

MANGROVE DISTRIBUTION IN NEW SOUTH WALES

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INTRODUCTION

The Division of Fisheries has now completed one phase of its estuarine inventory programme for New South Wales. A comprehensive report consisting of a compilation of fisheries-related information and an atlas of estuarine wetlands (mangroves, saltmarshes and seagrasses) for New South Wales will soon be published. This short article concerning mangroves is based on that report.

Mangroves are trees and shrubs growing within the intertidal zone which are important as wildlife habitats and for shoreline stabilization. They represent an indirect food resource and habitat for many commercially and recreationally important fish and crustacean species (State Pollution Control Commission, 1981). For this reason, the Division of Fisheries has mapped mangrove distribution in New South Wales.

The maps are used within the Division to assess the likely effects of development and re-zoning applications, and as an information base supplied on request to local councils conducting Local Environmental Studies. In the near future, mangrove distribution maps will be available showing historical changes and site specific studies.

METHOD

Base maps for each estuary were traced from Central Mapping Authority (C.M.A.) 1 : 25,000 topographic maps. Draft vegetation maps were prepared by the interpretation of recent aerial photographs, and the transfer of this information to the base maps. In most cases this involved the use of a Bausch and Lomb Zoom Transfer Scope. Field surveys were carried out in 1981-1983 to confirm boundaries, identify species present and refine the draft vegetation maps. Final estuarine wetland maps were then produced, and again checked against aerial photographs.

Mangrove areas were measured from these maps using millimetre grids. Resolution is approximately 0.001 square kilometres (i.e., 0.1 hectares). The error of area determination using this method is dependent on a number of factors including the accuracy of each estuarine wetland map and accumulative resolution errors from each wetland.

The distribution of mangrove species was compared with previously collected samples lodged at the National Herbarium (Sydney) and Queensland Herbarium (Brisbane).

RESULTS AND DISCUSSION

There are sixty-nine estuaries in New South Wales which contain mangroves, although eight of these contain too few to map at a scale of 1:25,000. The accompanying table lists these estuaries and the associated area of mangroves on our wetland maps. The total area of mangroves in New South Wales is approximately 102 square kilometres. In comparison, Galloway (1982) using a grid of points spaced one every 3 square kilometres estimated that in New South Wales there were 99 square kilometres of mangroves.

The percentages of mangroves within major estuaries, and within the planning regions established by the Department of Environment and Planning (N.S.W.) are shown in Figures 1 and 2, respectively. Figure 3 shows the proportions of mangrove area in various estuary types. The estuary types are those proposed by Roy (1982), namely, drowned river valleys (1), barrier estuaries (2) and coastal lakes (3), to which we have added the category of open embayments (4).

TABLE : Mangrove area (sq.km) and species checklist for N.S.W. estuaries.

Av = Avicennia marina, Ae = Aegiceras corniculatum,
 Ex = Excoecaria agallocha, R = Rhizophora stylosa,
 B = Bruquiera gymnorhiza.

Estuary Name	Mangrove Area	Av	Ae	Ex	R	B
TWEED RIVER	3.091	X	X	X	X	X
CUDGEN LAKE	0.094	X				
CUDGERA CREEK	0.138	X	X		X	
MOOBALL CREEK	0.053	X	X			
BRUNSWICK RIVER	0.018	X	X	X	X	X
BELONGIL CREEK	0.050	X	X			
RICHMOND RIVER	4.949	X	X	X		X
EVANS RIVER	0.330	X	X		X	
CLARENCE RIVER	5.208	X	X	X		X
SANDON RIVER	0.533	X	X		X	
WOOLI WOOLI RIVER	0.493	X	X	X	X	
CORINDI RIVER	0.189	X	X		X	
ARRAWARRA CREEK	0.000*	X		X		
DARKUM CREEK	0.001		X			
WOOLGOOLGA LAKE	0.002	X	X			
HEARNS LAKE	0.044	X				
MOONEE CREEK	0.036	X	X			
COFFS HARBOUR CREEK	0.167	X	X			
BOAMBEE CREEK	0.066	X	X			
BONVILLE CREEK	0.053	X	X			
BELLINGER RIVER	0.847	X	X			
DALHOUSIE CREEK	0.000*	X				
DEEP CREEK	0.008	X				
NAMBUCCA RIVER	0.779	X	X			
MACLEAY RIVER	5.201	X	X	X		
SOUTH WEST ROCKS CREEK	0.528	X	X			
KOROGORO CREEK	0.013	X				
KILLICK CREEK	0.000*	X	X			
HASTINGS RIVER	2.078	X	X	X		
LAKE INNES/LAKE CATHIE	0.001	X				
CAMDEN HAVEN RIVER	0.873	X	X	X		
MANNING RIVER	3.582	X	X	X		
WALLIS LAKE	0.786	X	X			
KARUAH RIVER	3.479	X	X			
MYALL RIVER	1.021	X	X			
PORT STEPHENS	23.260	X	X			
HUNTER RIVER	15.481	X	X			
LAKE MACQUARIE	0.998	X				
TERRIGAL LAGOON	0.000*	X				
BRISBANE WATERS	1.635	X	X			
HAWKESBURY RIVER	10.654	X	X			
PITTWATER	0.180	X	X			
PORT JACKSON	0.914	X	X			
BOTANY BAY	3.996	X	X			
GEORGES RIVER	2.038	X	X			
PORT HACKING	0.328	X	X			
LAKE ILLAWARRA	0.000*	X				
MINNAMURRA RIVER	0.484	X	X			
SHOALHAVEN RIVER	0.670	X	X			
CROOKHAVEN RIVER	2.806	X	X			
JERVIS BAY	1.250	X	X			
ST. GEORGES BASIN	0.252	X	X			
LAKE CONJOLA	0.000*	X				
NARRAWALLEE INLET	0.378	X	X			
CLYDE RIVER	2.318	X	X			
CULLENDULLA CREEK	0.916	X				
TOMAGA RIVER	0.210	X	X			
CANDLAGAN CREEK	0.021	X				
MORUYA RIVER	0.380	X	X			
TUROSS LAKE	0.566	X	X			
WAGONGA INLET	0.249	X				
BERMAGUI RIVER	0.434	X				
WAPENGO LAGOON	0.409	X				
NELSON LAGOON	0.271	X	X			
MERIMBULA LAKE	0.377	X	X			
PAMBULA LAKE	0.449	X				
NULLICA RIVER	0.000*	X				
TOWAMBA RIVER	0.090	X				
WONBOYN RIVER	0.000*	X				
Total Area :	106.725					

