

Phytosociological Studies on the Salt Marshes of Tasmania

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Introduction

An island wide phytosociological investigation of Tasmanian salt marshes has not been carried out. Earlier studies by Bridgewater (1982), Adam (1981), as well as Harris and Kirkpatrick (1997), comprise selected salt marsh areas of Tasmania. Therefore, little is known about plant sociological significance of communities compared with those on the Australian mainland, as well as geographical variation and species occurrence. In addition, the native salt marsh communities are affected by introduced species such as *Plantago coronopus* or *Spartina anglica*, which can replace or alter natural processes. Besides, there is an increasing pressure on coastal areas and many salt marshes have been either destroyed or heavily modified. However, some 21% of the recorded plant species within the salt marshes of Tasmania are naturalised, whereas 79% belong to native plants. Consequently, the portion of naturalised species is much less than in the salt marshes of New Zealand, where some 49% of the recorded plant species are introduced (Haacks and Thannheiser 2003). Last but not least, there is the aspect of nature conservation. In order to protect the uniqueness of native salt marshes it is important to know as much as possible about the communities and succession within them.

Study Site and Methods

Physiographical overview

Tasmania was linked to the Australian mainland until the late Oligocene or early Miocene. Due to uplift and downwarping, as well as Quaternary sea-level change, Tasmania has been separated from the mainland several times since then. Towards the close of the Pleistocene (13 500 - 12 000 years BP), the 200 km wide Bass Strait re-formed and isolated Tasmania with an area of 67 895 km² from the mainland (Scanlon et al., 1990). Tectonic depression has resulted in a ria coastline, about half of which is sandy. In general, depositional plains at the coast are narrow (Williams 1974). Some 3% of the Tasmanian coastline comprises bays, lagoons, and estuaries or is sheltered behind islands. In these areas, fine marine sediments accumulate, a precondition for the development of salt marshes. Limiting factors to the development and extent of salt marshes include: lack of a wide submarine tidal flat, small amounts of fine material, and low tidal range. Soil profiles in coastal areas show a characteristic lamination: clay and sand layers alternating with humus (Kelletat 1994). The large amounts of sandy material within Tasmanian salt marshes is remarkable. However, large tracts of salt marsh vegetation are rare in Tasmania. There are fewer than 100 registered areas of coastal salt marsh larger than 1 ha. On the north coast there are only four sites: Stanley, Port Sorell, Tamar River Estuary, and Bridport. On the east and south-east coasts, large areas of salt marsh are much more common. Due to geomorphological conditions (cliffs), much of the west and south coast is not appropriate for the development of salt marshes and supports only fragmentary halophytic vegetation.

The climate of Tasmania is Humid-Temperate (following Köppen 1936). On the west coast, annual precipitation reaches 1 300 mm, with the maximum during winter, whereas on the east coast annual rainfall is less (1 000 mm) and equally distributed over the year (State of the Environment Tasmania 1996). On the north and northeast coasts, average annual precipitation of 600 mm and 782 mm, respectively, has been recorded (Harris and Kirkpatrick 1997). The climatic contrasts between east and west coasts are related to the extensive ocean fetch to the west and prevailing westerly winds. There are high rainfalls in the western Tasmanian ranges due to orographic effects with a consequent rainshadow effect in the east. There is no well-defined seasonality in rainfall, high average amounts occurring throughout the island in each month (Williams 1974). The coolest areas are the large central and smaller north-eastern plateaux, whereas the warmest areas are found along the coastline (Williams 1974). The cool Antarctic Current flows along the

west coast while the East-Australian Current conveys warm water from tropical latitudes to the Tasmanian east coast throughout the year. Although growth of halophytic plants - as an azonal vegetation type (Schroeder 1998) - is not limited by climate (Adam 1990), it is greater on the east coast by the warm East-Australian Current. Furthermore, ocean currents are an important factor in spreading salt marsh species. For an example, *Euphorbia paralias* became established on Tasmanian coasts in the 1980s. Today, it is a common driftline plant on the north coast and is spreading southwards along the west coast. Seeds and fruits of *Euphorbia paralias* are carried by the East-Australian Current which occasionally enters Bass Strait and may even reach the northeast coast (Harris and Kirkpatrick 1997).

The flora of Tasmania

Tasmania is part of the Australian floristic kingdom. Much of the area is in the Tasmanian floristic region, while the northwest and northeast have been assigned to the Victorian floristic region (Kirkpatrick 1993). Repeated landlinks between Tasmania and the South-East-Australian mainland have permitted floristic and faunistic interchange. Overall, phytogeographical affinities are high with the Australian mainland, but there are considerable affinities with New Zealand and South America (Williams 1974). There are no endemic plant families in Tasmania, but 7% of the genera, as well as 20% of the species, are endemic (Bureau of Flora and Fauna 1981).

