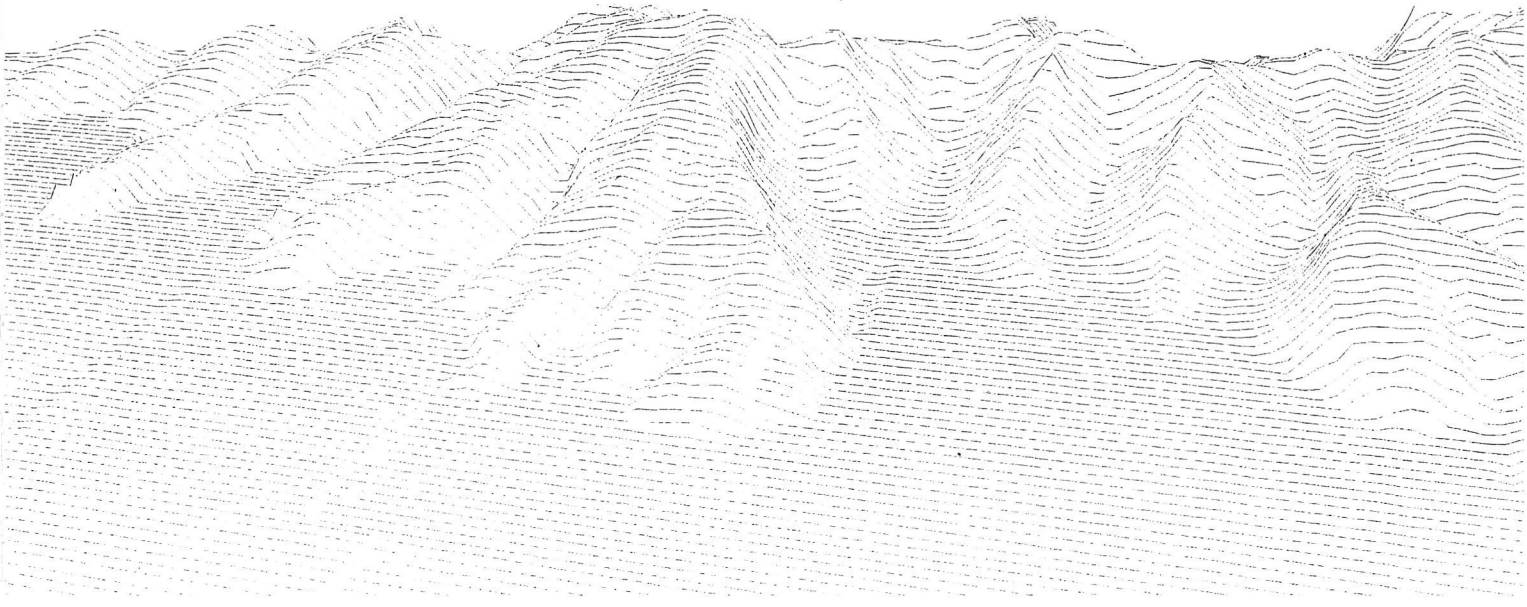

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1. Summary

1.1 Project and Client

This report was prepared in August 1999 for UNEP/Grid as part of Landcare Research's subcontractual obligations in a Ministry of the Environment SMF wetland monitoring project. It assesses the applicability of a combination of estuarine and palustrine wetland classification systems, developed earlier in the SMF project, at Waituna Lagoon Wetland to the east of Invercargill, a selected trial site in the Southland Region.

1.2 Objectives

To assess the wetland classification developed at Workshop 1 at Waituna Wetland, by:

- developing a tentative vegetation classification based on previous information;
- testing the classification on likely end-users;
- determining weaknesses in the classification and recommending improvements.

1.3 Main Findings

- Waituna Lagoon comprises predominantly one vegetation type, a *Leptocarpus similis* Rushland with little else. There is, however, some variation in minor components.
- Although the system is functionally estuarine (lagoon), the vegetation is very much freshwater (palustrine).
- Aquatic vegetation is a major component of Waituna Lagoon but is not included in the classification.
- Distinct structural forms exist for *Leptocarpus similis* and these can be related to differences in habitat. The classification does not allow separation of these.

