WILSON INLET MANAGEMENT AUTHORITY

THE FRINGING VEGETATION OF THE WILSON INLET DELTA 1946 TO 1994

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Cover Photo: Wilson Inlet Delta
Photo by Simon Neville

THE FRINGING VEGETATION OF THE WILSON INLET DELTA 1946 to 1994

Report to the Wilson Inlet Management Authority

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Abstract

The sand bar which closes the mouth of Wilson Inlet each year and which is breached artificially each winter to open it again, supports a number of plant communities including sedgeland, salt-marsh, fringing forest and shrubland. As a result of the accretion of sediment on the bar and the westward progradation of the Nullaki Peninsula, plant colonisation of bare sediment and foredune is progressing and plant community succession is evident. It is likely that the relatively vigorous introduced creeping grass, *Paspalum vaginatum,* has accelerated these processes in recent years.

Between 1946 and 1991 about 30% of the exposed delta was colonised by vegetation or lost to the growing Peninsula and its dunal vegetation. These processes continue today and, together with the choice of location for the initial breach of the bar each year, are important factors in determining the width of the mouth of Wilson Inlet which may be ultimately as little as 200-300 m of the original 700 m observed in 1946.

Acknowledgements

The author wishes to thank Mike Kerr and Margi Bond for assistance in the production of this report.

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1. Introduction

Aerial photographs have been used to document changes in fringing vegetation along some estuaries of south-western Western Australia (Pen 1981; Pen 1987; Pen 1992). Such changes have been observed to investigate the effects of human activity on the distribution and succession of plant commuities in relation to altering hydrological regimes. Changes to levels of inundation and/or salinity can cause some plant species to die-out and to bring about the succession of one community by another, even if that community is little more than an assemblage of weeds. Occasionally, the hydrological regime can be so drastically altered that bare substrate becomes available for the colonisation of fringing plant species, as has been observed along the foreshores of the Swan and Leschenault estuaries (Pen 1981; 1992).

A similar phenomenon has occurred at the mouth of Wilson Inlet on the south-coast of Western Australia (Figure 1.1). Here the early artificial breaching of this seasonal bar-built estuary, has reduced inundation by river-fed floodwaters in winter and is thought to have led to the build-up of sediment at the mouth of the Inlet (Hodgkin and Clark 1988; Hesp 1993). Both of these changes in the hydrological regime of the Wilson Inlet mouth are likely to have caused the colonisation of the bar by fringing estuarine plant communities and dunal vegetation which is apparent today. The object of this study is to document the colonisation of the Wilson Inlet bar from 1946 to 1994.

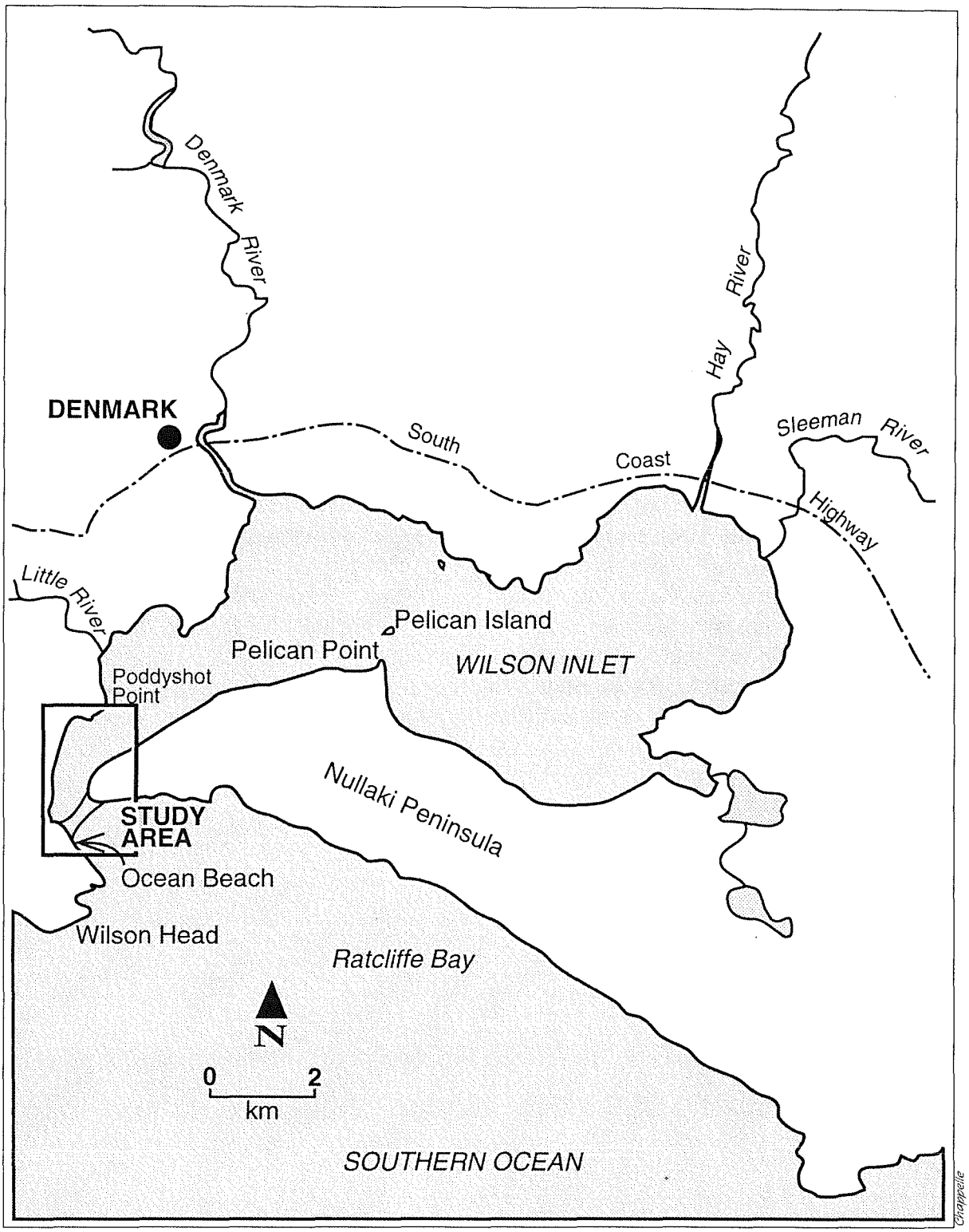


Figure 1.1 : Wilson Inlet Study Area

2. Background

Wilson Inlet was formed from the flooding of an ancient river valley during the last sea level rise 8000 to 6000 years ago (Hodgkin and Clark 1988). It is sheltered from the ocean by the high dunes of the Nullaki Peninsula, which tapers to the west where the mouth of the Inlet is located up against the limestone cliffs of Wilson Head (Fig. 1.1). The mouth of the Inlet is about 1 km wide at Poddy Point and about 500 m wide at the ocean. It is blocked by a tidal delta which closes the Inlet from the ocean over summer and autumn when river discharge is generally insufficient to overcome tidal sedimentation and scour a channel between the Inlet and the sea. During this time, wind and waves carry sand onto the delta and further build up the bar which runs along the ocean. The height of the bar varies from year to year.

Prior to European settlement, the onset of seasonal winter rains would cause the Inlet to flood with river waters, which would in most years breach the bar at a level determined by the height of the bar itself. However, in the 1920s the bar was opened artificially at the significantly lower Inlet level of about 1 m above Australian Height Datum (AHD). This was done to prevent the flooding of the Elleker-Nornalup railway which had been realigned along the northern shore of the Inlet. Although the railway has since closed, the artificial opening of the bar has been continued to prevent the flooding of roads, farmland and other developments on land which had formerly been periodically flooded (Hodgkin and Clark 1988).

It has been claimed that as a consequence of lower opening levels, significantly less water is available to scour out deep channels and transport sediment offshore and, in turn, facilitate the return of sediment, via tidal movements, right up the tidal delta (Lenanton 1974; Hodgkin and Clark 1988; Hesp 1993). Hesp (1993) suggests that this has put the tidal delta in a state of dis-equilibrium, but more work is required to show that this is reponsible for the build-up of sediment on the bar, which has been observed over the last few decades. However, it can be safely concluded that the lower opening levels have reduced the extent and period of inundation of fringing land, including the bar.