Phytosociological approach

In the year 1998, the plant species of the salt marshes were recorded and classified by sampling plots following the floristic-sociological method of Braun-Blanquet (1964). The vegetation types are named after the dominant species. Altogether 150 plots were sampled. Samples were taken of all types of salt marshes. The location of the plots was chosen depending on the structure and homogeneity of the investigated plant stands. An average plot size of 9 m² was chosen. Each community is represented by a constancy table. The taxa are listed with their constancy class in each community. Constancy class + means present in less than 5% of the records, I means present in less than 20%, II present in 20-40%, III present in 40-60%, IV present in 60-80% and V in more than 80%. The nomenclature of vascular plant species follows Curtis, Curtis and Morris (1963-1994) and Buchanan (1995).

Discussed Results

Within the Tasmanian salt marshes 43 vascular species were recorded. Dune plants such as *Spinifex sericeus* which are accidentally brought into the salt marshes were not regarded. The bulk are also found on the Australian mainland and in New Zealand. Together with Victoria and the southwest coast of Western Australia, the salt marsh vegetation of Tasmania is the most diverse in Australasia (IPIECA 1994). This reflects the general phenomenon of increasing complexity and diversity of temperate salt marshes with latitude (Saenger et al., 1977). Of the naturalised species, only *Plantago coronopus* and *Spartina anglica* are capable of forming dense stands which can be regarded as plant communities. Based upon field studies within the region, 16 vegetation units could be identified by the authors. They are represented in Table 1, where 12 associations and 4 communities are united. At present, information for the 4 communities is too sparse for statements about their sociological significance. In some cases, particularly for introduced species like *Plantago coronopus*, the neutral term "community" is preferred (Thannheiser and Holland 1994). Large area differentiation in the distribution of the recognised phytocoenoses was not evident, but small area physiognomic differentiation was evident: low salt marsh (Figure 1), which resembles typical salt meadows, and salt marsh with shrubs and rushes (high salt marsh, Figure 2). The first contains 10 vegetation units that are found in all salt marshes. The second is characterised by 6 vegetation units and occurs in higher parts of the investigated salt marshes.

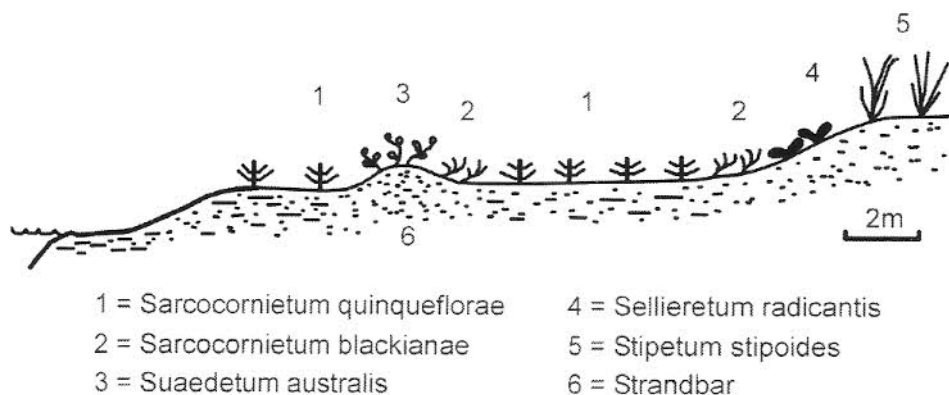


Figure 1: Diagram showing the zonation in salt marshes of Ralphs Bay (11.03.1998).

Table 1: Constancy table of vegetation units in the salt marshes of Tasmania

Number association or community	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Number of surveys	5	5	5	5	5	10	21	7	11	12	17	14	9	5	8	5	
Characteristic species of associations and communities:																	
<i>Zostera muelleri</i>	V	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ruppia polycarpa</i>
<i>Spartina anglica</i>	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Puccinellia stricta</i>	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Plantago coronopus</i>	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sarcocornia blackiana</i>	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sarcocornia quinqueflora</i>	.	.	II	II	V	III	II	IV	IV	III	IV	IV	IV	IV	IV	IV	II
<i>Distichlis distichophylla</i>	.	.	.	II	II	V	V	II	II	II	II	II	II	II	II	II	II
<i>Samolus repens</i>	V	III	III	III	III	III	III	III	II
<i>Selliera radicans</i>	II	V	II	II	II	II	II	II	II
<i>Suaeda australis</i>	II	II	II	II	II	II	II
<i>Juncus kraussii</i> ssp. <i>australis</i>	I	V	+	+	+	+	III
<i>Stipa stipoides</i>	+	+	+	+	+	+	+
<i>Gahnia filum</i>
<i>Sclerostegia arbuscula</i>
<i>Leptocarpus brownii</i>	II	II	II	II	II	II	II	II	II
Characteristic species of higher units and accompanying species:																	
<i>Disphylina crassifolia</i>	.	.	.	+	II	+	+	+	+	+	+	+	+	+	+	+	+
<i>Spergularia media</i>	.	.	II	I	I	.	.	.	.	I	+	.	.	.	.	.	I
<i>Deyeuxia cf. densa</i>	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Isolepis aucklandica</i>	.	.	.	+	+
<i>Festuca arundinaceae</i>	.	.	.	+	+
<i>Atriplex prostrata</i>
<i>Isolepis nodosa</i>
<i>Triglochin striatum</i>
<i>Linonum australe</i>
<i>Elymus farctus</i> ssp. <i>borealis</i>	+	I
<i>Juncus pauciflora</i>
<i>Cakile maritima</i>	II	.	.	.	.	.	.	.	.	.	.
<i>Chenopodium glaucum</i>	II