2. Introduction

This report was prepared in August 1999 for UNEP/Grid (Smith 1998) as part of Landcare Research's subcontractual obligations in a Ministry of the Environment SMF wetland monitoring project. It assesses the applicability of a combination of estuarine and palustrine wetland classification systems, developed earlier in the SMF project, at Waituna Lagoon Wetland to the east of Invercargill, a selected trial site in the Southland Region.

3. Background

A tentative standardised hierarchical classification system for all New Zealand wetlands that is required to be useful and practical for monitoring programmes was developed during a workshop held on 12-13 March in Lincoln (Goal 1). This second phase (Goal 2) of the project involves trialling the practical application of the classification system at various selected wetland sites in five New Zealand regions.

The trial wetland sites were selected according to a range of criteria including representativeness, existing information, significance, and size (Smith 1998). Waituna Lagoon Wetland was chosen as one of two trial sites in the Southland Region as it was considered to be a significant and representative large wetland for which much information already existed. It was also chosen as it comprises vegetation predominantly of one kind, but with minor variants scattered throughout. It also has a large aquatic component.

Waituna Lagoon wetland is summarised using the descriptor criteria (Smith 1998 p.12) thus:

Southland
Waituna Lagoon Wetland
Biological values: Large coastal brackish lagoon of considerable value to waterfowl. Opened to the sea on an irregular basis only when water levels become high.
Location : 46° 34' S, 168° 35' E.

The proposed wetland classification system for estuarine wetlands comprises four hierarchical levels with each subsequent level providing increasing detail (Ward & Lambie 1998):

Level 1: estuarine hydroclass
Level 2: forcing functions (salinity and inundation, duration and frequency, underlying substrate)
Level 3: vegetation structural class (e.g., rushland, shrubland, mud flat)
Level 4: canopy species composition (e.g., mangroves, sea rush, cockle).

Wetlands can be classified at Level 1 subhydroclass as an estuary, lagoon, or dune swale using just physical characteristics, but some vegetation (or in certain cases faunal) information is needed at Levels 3 and 4. This is because canopy vegetation can be used as a tool for indicating underlying Level-2

physical characteristics, as this is easier to sample than the physical characteristics themselves, and is readily interpretable using aerial photographs or satellite imagery. In addition, vegetation information provides a useful basis for assessing representativeness, which underpins management and planning decisions. The detail required at Levels 3 and 4 will be determined by the mapping scale, but should be readily interchangeable from fine scales as in local maps (1:10 000 – 1:2 500, with detailed vegetation types or subtypes as mapping units) to broad scales as in regional maps (1:50 000, with vegetation classes as mapping units).

4. Objectives

To assess the wetland classification developed at Workshop 1 at Waituna Wetland, by:

- developing a tentative vegetation classification based on previous information;
- testing the classification on likely end-users;
- determining weaknesses in the classification and recommending improvements.

5. Methods

5.1 Field survey

- This study was carried out using information contained in separate reports produced for the Department of Conservation on Waituna Lagoon (Johnson & Partridge 1996,1998). Those studies were carried out with the assistance of Dr Carol West of the Southland Conservancy of the Department of Conservation.
- The descriptions in that report were modified to follow the Wetland Classification developed at Workshop 1 (Ward & Lambie 1998).

5.2 Field verification and testing

- Southland Regional Council and Department of Conservation staff tested the classification on the margin wetlands of Waituna Lagoon.

5.3 Evaluation

- The effectiveness and limitations of the classification and mapping methods were assessed and are discussed in this report.

6. Results

6.1 Wetland classification

The following is a hierachical classification for Waituna Lagoon Wetland based on the system described in Ward & Lambie (1998).

Level 1: Hydroclass *Estuarine*
Subhydroclass: *Lagoonal*

Level 2: Forcing functions:
2a Salinity and inundation regime:
Brackish (long periods flooded and exposed)
2b Underlying substrate:
Mud (anaerobic)
Sand (aerobic)

Level 3: Vegetation Structure: 3 Rushland 4 Herbfield 9 Grassland

Level 4: Vegetation canopy:
These are listed in the hierarchical order given above (functional then structural).