3. The Study Area And Aims of The Study

The study area consists of that area of the mouth of Wilson Inlet which supports estuarine fringing vegetation or colonising or unconsolidated dune vegetation (Fig. 1.1). It also includes that region of the sand bar which is exposed at low tide. The study area extends from the Southern Ocean to Poddyshot Point (Fig. 1.1).

The aims of the study were to:

1. Describe the fringing plant communities which inhabit the Wilson Inlet delta;
2. Map the fringing vegetation on the delta;
3. Document the vegetation changes which occurred on the delta between 1946 and 1994; and
4. Consider those factors which influence the health of the vegetation and the implications for its management.

4. Materials And Methods

4.1 Vegetation description and mapping

Colour aerial photographs of the study area at 1:20 000 scale from the Department of Land Administration were obtained in 1991 (see Appendix 1) and sketchmaps were produced using a Zeiss Aerosketchmaster to a 1:10 000 scale. The sketchmaps were drawn to convey information on the distribution of vegetation, vegetation type and adjacent land use (for example, pasture or road).

The sketchmaps were taken into the field in January 1994 and anotated with relevant information on plant communities, weed infestations and colonising vegetation. Plant communities were recognised and described on the basis of dominant species and projective foliage cover, and height of the tallest stratum (Specht 1981).

4.2 Vegetation change

Vegetation changes over time were observed by comparing the present situation with that of the past, using photographs from 1946, 1957, 1965, 1971, 1975, 1981, 1985, 1986, 1987, 1989 and 1991 (see Appendix 1). Examples of changes were documented by reducing vegetation maps of the distribution of the plant communities at particular places and times to the same scale using the Zeiss Aerosketchmaster.

5. Vegetation Of The Wilson Inlet Delta

5.1 Beach and dune vegetation

Beach and foredune colonising vegetation

Areas of the sand bar which become stable for short periods of generally less than a year, are colonised by the herbs *Cakali maritima* (Sea rocket) and *Arctotheca populifolia* (Dune Arctotheca). Both are introduced species. These annual species produce a low open herbland in small patches or, at times, large stands across the bar, which are washed away over winter by storm waves or when the bar is breached by the Inlet water.

In the more stable areas of the lower foredunes, especially on the western end of the Nullaki Peninsula (see Fig. 5.1), a variety of species becomes established. These include: the grasses - *Spinifex longifolius and Spinifex hirsutus* (Hairy spinifex); the sedge - *Isolepis nodosa* (Knotted club-rush); and the introduced herbs - *Pelargonium capitatum* (Rose pelargonium) *Carpobrotus edulis* (Pigface) and *Euphorbia terracina* (False caper). However, the introduced grass *Paspalum vaginatum* is by far the most vigorous species. Occasionally, the large shrub *Olearia axillaris* (Coast daisy bush) is present on the upper part of the foredune.

Stable dune vegetation

A number of plant communities are generally associated with the coastal stable dunes of south-western Australia (Bridgewater and Zammit 1979; Trudgen 1984; Cresswell and Bridgewater 1985). While it is beyond the scope of this work to describe those on the western end of the Nullaki Peninsula, the stable dune vegetation is nonetheless relevant to this study. This is because, as sand accretes on both sides of the bar, coastal dune vegetation is slowly replacing the bar plant communities (see Section 6.2). The coastal dune vegetation occurs in areas which are never inundated by floodwaters, but may be slightly swampy in character due to groundwater seepage (see Fig. 5.1).

Stable dune vegetation either side of the bar mainly consists of low, closed forest and tall heaths of the small tree *Agonis flexuosa* (Western Australian peppermint), the tall shrubs *Acacia cyclops* (Coast wattle), *A. littorea*, *Spyridium globulosum* (Basket bush), *Olearia axillaris* and *Hibbertia cuneiformis* (Cut leaf Hibbertia), and the shrubs *Leucopogon parviflorus* (Coast bear bush) and *Acrotriche cordata* (Coast ground berry). In the depressions between dunes, the small tree *Melaleuca lanceolata* (Rottnest tea tree) and the large shrubs *Olax phyllanthi*, *Acacia cyclops* and *Hakea oleifolia*, the small sedge *Isolepis nodosa* and the large sedge *Lepidoperma gladiatum* (Coastal sword sedge) are common. In low lying areas, the introduced buffalo grass (*Stenotaphrum secundatum*) is found infesting the natural vegetation.

Isolepis nodosa - Paspalum vaginatum open sedgeland community

This plant community is responsible for much of the colonisation of the delta and is today found in areas which are occasionally inundated (Fig. 5.1). It consists of tufts or bands of the medium to low sedge *Isolepis nodosa* and the rhizomatous or creeping grass *Paspalum vaginatum* (Water couch). As *P. vaginatum* is introduced, this community is not a natural one. Other species present include the sedge *Baumea juncea* (Twig rush) the rush *Juncus kraussii* (Shore rush) and the herb *Samolus repens* (Creeping brookweed). Occasionally, *Acacia cyclops* is present as scattered shrubs.

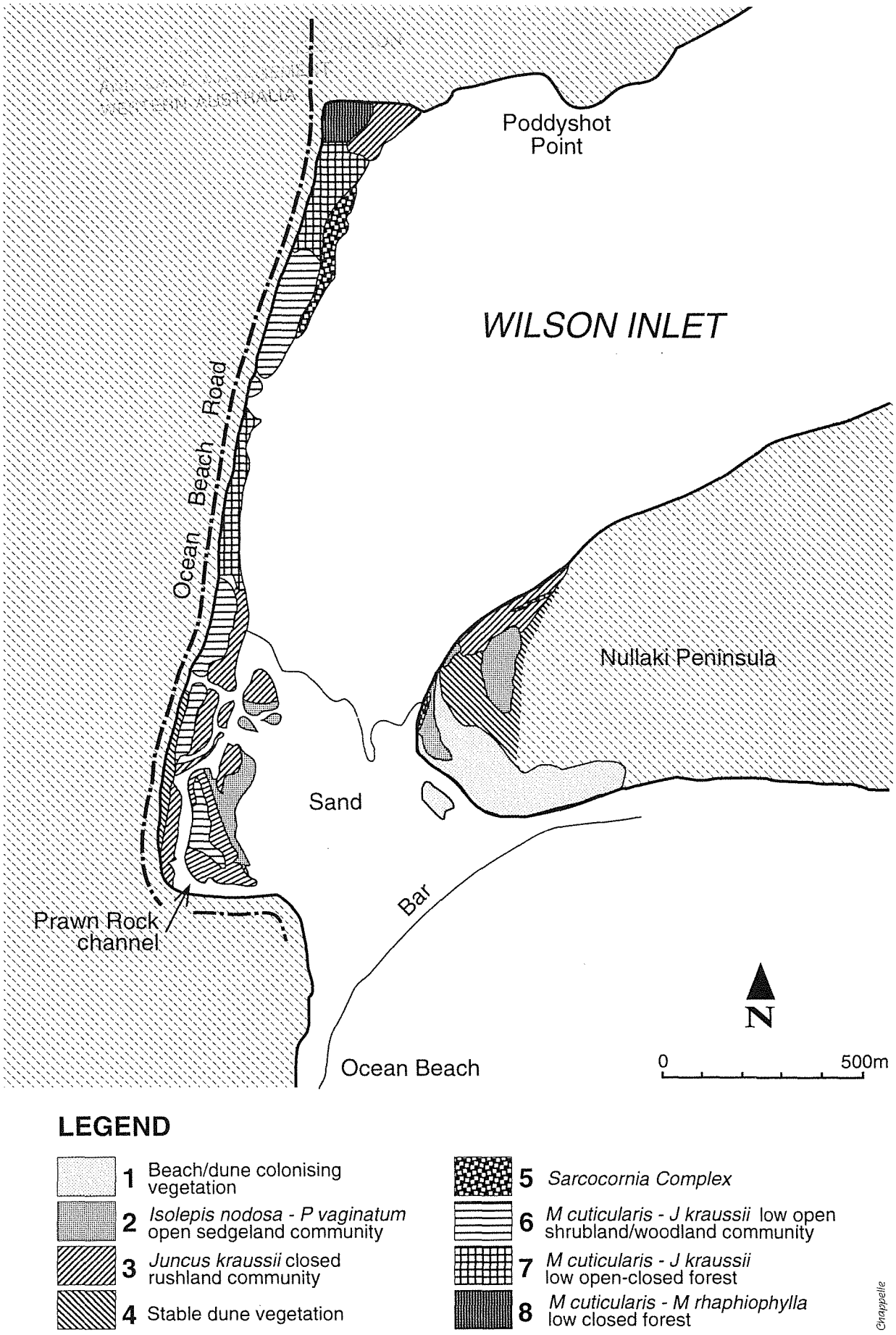


Figure 5.1 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1991.