* Isolated, individual trees only.

There are at least five mangrove species present in New South Wales. *Avicennia marina* and *Aegiceras corniculatum* are the two most common, whereas *Rhizophora stylosa*, *Bruguiera gymnorhiza* and *Excoecaria agallocha* are located only in the northern estuaries. The Tweed River is the only estuary in which specimens of all five species of mangroves have been collected.

The species listed in the accompanying table were sighted during the present study and their ranges correspond to specimens held at the National and Queensland Herbariums. Other unconfirmed reports suggest that *Ceriops tagal* occurs in New South Wales (Shine *et al.*, 1973; Lear and Turner, 1977), that *Rhizophora stylosa* occurs in the Richmond River, and that *Excoecaria agallocha* is found in Coffs Harbour Creek (Lear and Turner, 1977).

The following section is a guide to the mangrove species of New South Wales. For a discussion of mangrove ecology in Australia refer to Lear and Turner (1977) and Saenger *et al.* (1977).

Avicennia marina (Grey Mangrove).

Description: The most conspicuous feature of *A. marina* is the presence of pneumatophores (breathing roots). These are peg-like projections arising from roots just below the sediment. *A. marina* produces opposite leaves that have a shiny green upper surface and are dull grey underneath. Clusters of small yellow flowers can be found in spring and the fruit mature in summer. Seedlings drop from the trees to take root in the sediment or be distributed by the tide. *A. marina* generally has a light grey bark. Distribution: *A. marina* inhabits low tidally-exposed positions through to dryer saltmarsh areas, in sea-water to near freshwater conditions, on sand to silt sediments. Within these various environmental conditions, *A. marina* exhibits a wide range of morphological variation. For example, the species has a small shrub-like appearance when found in dry saltmarsh regions, in wind-exposed situations or when occasionally found on rock platforms. Under more favourable conditions trees may be up to twelve metres in height, with either spreading stems at low tree densities or an upright 'pencil-like' appearance when closely spaced.

A. marina was the most widespread mangrove, and was found in all New South Wales estuaries with permanent entrances. On the north coast stunted trees also occurred in small creeks and lagoons that, although brackish, are closed from the sea during low rainfall periods. It was the dominant species in all of the sixty-eight estuaries in which it was found.

Aegiceras corniculatum (River Mangrove).

Description: *A. corniculatum* can attain heights of up to five metres (e.g. in the Hunter River) but is more usually one to two metres tall. The bushes can form a dense thicket. The leaves, which are broad, leathery and more rounded than those of *A. marina*, are often encrusted with white salt deposits and are arranged alternately along the branches. White-yellow flowers are produced in clusters during winter and curved horn-shaped fruit appear in early summer. As with *A. marina*, seedlings are often found close to the base of mature trees, or may be distributed by the tide. Roots of *A. corniculatum* often protrude across the sediment surface, probably to assist in aeration. The bark of *A. corniculatum* ranges from dark grey to black.

Distribution: *A. corniculatum* often occupies a narrow seaward band, and/or a wider band behind *A. marina*. Occasionally the two species are interspersed. *A. corniculatum* is referred to as the river mangrove as it is generally the predominant mangrove in areas of lower salinity.

A. corniculatum was found from the Tweed River in the north to Merimbula Lake in the south. The species was noted in forty-nine estuaries, and only rarely occurred in lagoons not permanently open to the sea.

Excoecaria agallocha (Milky Mangrove).

Description: *E. agallocha* is a tall tree with elliptical leaves which are rounded at the base and usually finely toothed. When the plant is damaged, a milky white sap is exuded, which can cause skin and eye irritation. This has led to another common name, the 'blind-your-eye' mangrove. In summer, male and female flowers are borne on separate trees.