6.2 Summary of types

1. Brackish
Herbfield:
1a. *Lilaeopsis novae-zelandiae – Selliera radicans* Herbfield
1b. *Mimulus repens – Limosella lineata* Herbfield

Rushland
2a. *Leptocarpus similis* Rushland
2b. *Schoenoplectus pungens* Rushland

2. Freshwater
Rushland
3a. *Leptocarpus similis – Phormium tenax* Rushland
3b. *Leptocarpus similis – Juncus gregiflorus* Rushland
3c. *Isolepis nodosa – Poa cita* Rushland/Grassland
3d. *Isolepis nodosa – Lepidosperma australe* Rushland/Grassland
3e. *Carex pumila – C. buchananii* Rushland
3f. *Carex gaudichaudiana – Eleocharis acuta* Rushland

Shrubland
4a. *Leptospermum scoparium* Shrubland
4b. *Ulex europaeus* Shrubland

Grassland

5a. *Agrostis stolonifera* Grassland

6.3 Descriptions

1a. ***Lilaeopsis novae-zelandiae - Selliera radicans*** Herbfield

Turf of salt-tolerant species is confined to areas adjacent to the opening of the lagoon. On gravelly sites it comprises *Lilaeopsis novae-zelandiae*, *Selliera radicans,* and *Samolus repens*, all indicative of brackish conditions

1b. ***Mimulus repens - Limosella lineata*** Herbfield

On slightly higher ground the turf comprises *Mimulus repens*, *Limosella lineata*, *Crassula sinclairii,* and *Cotula coronopifolia*. These comprise a mixture of brackish and freshwater indicators.

2a. ***Leptocarpus similis*** Rushland

Virtually the entire margin of Waituna Lagoon is dominated by *Leptocarpus similis*. There are, however, considerable differences in stature and growth form of this plant, and variations in associated species. The differences are greatest where the lower and upper margin portions of the stands are compared. *Leptocarpus similis* plants closest to the lagoon are typically 1.8 to 2.0 m tall, growing upon hummocks usually 0.2 to 0.4 m high. These are old plants that have built the hummocks by trapping sediments among their stem bases. Wave action is concentrated upon these "foreshore" plants, so it is that most sediment is available for hummock building. The largest *Leptocarpus similis* clumps seen, along the exposed western shore, were 2.2 m tall, upon 0.6 m undercut pedestals.

By contrast, *Leptocarpus similis* rushes in the "inshore" portion of their zone, grow upon much more smooth ground. The stems are less dense, uniformly erect, and have an even top height of usually 1.7 to 1.8 m. The plants here often have a more yellowish appearance, and it is less easy to distinguish individual plants on the basis of growth form.

Although *Leptocarpus similis* most commonly occurs without associated species, some mixtures do occur. Where these species form conspicuous components they are covered separately. There are, however, many low-growing herbaceous plants that indicate different conditions. Near the opening, saline indicator turf plants are common, including *Selliera radicans*, *Isolepis cernua*, *Triglochin striatum* and *Leptinella dioica*, although some truely freshwater species such as *Potentilla anserinoides*, *Centella uniflora*, *Hydrocotyle sulcata* and *H. novae-zelandiae* are often present. At higher elevations away from salt influence, other herbs including *Nertera balfouriana*, *N. setulosa*, *Myriophyllum votschii*, *Viola cunninghamii*, *Pratia angulata*, *Galium perpusillum*, *G. propinquum*, *Schoenus maschalinus*, *Carex flaviformis* and *Euphrasia repens* are found. Where detritus accumulates, the common associates are *Atriplex prostrata*, *Cotula coronopifolia* and *Agrostis stolonifera*. Scattered throughout are conspicuous shrubs of *Plagianthus divaricatus* and *Coprosma propinqua*, but these are very minor components.

2b. ***Schoenoplectus pungens*** Rushland

Swards of *Schoenoplectus pungens* often form pure stands, a few metres in extent, in loose gravels of small bays, fronting the *Leptocarpus similis* zone, but rushland of this or other types is a minor feature around Waituna Lagoon.