5.2 Salt-marsh vegetation

***Juncus kraussii* closed rushland community**

The medium sized rush, *Juncus kraussii,* forms broad bands of closed rushland either side of the Prawn Rock Channel, on the northern tip of the Nullaki Peninsula and west of Poddyshot Point, in areas which are regularly inundated by tidal waters when the Inlet is connected to the ocean (see Fig. 5.1).

Other native species present include the sprawling herbs *Apium prostratum* (Sea celery) and *Lobelia alata* (Angled lobelia). *Isolepis nodosa* and the tall sedge *Gahnia trifida* (Common saw sedge) are often found fringing the edges of this community. Stunted stands of *Melaleuca cuticularis* (Salt-water paperbark) are very occasional. As with most of the delta vegetation, this community is infested with *P. vaginatum*, but mostly only in areas that have been recently colonised, disturbed by vehicles or mown to enable access.

***Sarcocornia quinqueflora* low closed herbland complex**

Small stands of samphire marsh dominated by *Sarcocornia quinqueflora* are present on the northern tip of the Nullaki Peninsula and along the beach west of Poddyshot Point (Fig. 5.1). Other species which constitute the herbland include *Samolus repens*, *Apium prostratum*, *J. kraussii*, *Atriplex hypoleuca* and *A. prostrata*. *Paspalum vaginatum* is found infesting the Peninsula stands of samphire.

5.3 Estuarine fringing forest and shrubland

Where freshwater seepage from the land reduces soil salinity, the small paperbark trees *Melaleuca cuticularis* and *M. rhaphiophylla* (swamp paperbark) can form communities with *Juncus kraussii* in areas regularly inundated by tidal waters. On Wilson Inlet, from Poddyshot Point to the bar, *M. cuticularis (*the more salt-tolerant species) is dominant (see Fig. 5.1).

***Melaleuca cuticularis* - *Melaleuca rhaphiophylla* low closed forest**

Both paperbark species form a closed forest on a small area to the west of Poddyshot Point Point (Fig. 5.1). Here freshwater seepage is particularly strong, enabling *Melaleuca rhaphiophylla*, the less salt-tolerant of the two paperbarks, to join *M. cuticularis* and *Juncus kraussii.*

***Melaleuca cuticularis* - *Juncus kraussii* open-closed forest**

This community essentially consists of the small tree *Melaleuca cuticularis* over the rush *Juncus kraussii.* The most common understorey species is the mat grass *Sporobolus virginicus* (Salt water couch). Other understorey species include *I. nodosa*, *G. trifida*, *Samolus repens* and *junceus* (see Fig. 5.1).

***Melaleuca cuticularis* - *Juncus kraussii* open low shrubland/woodland**

Stunted trees of *M. cuticularis* form an open shrubland with *Juncus kraussii* on the large island which lies on the bar side of the Prawn Rock Channel (Fig. 5.1). Other understorey species are as for the *Juncus kraussii* community (see Section 5.2).

Where *M. cuticularis* trees are dying along Ocean Beach Road (see Section 6.3), the overstorey of trees becomes very open and the community is more accurately described as a low woodland (Fig. 5.1).

This woodland community represents a senescing form of the open-closed forest community described above. The mat grass *Sporobolus virginicus* and the herb *Samolus junceus* are particularly abundant in the understorey.

6. Vegetation Changes Since 1946

6.1 Bar colonisation

In 1946 the Wilson Inlet bar was essentially free of terrestrial vegetation (see Fig. 6.1). From the vegetated western tip of the Nullaki Peninsula the bar extended, in a south-westerly direction, to the landward vegetated bank of the Prawn Rock Channel for about 880 m. In 1991 that part of the sand bar free of perennial vegetation, along this same line, had been reduced to 500 m (Fig. 5.1). Over 45 years, vegetation has colonised large areas on both sides of the bar.

Between 1946 and 1957 there was a minor increase in the extent of vegetation on the western side of the bar, but on the Nullaki Peninsula vegetation had moved between 50 m and 100 m across the bar from its earlier extent (Fig. 6.2), having colonisied about 2 ha. Aerial photographs from 1957 were not of sufficient quality to enable the recognition of plant communities which had colonised the bar, but estuarine fringing vegetation appears to have colonised mudflats on the sheltered Inlet side, while beach and dunal vegetation colonised the foredune on the ocean side.

Further colonisation at the tip of the Nullaki Peninsula between 1957 and 1965 was only minor. However, on the western side a large island of vegetation had formed on the bar side of the Prawn Rock Channel over an area of about 2.5 ha (Fig. 6.3). The vegetation along Ocean Beach Road had also encroached tens of metres upon the delta over a distance of about 500 m (Fig. 6.3). Colonisation of the bar in these areas has basically continued through to the present day (compare Figs 6.4 to 5.1 and 6.7), the vegetation having moved across the bar between 20 m and 200 m over a front of 800 m on the western side and between 120 m and 230 m over a 500 m front on the eastern side.

The total area colonised between 1946 and 1991 was about 18 ha, representing about 30 % of that area of the bar which is generally exposed over the summer period.

6.2 Plant community succession

The recent growth of fringing vegetation at the mouth of Wilson Inlet could be a response to reduced levels of inundation by tidal waters and floodwaters on the higher parts of the bar. Sediment build-up in areas of the bar close to the entrance channel, as identified by Hesp (1993), would be the main cause of this, but reduced flood levels as result of the early breaching of the bar would also be a factor.

The main pioneering plant community on the delta is the *Isolepis nodosa - Paspalum vaginatum* open sedgeland community. However, it is not known when the introduced *P. vaginatum* became active on the bar. In the more inundated areas, this community appears to have been replaced by *J. kraussii* closed rushland. This in turn has been replaced in some areas by fringing forest as *Melaleuca cuticularis* grew out over the rushland. In recent years the *Melaleucas* have begun to die back (see Section 6.3).

At the tip of the Nullaki Peninsula, pioneering dunal vegetation has become established on the foredune as it has grown westwards (Hesp 1993). In turn this vegetation has slowly been replaced by species associated with stable dunes (see Section 5.1). This means, in effect, that the Nullaki Peninsula, along with its vegetation, is prograding westwards upon the bar (Hesp 1993).