^a 1 = *Zosteretum muelleri*, 2 = *Ruppium polycarpae*, 3 = *Spartinetum anglicae*, 4 = *Puccinellietum strictae*, 5 = *Plantago coronopus-com.*, 6 = *Sarcocornietum blackianae*, 7 = *Sarcocornietum quinqueflorae*, 8 = *Distichlis distichophylla-com.*, 9 = *Samolietum repentis*, 10 = *Sellieretum radicans*, 11 = *Suaedetum australis*, 12 = *Juncetum kraussii*, 13 = *Stipetum stipoides*, 14 = *Gahnia filum-com.*, 15 = *Sclerostegietum arbusculae*, 16 = *Leptocarpus brownii-com.*

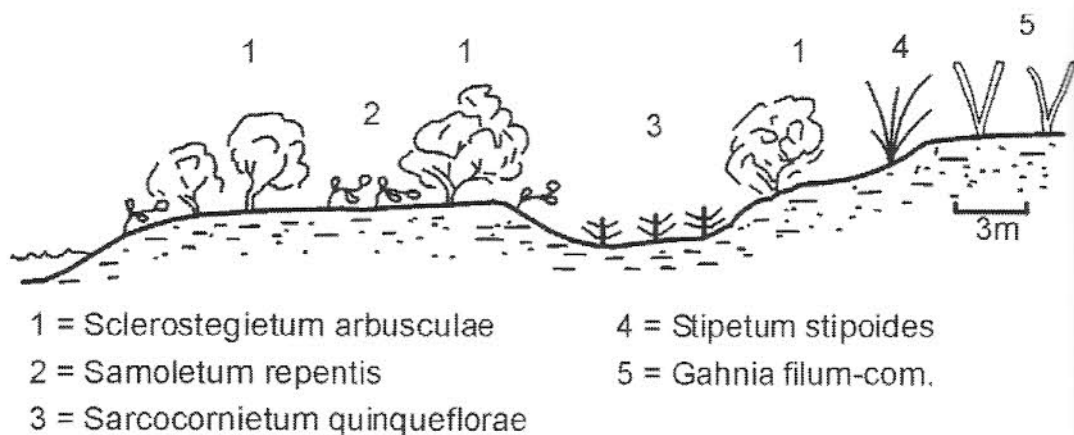


Figure 2: Diagram showing the zonation in salt marshes near Pittwater (11.03.1998).

The vegetation cover of Tasmanian salt marshes is heterogeneous. Thick, herbaceous vegetation carpets the area and alternates with patchy meadow and shrubby stands (Figure 3). Like salt marshes on the mainland, Tasmania's salt marshes lack the extensive dominance of grasses found in north temperate regions (Adam 1981). Furthermore, the communities are species poor and dominated by one or two species. Although the vegetation appears natural, closer inspection shows that more than half has been influenced by introduced grazing animals (Figure 4).

Only few botanical publications refer to Tasmanian salt marshes. Kirkpatrick and Glasby (1981) focus on salt marsh vegetation in bays near Hobart. The investigated sites on Pitt Water and the flanks of the Derwent River have been affected by construction of bridges and the water has become brackish. The study does not represent the undisturbed and therefore natural character of halophytic phytocoenoses. Furthermore, as Thannheiser (1998) reported, the vegetation cover had changed in Pipe Clay Lagoon and Ralphs Bay during the last 20 years. The only plant sociological publication dealing with coastal salt marsh in southern Australia is that of Bridgewater (1982), who carried out studies in Tasmania and distinguished several associations for the first time.

The halophytic marsh vegetation of Tasmania resembles that of New Zealand (Chapman 1959; Adam 1981; Thannheiser and Holland 1994; Dickinson and Mark 1999), and the two islands have much in common, especially in their climate and flora. Like in New Zealand, Tasmania's salt marsh vege-