3a. ***Leptocarpus similis - Phormium tenax*** Rushland/Shrubland

On gently sloping shores, the *Leptocarpus similis* can grade into increasing amounts of the taller herbs, especially flax (*Phormium tenax*) and toetoe (*Cortaderia richardii*), with shrubs such as *Plagianthus divaricatus*, *Coprosma propinqua,* and manuka (*Leptospermum scoparium*), sedges, and ferns.

3b. ***Leptocarpus similis - Juncus gregiflorus*** Rushland
At the inland side of the lagoon there are stock-damaged areas where trampling and nutrient enrichment have allowed other rushes such as *Juncus gregiflorus*, *J. pallidus*, *J. articulatus* and *J. bufonius* to occur with the *Leptocarpus similis*.

3c. ***Isolepis nodosa - Poa cita*** Rushland/Grassland
This mixed rushland and grassland community is confined to the crests of gravel bars. Associated with the *Isolepis nodosa* and *Poa cita*, are *Agrostis stolonifera*, *Deschampsia caespitosa*, *Anthoxanthum odoratum*, *Holcus lanatus*, *Lotus pedunculatus*, *Leontodon taraxacoides*, and mosses, especially *Thuidium furfurosum*.

3d. ***Isolepis nodosa - Lepidosperma australe*** Rushland/Grassland
In a narrow zone between *Leptocarpus similis* Rushland and Scrub, there is a rich flora, comprising the species of 3d (*Isolepis nodosa - Poa cita* Rushland/Grassland), but with other rushes and sedges such as *Lepidosperma australe*, *Carex coriacea*, *C. sinclairii*, *C. flaviformis*, numerous turf herbs, and *Chionochloa rubra* tussocks.

3e. ***Carex pumila - C. buchananii*** Rushland
These small rushes occur on the upper parts of relatively stable gravel beaches at the east end of the lagoon.

3f. ***Carex gaudichaudiana - Eleocharis acuta*** Rushland
Swards of *Carex gaudichaudiana*, *Eleocharis acuta*, and *Carex coriacea* occur along parts of the exposed western shore which are subjected to much wave-disturbance of gravels.

4a. ***Leptospermum scoparium*** Shrubland
The dense manuka (*Leptospermum scoparium*) scrub which grows on the peatland surrounding most of Waituna Lagoon is quite uniform in structure and composition. It may be accompanied by *Dracophyllum longifolium*, and there may be a sparse shrub understorey of *Cyathodes juniperina* in well-lit places. Tall bracken (*Pteridium esculentum*) also occurs in patches.

4b. ***Ulex europaeus*** Shrubland
Gorse (*Ulex europaeus*) occurs as scattered shrubs or as patches in various habitats, but especially within and near the lower margin of manuka scrub, and on the rear slopes of the coastal storm ridge.

5a. ***Agrostis stolonifera*** Grassland
Within some areas of *Leptocarpus similis* are open patches where water ponds and anaerobic conditions occur. These are typically dominated by *Agrostis stolonifera*, *Cotula coronopifolia*, and *Mimulus repens*.

7. Vegetation Maps (Appendix)

With the exception of the vegetation type dominated by *Leptocarpus similis* (2a), all the other vegetation types are too fragmentary and minor to be mapped. Thus the vegetation map of Waituna Lagoon comprises a *Leptocarpus similis* Rushland at both the broad scale (1:50 000) and the fine scale (1:10 000 to 1:2500). This problem is addressed in the Evaluation section. Instead there are presented four maps of part of Waituna Lagoon at Hansens Bay on the south shore, showing the extent of *Leptocarpus similis* at four different times (1951, 1962, 1977, 1985).

The numbers on the 1977 refer to two detailed transects. Transect 1 comprises 15 m of *Leptocarpus similis* Rushland (2a), then 10 m of *Agrostis stolonifera* Grassland (5a), then a further 5 m of *Leptocarpus similis* Rushland (2a), then another 10 m of *Agrostis stolonifera* Grassland (5a), before 5 m of *Leptocarpus similis* Rushland (2a). It was chosen because of the grassland component. Transect 7 comprises 5 m of *Leptocarpus similis* Rushland (2a), then 5 m of *Leptocarpus similis - Phormium tenax* Rushland at the upper limit of the lagoon margin, beyond which are the gravel bank non-wetland types not described here.