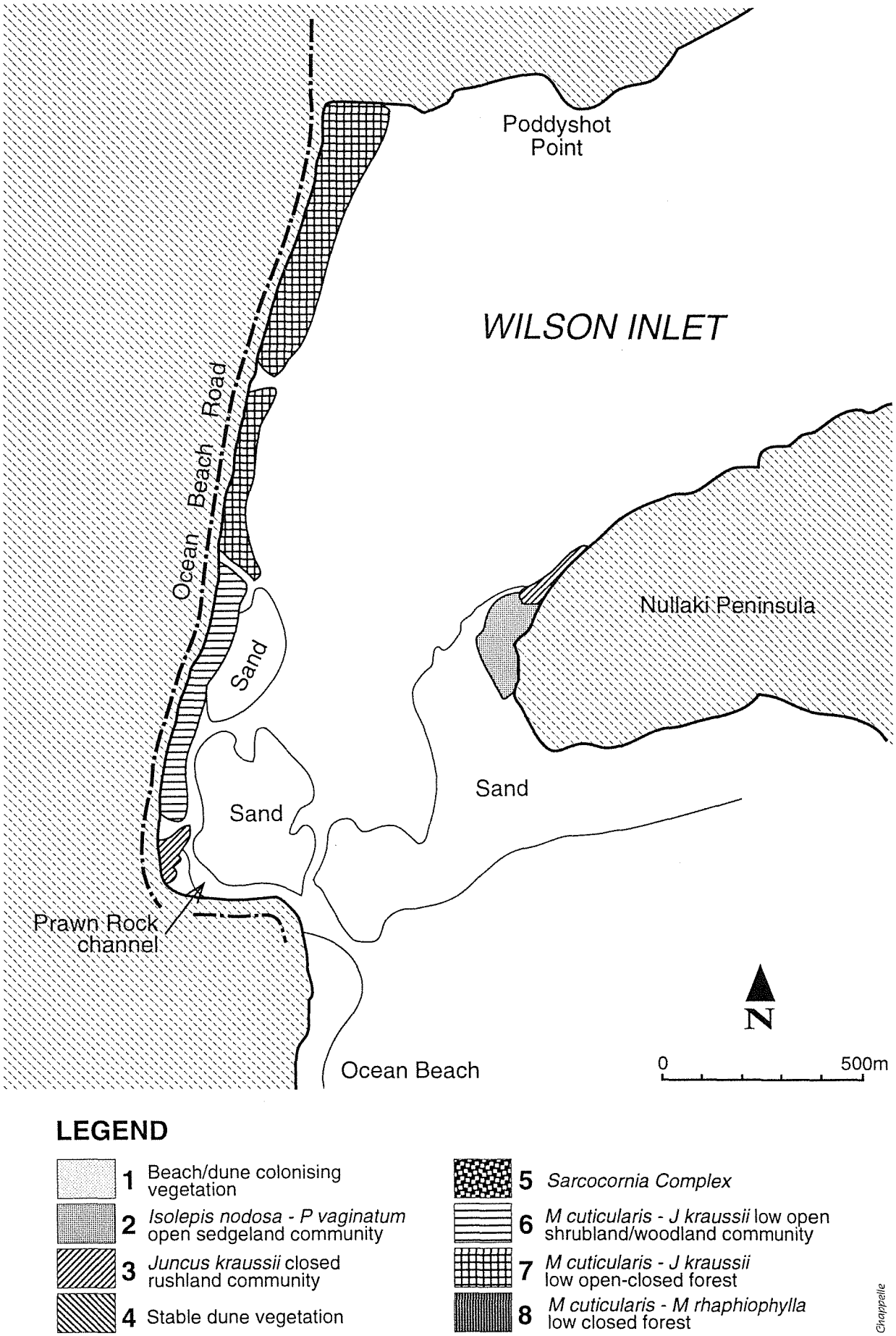


Figure 6.1 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1946.

Furthermore, minor foredunes have formed on the large island adjacent to the Prawn Rock Channel (Hesp 1993), approximately between the rushland and open sedgeland (see Fig. 5.1), and dunal species, namely *Agonis flexuosa* and *Olearia axillaris*, are becoming established.

6.3 Decline and growth of *Melaleuca cuticularis*

Along Ocean Beach Road large numbers of mature trees of *Melaleuca cuticularis* have died in recent years. The probable cause is a reduction in freshwater seepage from the land caused by the compacted road bed which runs along this part of the Inlet. It is likely that *M. cuticularis* requires some relief from high salinity during the year and that many of the trees along Ocean Beach Road had come to depend on a level of freshwater seepage which was greatly reduced when the roadway was upgraded. Similar die-offs of *M. cuticularis* have been observed along the Leschenault Inlet near Bunbury (Pen 1992) following road construction and on Oyster Harbour following alterations to local drainage (Pen In prep.).

Contrasting with the death of many trees along the western foreshore of the study area is the growth of stunted *M. cuticularis* on the island east of the Prawn Rock Channel. These stunted trees or large shrubs first appeared in the mid-1980s and in the years since have formed a low open shrubland with *Juncus kraussii* over about 20% of the island. The presence of many young plants in and about the stand of mature plants indicates that the community is regenerating and spreading. The stunted nature of the trees is probably a response to the dry, saline conditions which persist over summer and autumn when the bar is closed.

A respite from these conditions in winter and spring, when the bar recieves an input of fresh water from heavy rains and the flooding rivers, is probably all that is needed to make this stand of stunted trees viable in the long term.

6.4 Accretion and erosion of the delta

In 1946 the entire flood tide delta at the mouth of Wilson Inlet was active; that is sedimentation could be seen to be occurring from the ocean to Poddyshot Point (Hesp 1993). However, by 1985 the active area of the bar was reduced to the entrance region, about one third to one quarter of the delta.

Hesp (1993) hypothesised that, as a result of the lower artificial openings of the bar, either the transport of sediment into the mouth of the Inlet was decreasing or it remained the same but was now building up the seaward portion of the delta and thus closing up the mouth of the Inlet.

The growth of most of the vegetation on the bar by estuarine fringing vegetation is almost certainly in response to stabilisation and/or the build-up of sediment, as areas subject to a moderate level of inundation by tides and floodwaters become available for colonisation. The vegetation is most probably accelerating the capture of wind blown sand and significantly retarding erosion, especially when the bar is breached and scouring is at a maximum. This explains the ongoing formation of marsh islands and low foredunes on the western side of the bar behind Wilson Head to this day (see Hesp 1993).

On the eastern side of the bar the Nullaki Peninsula is prograding westwards mainly via foredune formation, with marsh areas forming in sheltered areas behind the dune (see Hesp 1993).

This process may be viewed as the Peninsula dune encroaching upon the bar, rather than as delta build-up as is occuring on the western side. In recent years the extent of this encroachment has been limited by eastern openings. Figure 6.7 shows two islands of vegetation west of the Peninsula in 1986, the western one of which is absent in 1991 (Fig. 5.1). These two islands had formed on two sandy knolls after 1975 and were still present in 1989 following a series of mainly western openings and only two slightly east of centre openings (Fig. 6.7).

However, in 1990 and 1991 the bar was breached on the extreme eastern side, washing away the entire western island and about half of the larger eastern island. If not for these two eastern openings the Nullaki Peninsula would extend a further 100 m to the west than it does today.