Distribution: *E. agallocha* was found in ten New South Wales estuaries from the Tweed River south to the Manning River. This represents a slight extension of the previously recorded southern range. The species occupied high tidal and landward positions, and unlike most mangroves occurred singly or in patches of a few trees.

Rhizophora stylosa (Stilted Mangrove).

Description: The most conspicuous feature of this species is the existence of prop roots descending from lower branches and from the trunk. *R. stylosa* has large leaves which reach lengths of 15 cm and are arranged in an opposing pattern. White flowers are borne in pairs. The small brown fruit produce a long

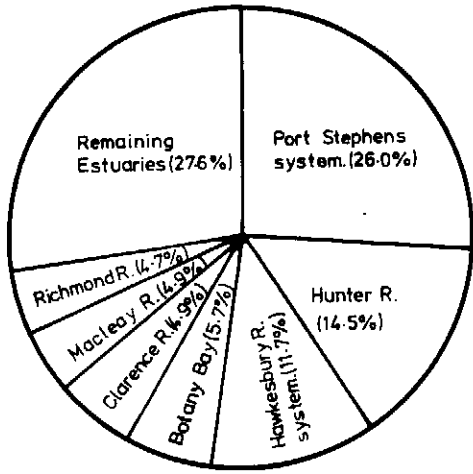


Fig.1. Percentage of total mangrove area by estuary.

'Port Stephens system' consists of Port Stephens, Karuah R. and Myall R.
 'Hawkesbury R. system' consists of the Hawkesbury R., Pittwater and Brisbane Waters.
 'Botany Bay' consists of Botany Bay and the Georges R.

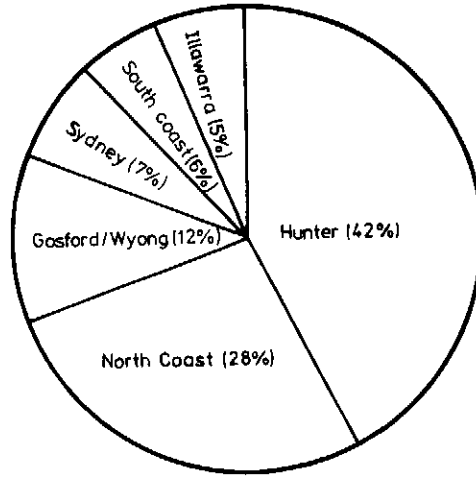


Fig.2. Percentage of total mangrove area by planning region.

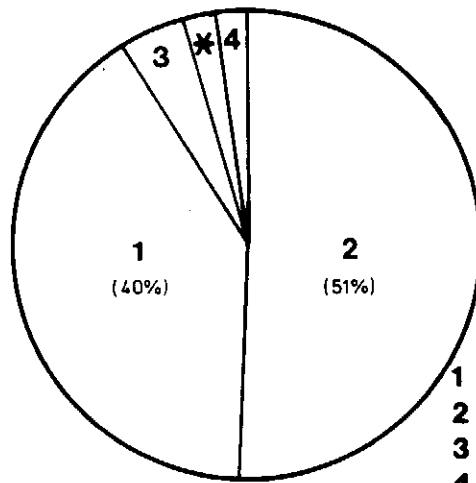


Fig.3. Percentage of total mangrove area by estuary type.

Aegiceras corniculatum
 Photo by D. Rogers



curved, light green hypocotyl. Flowers, fruit and seedlings are often present together on the trees throughout the year. In New South Wales *R. stylosa* reaches a height of about five metres.

Distribution: *R. stylosa* was found in seven estuaries, the Corindi River being the most southern. The largest stands were in the Tweed River, and only occasional trees were found in other areas. The species was usually situated on or close to the outer fringe of mangrove stands.

Bruguiera gymnorhiza (Large Leaved Mangrove).

Description: *B. gymnorhiza* grows up to twelve metres high and has large elliptical leaves, which are 10-20 cm long and 4-5 cm wide. The flowers are large, red-yellow in colour, and produce a fruit which develops a long, dark green 'cigar-shaped' hypocotyl (root). A characteristic feature are the knee roots which arch from the mud providing aeration.

Distribution: *B. gymnorhiza* was identified in only four estuaries, the most southerly being the Clarence River. There were no extensive areas of *B. gymnorhiza* in New South Wales. The species was usually found centrally located within the intertidal zone and interspersed with *A. marina*.

In this article we have presented an inventory of the mangroves of New South Wales. This inventory was compiled with time as a major constraint, leading to restrictions in the choice of map scales, site inspections and data collection. We intend to update and improve this inventory on a regular basis. There are many aspects of mangrove distribution that require further attention, in particular site specific studies of natural and man-induced changes would be useful. To date, there are few such studies, e.g. Sydney Harbour (C.A. Thorogood, Division of Fisheries, pers. comm.), Towra Point (W.G. Allaway, University of Sydney, pers. comm.) and Brisbane Waters (D.E.P., 1983). Such site specific studies would be interesting and rewarding projects for small study groups from teaching institutions or clubs.

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