The maps clearly demonstrate the changing nature of the extent of *Leptocarpus similis* Rushland. In 1951, it formed a discontinuous fringe against the scrub vegetation of the shore, but was present also as discrete clumps, partly coalescing, upon the gently sloping shore platforms. In addition, the 1951 air photos illustrate patches of pale grey tone, probably indicative of turf vegetation, in the vicinity of some of the *Leptocarpus similis* clumps. The increase in *Leptocarpus similis* Rushland between 1951 and 1977 has occurred similarly around most of the margin of Waituna Lagoon. It has not taken the form of a gradual outward or downslope movement of a front of *Leptocarpus similis* Rushland, but instead via an early phase where there were scattered *Leptocarpus* clumps, and then by an infilling process within that initially colonised extent.

8. Evaluation

8.1 System and vegetation classification

The primary ecosystem-based division in the wetland classification hierarchy is palustrine versus estuarine wetland systems. This allows individual wetlands to be classified according to major "forcing functions" that determine how the system operates. For Waituna Lagoon, there is considerable difficulty in using vegetation to assign the system to Palustrine or Estuarine. Of the three lagoons used in this study (the other two are Te Waihora, Canterbury and Okarito Lagoon, Westland), this is the most difficult to assign. Functionally, there is no doubt that the system is estuarine, as it behaves according to the typical lagoon patterns. However, most of Waituna Lagoon is indicative of freshwater conditions (*Leptocarpus similis* occurs as both a plant of saline salt marshes and inland lake margins) where vegetation typical of palustrine systems occur. The classification system developed in this project needs to be flexible enough to be able to cope with such situations. Therefore, while the system here is estuarine by geomophology, the vegetation itself is indicative of a dominant palustrine nature.

8.2 Canopy versus compositional community distinction

The descriptive technique used here is based on canopy composition, in which only those species visible vertically are used in the descriptions. This is because an important aim of this wetland mapping project is the desire to use aerial or satellite mapping as a technique for assessing wetland spatial extent and change. Comparison with other studies shows that using canopy composition under-represents diversity in structurally diverse vegetation in comparison with that which is structurally simple. There is, for instance, considerable variation in composition below the *Leptocarpus similis* canopy, especially in the form of turf species. These variations cannot be detected by remote sensing, and are even difficult to determine by field examination. Forest subcanopy variations can at least be observed by walking through, but these kinds of differences are virtually invisible beneath the dense rushes. Recognition of these limitations to mapping need to be recognised.

8.3 Vegetation of different structure but the same composition

As indicated in the description of the *Leptocarpus similis* Rushland (2a), the dominant plant has two quite different growth forms in response to differing environmental conditions. One comprises tall pedestals, while the other is a rhizomatous form on smooth sediment. These growth forms occupy two distinct zones and would be well worth considering as two distinct vegetation types, despite having exactly the same composition.

8.4 Understanding parameters of changes in vegetation extent and composition

Wetland vegetation is highly dynamic, and changes can be both desirable and undesirable. At Waituna Lagoon, the vegetation dominated by *Leptocarpus similis* that constitutes most of the wetland is expanding considerably, while the open water and aquatic components are declining. These kinds of changes need to be understood in terms of natural successional change and accelerated processes or undesirable loss.

The end point of these processes may be eventual loss of wetland through completely natural events. Wetlands can also be lost through undesirable changes, such as drainage. Any assessment needs, therefore to carefully consider and assess change and advise action according to long-term desirable outcomes.

8.5 Aquatic vegetation

Aquatic vegetation has been excluded from the wetland classification system, but at Waituna Lagoon, much of the diversity in vegetation is in the aquatic component, and its values are very much tied to the surrounding emergent vegetation. These aquatics are both submerged and floating and include species of considerable note such as *Ruppia megacarpa*, *R. polycarpa*, *Myriophyllum triphyllum*, *Glossostigma elatinoides* and *Lilaeopsis novae-zelandiae*. The exclusion of this diversity seriously under-represents the values of Waituna Lagoon. Floating and submerged aquatic plants do, however, present major problems to mapping, frequently being below water or floating and thus highly unpredictable in location.