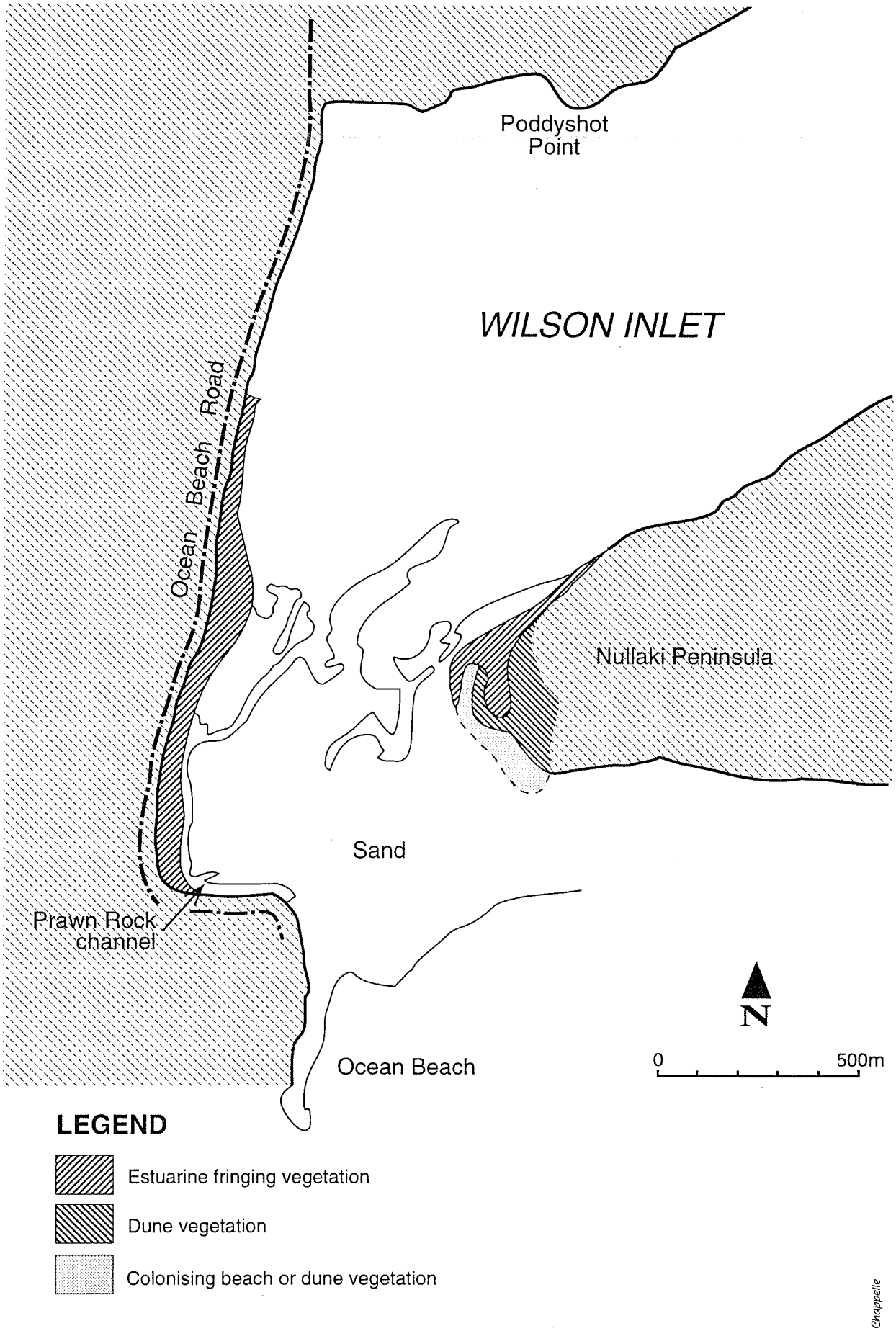
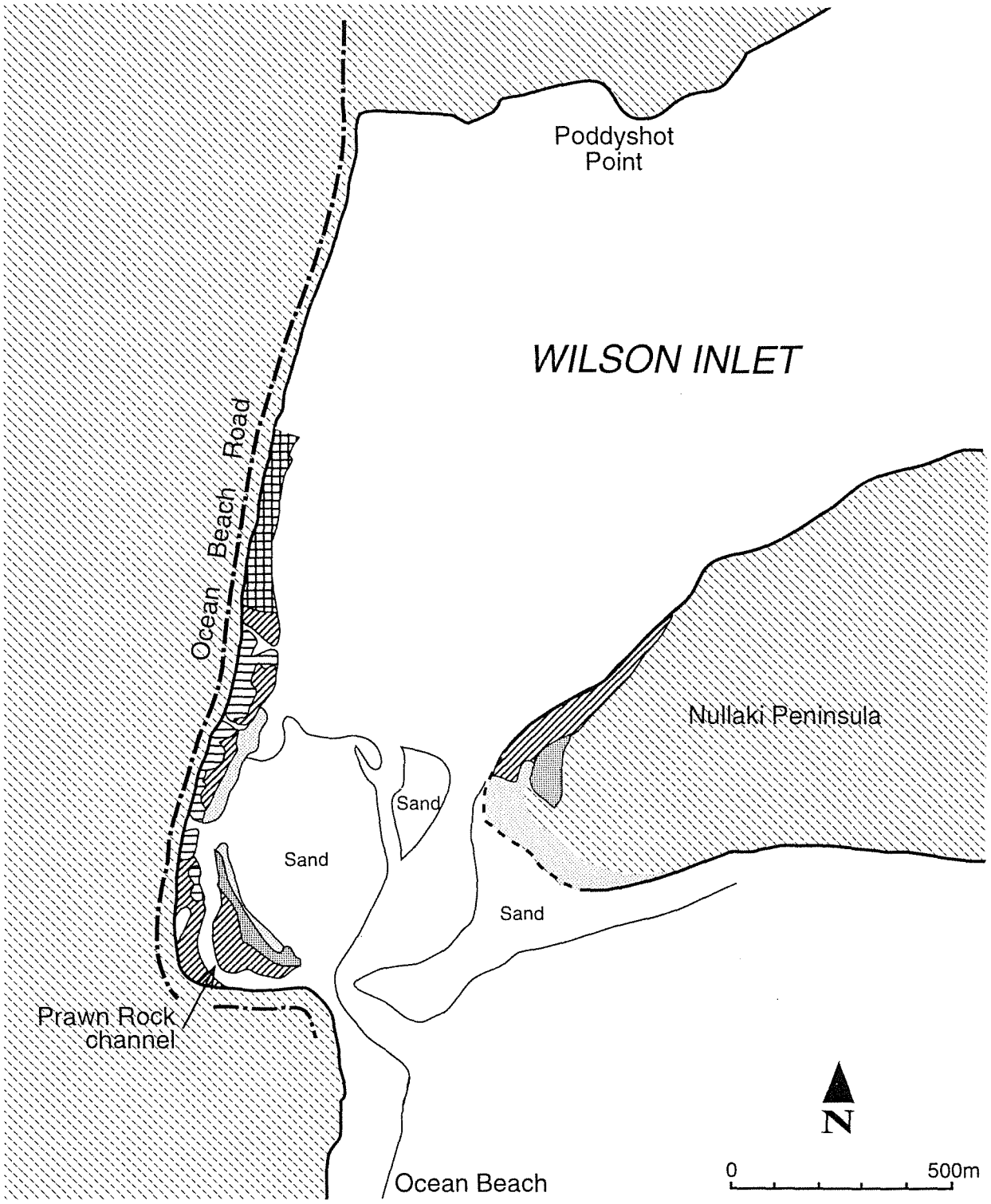


Figure 6.2 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1957.



LEGEND

1 Beach/dune colonising vegetation

2 *Isolepis nodosa - P vaginatum* open sedgeland community

3 *Juncus kraussii* closed rushland community

4 Stable dune vegetation

5 *Sarcocornia Complex*

6 *M cuticularis - J kraussii* low open shrubland/woodland community

7 *M cuticularis - J kraussii* low open-closed forest

8 *M cuticularis - M rhaphiophylla* low closed forest

Chappelle

Figure 6.3 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1965.

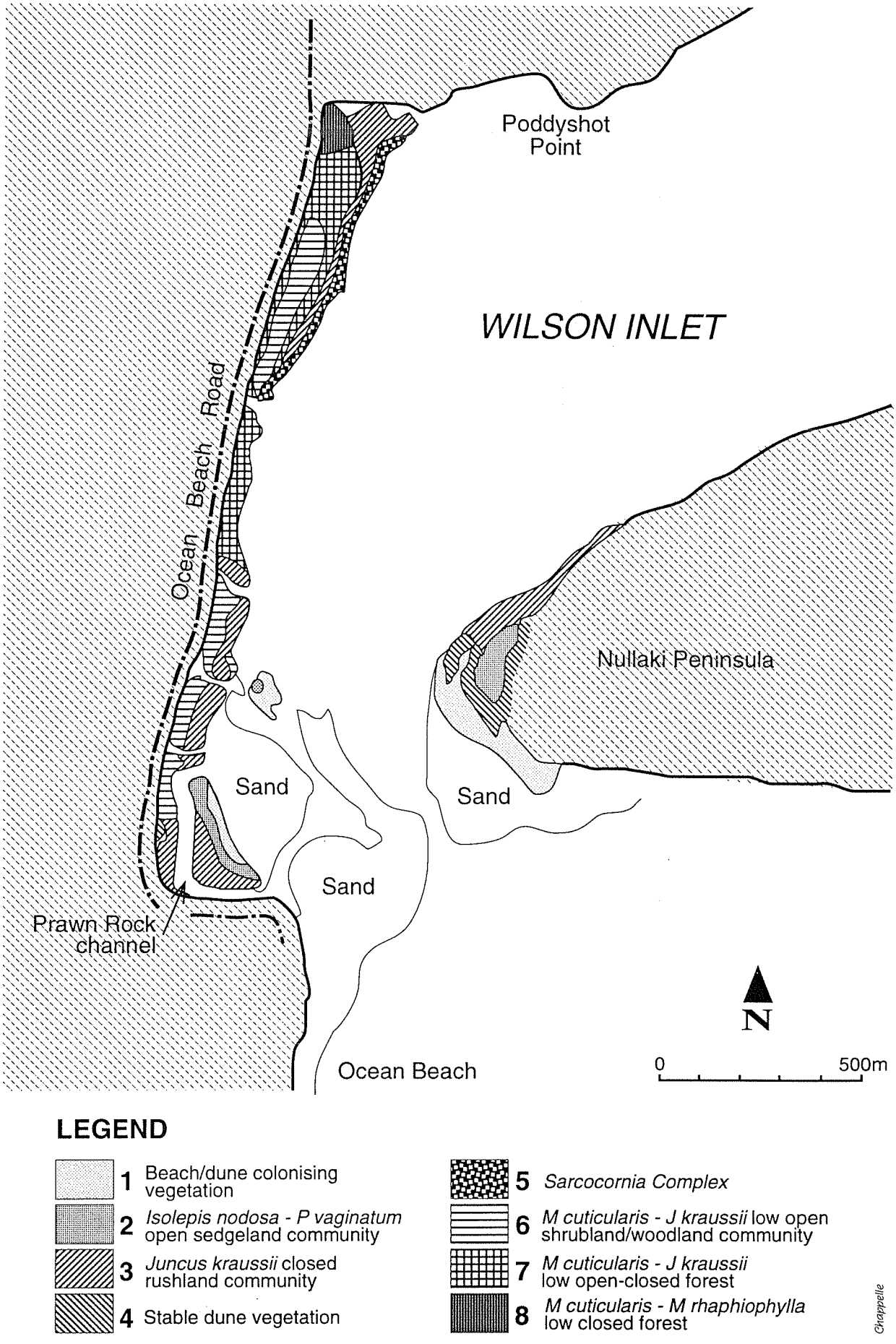
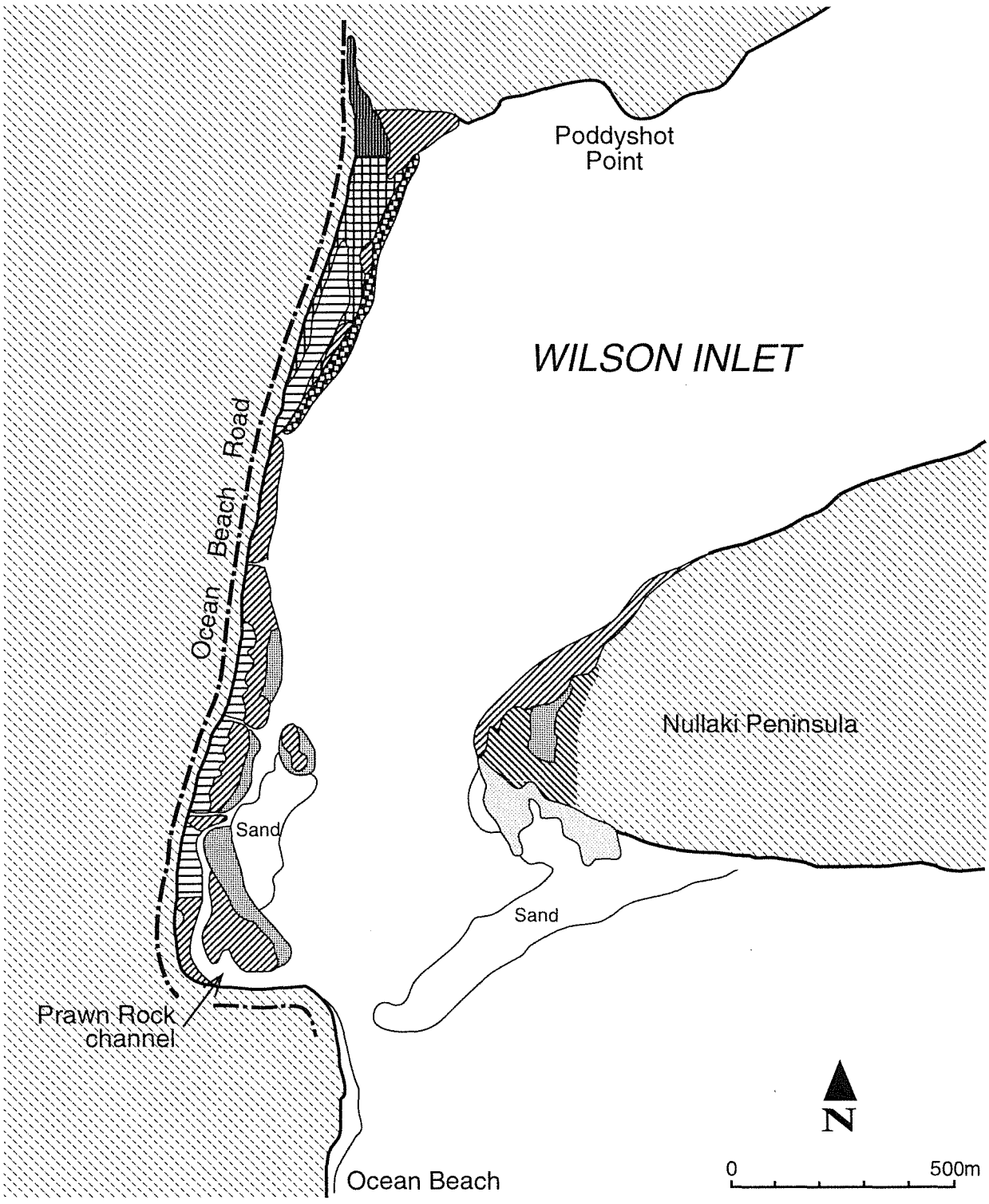


Figure 6.4 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1971.



LEGEND

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7 *M cuticularis - J kraussii* low open-closed forest

8 *M cuticularis - M rhaphiophylla* low closed forest

Chappelle

Figure 6.5 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1975.

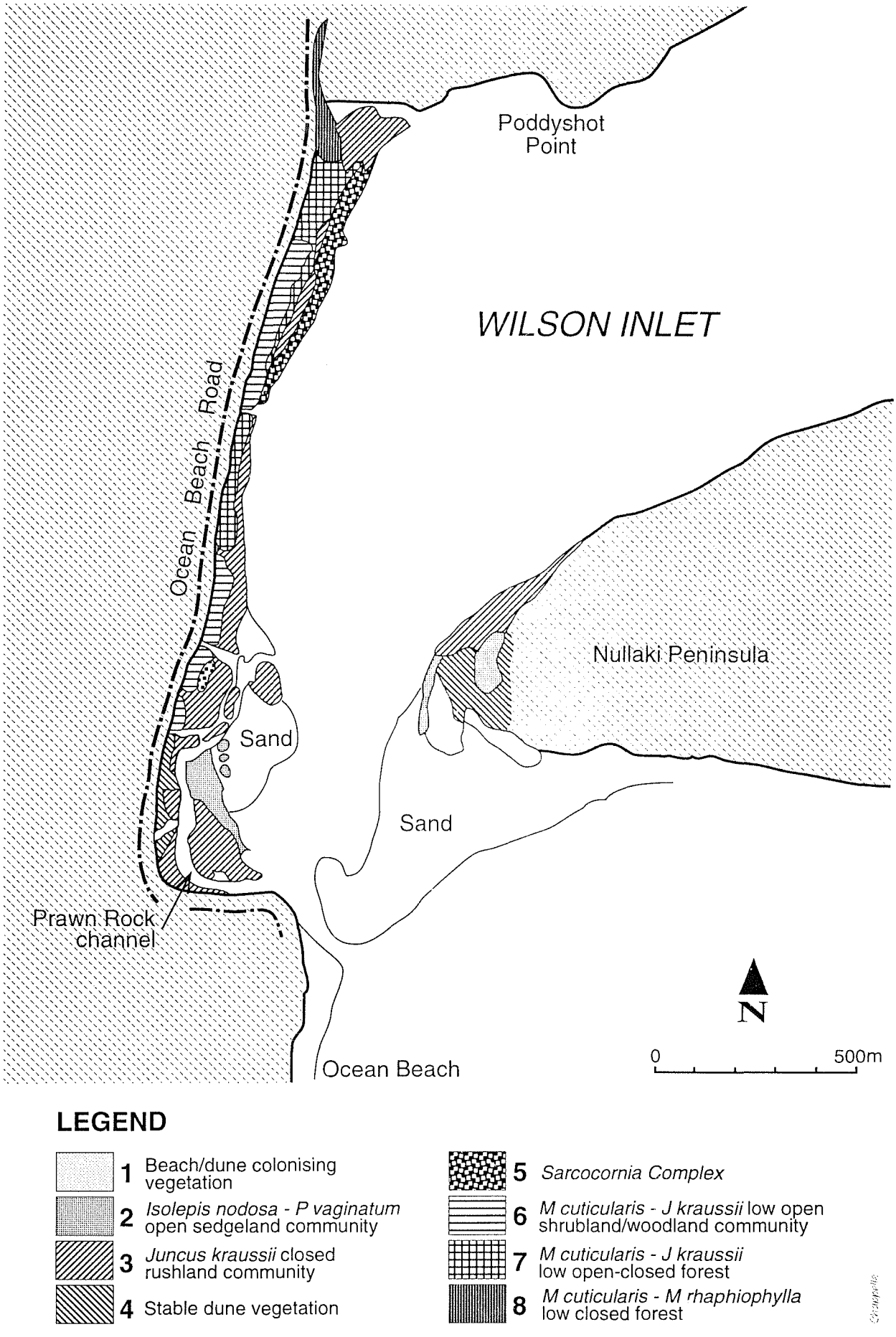

Figure 6.6 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1981.