9. References

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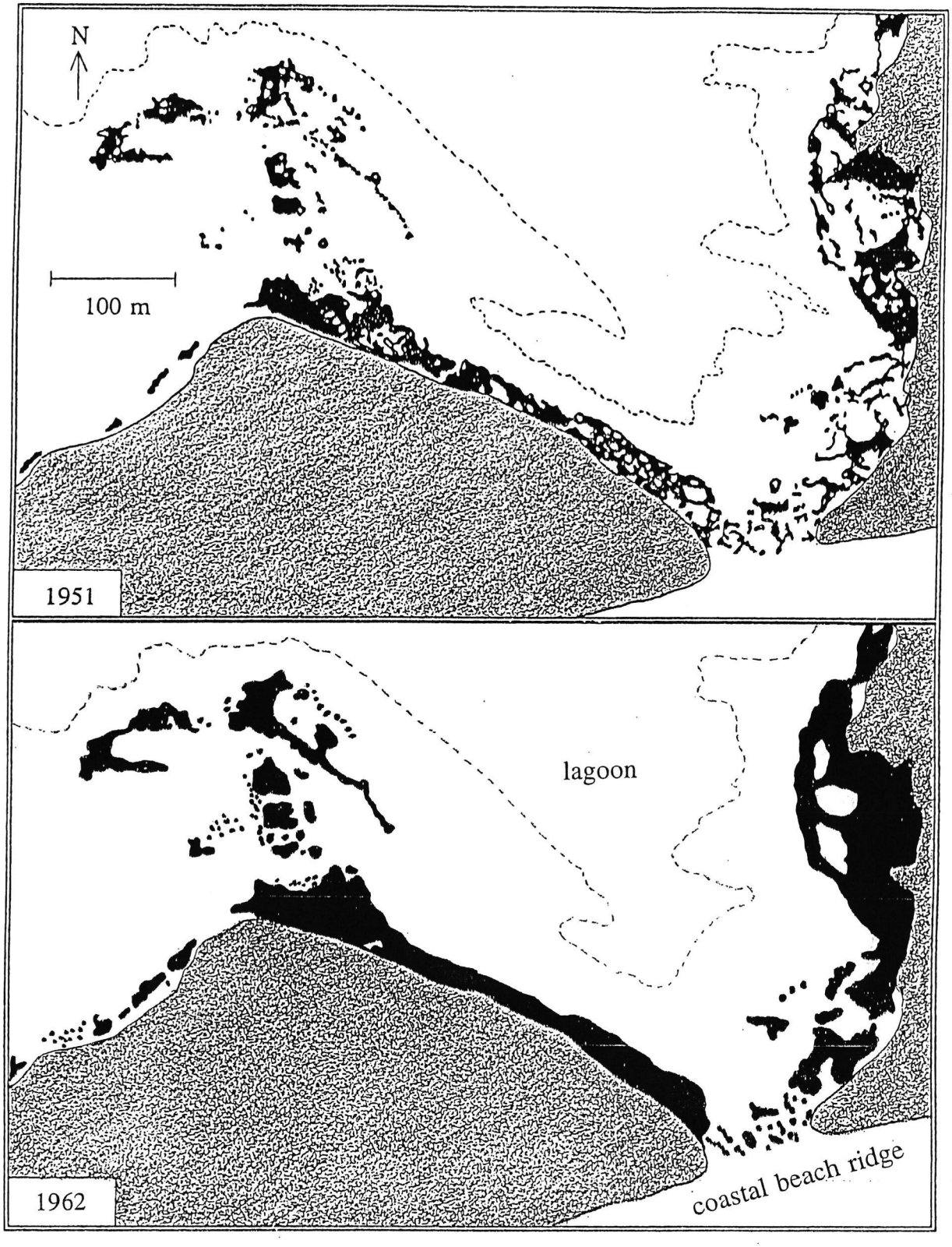