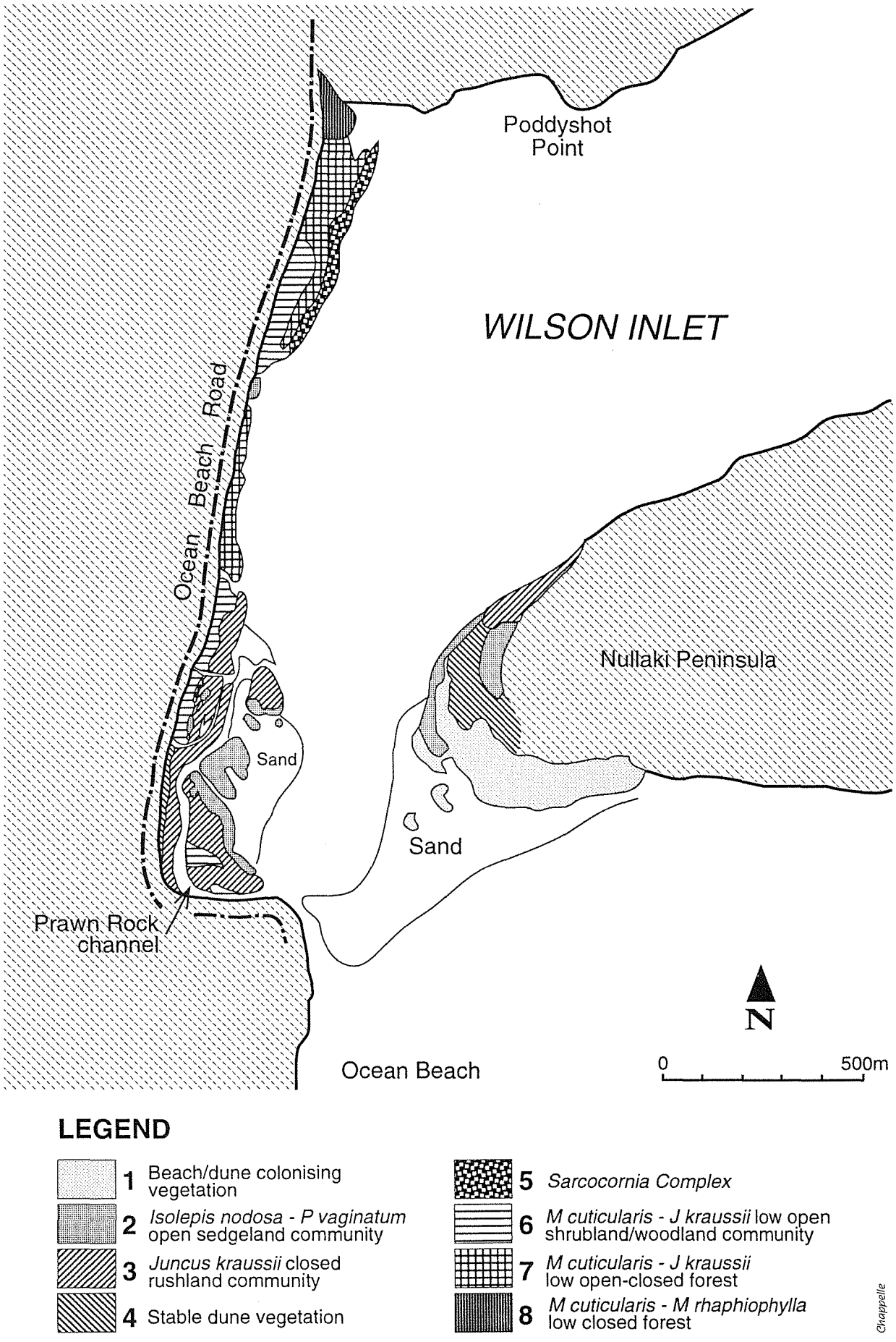

Figure 6.7 : The distribution of fringing plant communities at the mouth of the Wilson Inlet in 1986.

7. Weed Infestations

The predominant weed on the Wilson Inlet delta is the creeping grass *Paspalum vaginatum*. It infests most plant communities in the study area and along with the native sedge, *Isolepis nodosa*, it is the most vigorous and abundant species now colonising the bar, mainly on the western side (see Section 5.1). Undoubtably, this species has increased, at least recently, the rate at which the bar has become colonised by vegetation.

Two other introduced species, the low annual herbs *Cakali maritima* and *Arctotheca populifolium*, appear to have occupied a niche on the bar hitherto vacant of native plant species. This is the exposed foredune area above the beach and other unstable sandy areas not subject to inundation. Both species are very quick to colonise the bar over winter and spring, but despite this, play no role in the long-term colonisation and consolidation by vegetation, as they are easily washed away in summer and autumn storms or when the bar is breached in winter.

8. Discussion: The Future

The encroachment upon the delta of fringing and foredune vegetation is continuing today and is ultimately only limited by the extent of scouring when the bar is open, especially during the first few days following the initial breach. By examining aerial photographs after 1985 it is possible to recognise those areas of the delta which are building up and may be sufficiently stable to support vegetation under the current regime. Figure 8.1 shows the possible long term extent of marsh and foredune encroachment for both eastern and western openings.

It suggests that a further 5 ha to 10 ha may be colonised under western openings as opposed to 10 ha to 15 ha under eastern openings.

Whatever is the case, at least 50% of the delta may one day either be colonised by fringing vegetation or be replaced by vegetated dune. Furthermore, under exclusively eastern openings the width of the Inlet mouth at its narrowest point may be only 200 m and along the ocean beach about 400 m.

The occasional eastern openings over the last two decades appear to have kept the mouth of Wilson Inlet wider than it would have otherwise been by eroding the western growth of the Nullaki Peninsula. In the absence of eastern openings, the Nullaki Peninsula may continue to grow and the delta width be reduced to as little as 300 m compared with the 1946 width of 700 m.

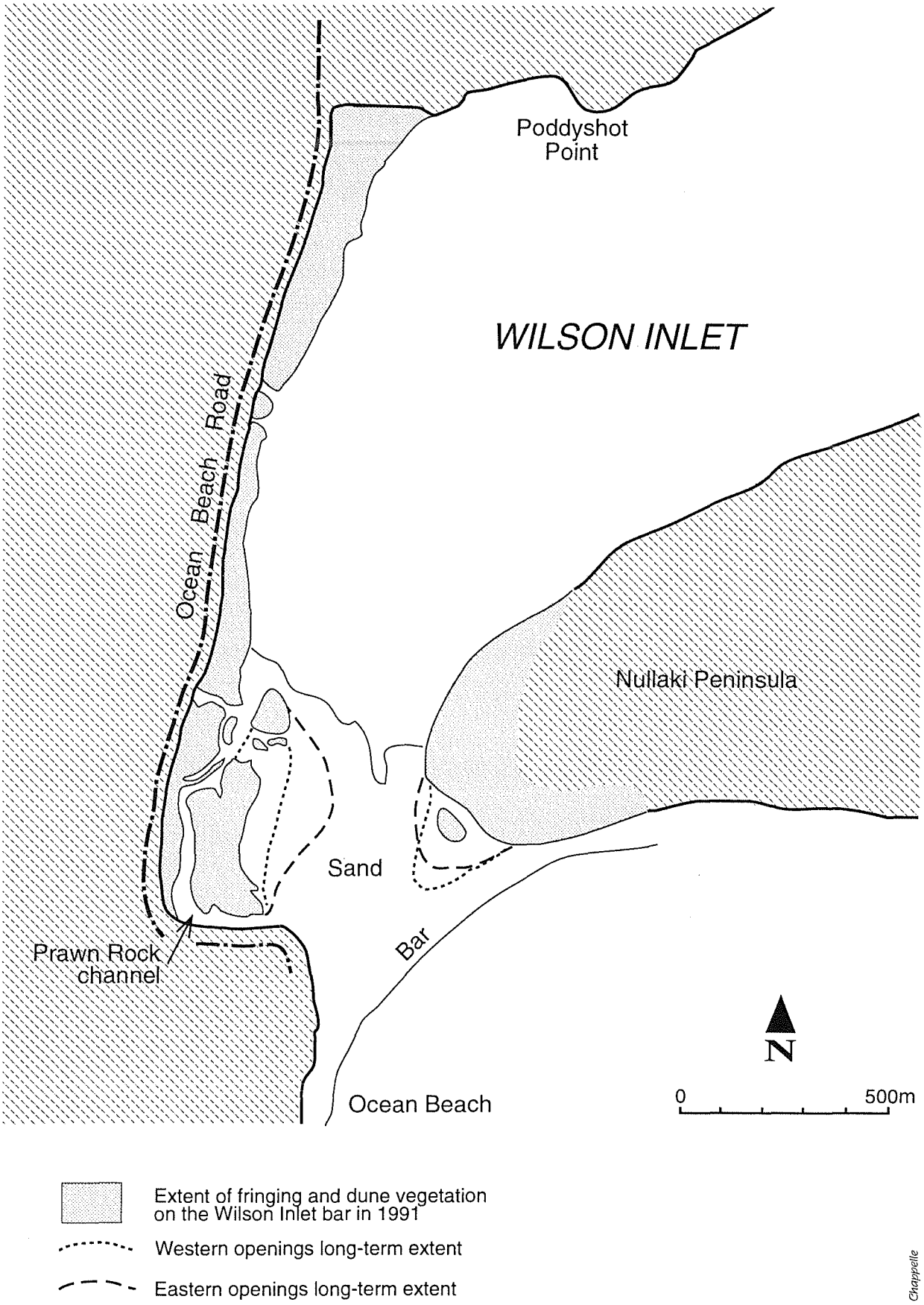

Figure 8.1 : The possible long-term extent of marsh and foredune encroachment upon the Wilson Inlet bar for either western or eastern openings under the current low level opening regime.

9. Management

Tree death. The death of *Melaleuca cuticularis* on the Inlet side of Ocean Beach Road could possibly be reduced by placing more culverts under the road, thereby enabling the passage of more fresh groundwater through the foreshore. This would reduce salinity and possibly decrease the level of stress on the trees. Alternatively, a level of tree decline could be accepted as the plant communities adjust to changing conditions. Indeed, less trees may be preferred to maintain the view of the Inlet from the road.

Extent of vegetation. The present general extent of vegetation on the bar is determined by the current low opening regime. Should this regime be terminated in favour of a higher, more "natural" opening, most if not all of the vegetation on the bar would very likely be killed through increased levels of flooding and erosion.

While none of the plant communities on the bar are worthy of special protection, the loss of the vegetation would have implications for the stability of the Prawn Rock Channel which has local and regional recreational significance (Prince 1994).

Weeds. The weed species on the bar do not represent a serious problem. They complement rather than degrade the plant communities on the bar and mainly occupy an early pioneering niche on bare wet substrate or foredune. However, their vigour in these zones needs to be taken into account when considering the long-term management of the bar.

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APPENDICES

Appendix 1

Details of aerial photographs used to map the plant communities and document vegetation changes on the Wilson Inlet delta.

1946 Parry Inlet 23.3.1946

SVY69 Run 1 Nos A6726 - A6729

1957 Photographic mosaic of unknown aerial photographs taken in 1957. Copy lodged with the Albany Office of the Water Authority of Western Australia.

1965 Coastline Kalbarri-Israelite Bay 7920' 10.12.1965 Proj. E51

WA940 Nos 5182 - 5184

1971 Kalbarri-Israelite Bay (Wilson Inlet) 7920' 20.1.1971 Proj. L34

WA1307 Nos 5195 - 5196

1975 Coast Run Kalbarri to Israelite Bay Scale 1:15,000 28.11.1975 Proj. Q.101

WA1594 Nos 5276 - 5277

1981 Coast Run Kalbarri to Israelite Bay Scale 1:15,000 28.11.1975 Job no. 800084

WA1994 Nos 5128 - 5129

1985 Coastline (Cape Leeuwin - Albany) Scale 1:25,000 26.11.1985 Job no. 850211

WA2366(c) Run 2 Nos 5134 - 5136

1986 Coastline Kalbarri - Israelite Bay (Cliffy Head-Albany) 1:15,000 1.1.1986 Job no. 850147

WA2376 Nos 5072 - 5073

1987 Southern Forest Region 1:25,000 8.3.1987 Job no. 850195

WA2492 Run 35 Nos 5063 - 5066

1989 Albany and Denmark Areas 1:20,000 27.3.1989 Job no. 880249 (Colour)

WA2714(c) Run 6 Nos 5090 - 5091

1991 Wilson Inlet 1:20,000 28.1.1991 Job no. 900572 (Colour)

WA2949(c) Run 4 Nos 5025 - 5028

Appendix 2

Scientific names, common names and short descriptions of the fringing plant species found on the Wilson Inlet delta.

Scientific Name	Common Name	Plant Form
Acacia cyclops	Coastal wattle	large shrub
Acacia littorea		large shrub
Acrotriche cordata	Coast ground berry	medium erect shrub
Agonis flexuosa	WA peppermint	small tree
Apium prostratum	Sea celery	sprawling herb
**Arctotheca populifolia*	Dune Arctotheca	decumbent herb
Atriplex hypoleuca		undershrub
**Atriplex prostrata*		prostrate herb
Baumea juncea	Twig rush	medium sedge
**Cakali maritima*	Sea rocket	annual herb
**Carpobrotus edulis*	Pigface	prostrate herb
Centella cordifolia		prostrate herb
**Cynodon dactylon*	Couch	creeping grass
**Euphorbia terracina*	False caper	erect herb
Gahnia trifida	Common saw sedge	tall sedge
Hakea oleifolia		
Hibbertia cuneiformis	Cut-leaf Hibbertia	tall shrub
Isolepis nodosa	Knotted club-rush	medium sedge
Juncus kraussii	Shore rush	medium rush
**Lagurus ovatus*	Pussy's tail	annual grass
Lobelia alata	Angled Lobelia	herb
Lepidosperma gladiatum	Coastal sword sedge	tall sedge
Leucopogon parviflorus	Coast bear bush	shrub
Melaleuca cuticularis	Salt-water paperbark	small tree
Melaleuca lanceolata	Rottnest tea tree	small tree
Melaleuca rhaphiophylla	Swamp paperbark	small tree
Olax phyllanthi		tall shrub
Olearia axillaris	Coast daisy bush	large shrub
Oxylobium lanceolatum	Green bush	large shrub/small tree

**Paspalum vaginatum*	Water couch	creeping grass
**Pelargonium capitatum*	Rose Pelargonium	shrub
Rhagodia baccata	Sea berry saltbush	tall shrub
Samolus junceus		erect herb
Samolus repens	Creeping brookweed	small herb
Sarcocornia quinqueflora	Samphire	decumbent shrub
Spinifex hirsutus	Hairy Spinifex	creeping grass
Spinifex longifolius		creeping grass
Sporobolus virginicus	Saltwater couch	creeping grass
Spyridium globulosum	Basket bush	large shrub
Stenotaphrum secundatum	Buffalo grass	creeping grass

* Denotes exotic species

Description of Plant Form

Size	Scale
small tree	< 10 m
medium tree	10 - 30 m
large tree	> 30 m
small shrub	<0.25 m
shrub (medium)	0.25 - 2 m
large shrub	> 2 m
herb	0.25 - 1 m
small herb	0.1 - 0.25 m
tiny herb	< 0.1 m
small sedge	< 0.5 m
sedge	0.5 - 1 m
tall sedge	> 1 m
rush	< 1 m
large rush	> 1 m
grass	< 1 m
tall grass	> 1 m