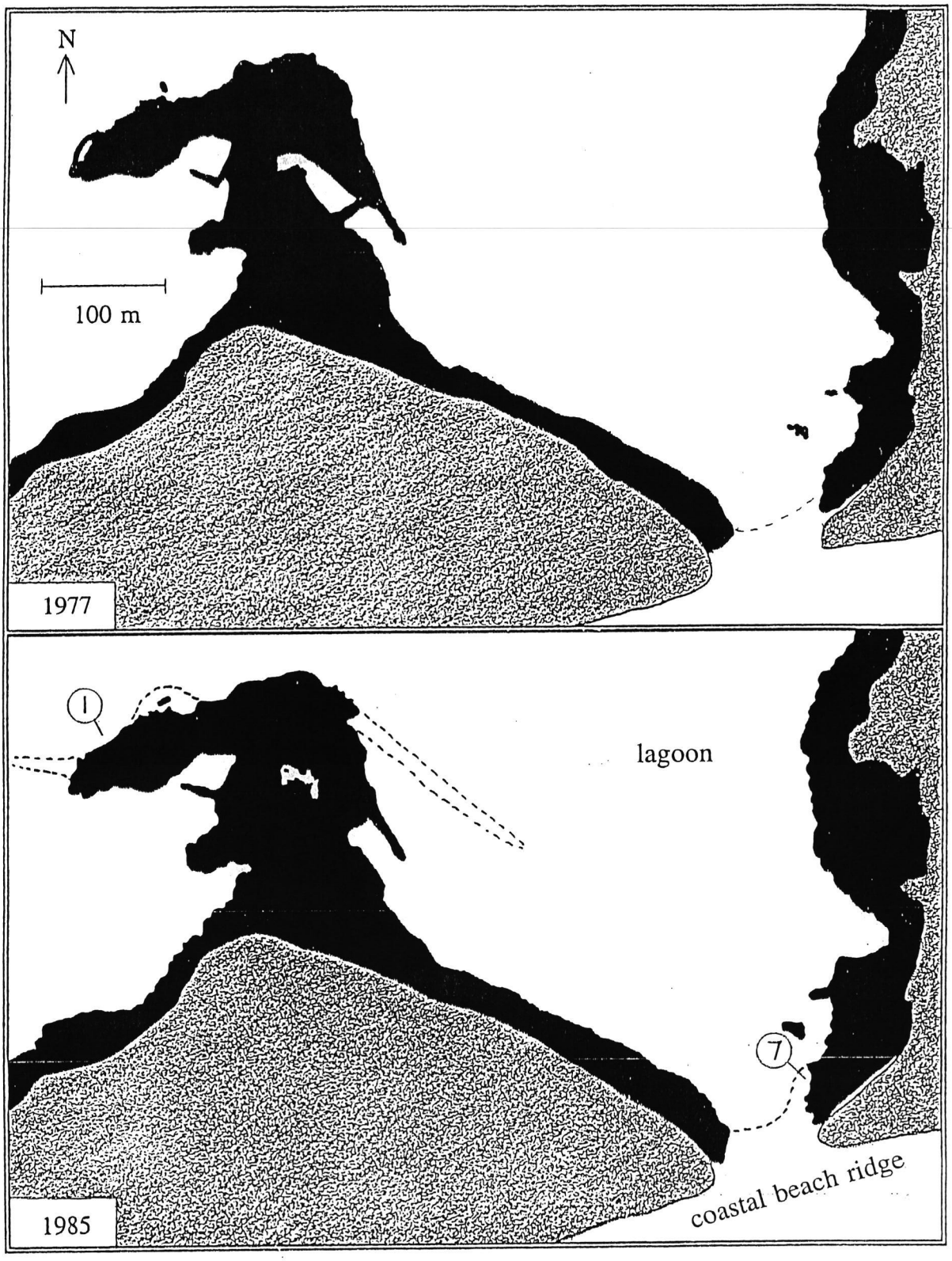

N
100 m
1951
lagoon
1962
coastal beach ridge


N
100 m
1977
1
lagoon
7
coastal beach ridge
1985