Theme: Habitats

The Gippsland Lakes supports a wide range of different vegetation types, which are described under the theme “habitats” for consistency with the State of the Bays reporting. Four indicators of condition have been selected:

- Seagrass – three species of seagrass occur in Lakes Victoria and King: *Zostera nigricaulis* in deeper areas, and *Zostera mulleri* in shallower, often intertidal, areas where the seagrass may be exposed at low tide, and *Ruppia spiralis*.
- Coastal saltmarsh – EPBC listed vulnerable community that occurs across many of the fringing wetlands as well as across the hypersaline Lake Reeve. Coastal saltmarsh includes a wide variety of plants differing greatly in their taxonomic, structure and life histories. In general, though, they occur in consistently saline environments and are generally dominated by low succulent chenopods (e.g. *Sarcocornia* spp.).
- Freshwater wetland vegetation – in Sale Common and MacLeod Morass. Includes a variety of emergent reeds, and sedges such as Common Reed (*Phragmites australis*), *Baumea* spp., *Bolboschoenus* spp., *Carex* spp., *Cyperus* spp., *Juncus* spp., *Schoenoplectus* spp.
- Variably saline wetland vegetation – which includes woody communities such as Swamp Paperbarks (*Melaleuca ericifolia*) as well as a variety of emergent salt tolerant rushes and sedges.

The vegetation of the Gippsland Lakes plays a critical role in the lakes' ecology including:

- primary production, via photosynthesis, supplying energy to the system and food for a range of fauna
- provision of the habitat used by animals for shelter
- contributions to nutrient cycles via take-up and release nutrients such as nitrogen and phosphorus
- stabilisation of shorelines, protecting them from erosion
- contributions to biodiversity and other intrinsic values (Batavia and Nelson 2017).

The vegetation of the Gippsland Lakes also provides social and economic values. Some types of plants, for example. seagrass, are especially valued for anglers for their contribution to productive and sustainable fisheries. Other types, for example, the fringing vegetation of freshwater and variably saline wetlands, are valued by birdwatchers for the waterbirds they support. Although perhaps not as widely recognised is the value that fringing vegetation including paperbark swamps, reed beds and coastal *Banksia* woodlands have in preventing shoreline degradation and in maintaining the aesthetics of the Gippsland Lakes.

Variably saline wetlands

Indicators and thresholds

There are Limits of Acceptable Change (LAC) and Resource Condition Targets (RCT) for the Ramsar site for this indicator (BMT WBM 2010):

LAC = The total area of common reed at Dowd Morass will not decline by greater than 50 percent of the 1982 baseline value (that is not less than 245 hectares) in two successive decades.

RCT = Maintain the extent, diversity, and condition of variably saline vegetation communities.

Unfortunately, the LAC covers a single vegetation community at one location only and the RCT does not have a defined benchmark against which current condition could be assessed. The variably saline wetlands are characterised by habitat mosaics of open water, emergent, non-woody vegetation, and paperbarks. An alternative benchmark that accounts for this has been included in the thresholds for the GLER condition assessment.

Condition thresholds for variably saline wetland vegetation extent are as follows:

- Good = meets RCT
- Fair = reduction in extent of one or more vegetation type, but maintenance of a habitat mosaic.

- Poor = loss of habitat mosaic, with a dominance of a single vegetation type covering more than 70% of the wetland (e.g. emergent macrophytes, paperbark or saltmarsh)

Vegetation composition and structure was used to assess the condition of variably saline wetland vegetation extent, specifically in terms of conformity with EVC benchmarks. The Index of Wetland Condition biotic sub-index is used to assess vegetation across several themes: structure, community composition, and weeds. This is used to derive a condition score out of 20 for each vegetation community. Condition is reported on a five point scale, which has been translated into the three categories for the Gippsland Lakes Environment Report Card as follows:

- Good = biota score 16 - 20
- Fair = biota score 13 - 10
- Poor = biota score 0 – 9

Locations

Wetlands of the Gippsland Lakes that experience variably saline regimes include Dowd Morass, The Heart Morass, Lake Coleman and Clydebank Morass. While there has been recent satellite mapping of wetland vegetation across the Lakes (Brooks and Hale 2021b), there is no benchmark against which change can be assessed in terms of extent, with the exception of Dowd Morass. Data on vegetation composition is also limited to two of these wetlands: Heart Morass and Dowd Morass.

Results

Indicator	Status and trends				Summary
	Unknown	Poor	Fair	Good	
Variably saline vegetation extent					Vegetation in wetlands of the Gippsland Lakes that experience variably saline regimes are often dominated by swamp paperbark *Melaleuca ericifolia*, but beds of reeds and sedges are also common and important. Quantitative information on vegetation condition is available only for two of the major variably saline wetlands, Heart Morass and Dowd Morass. The condition of other large, variably saline wetlands associated with the Gippsland Lakes is not known. The quantitative information available indicates that the status should be given as Good. There is no information available to discern any trend in condition or in area. Substantial changes in vegetation types, condition and extent are, however, likely to be related as much to long-term patterns in climate as they are to direct human activities over time frames relevant to this assessment.
	Data quality:  Good **Data custodian:** DELWP				
Variably saline vegetation condition					
	Data quality:  Fair **Data custodian:** DELWP				

Status

The vegetation of the fringing wetlands was mapped from satellite data in six categories in 2021 (Brooks and Hale 2021b):

- Saltmarsh (see section 4.2)
- Tall marsh (emergent wetland vegetation largely dominated by common reed or cumbungi)
- Shallow marsh (wetland vegetation dominated by a variety of species including spike rush, giant rush, Azolla spp., etc.)
- Swamp scrub (dominated by paperbark)
- Open water

The results indicated that there is approximately 1800 hectares of tall marsh, 1500 hectares of shallow marsh and 5500 hectares of swamp scrub (Figure 1). This is the first mapping of these wetland communities across the Lakes and so what this means with respect to condition status (i.e., good, fair or poor rating) is not known. Repeat assessments over time will allow for consideration of trajectories of change.

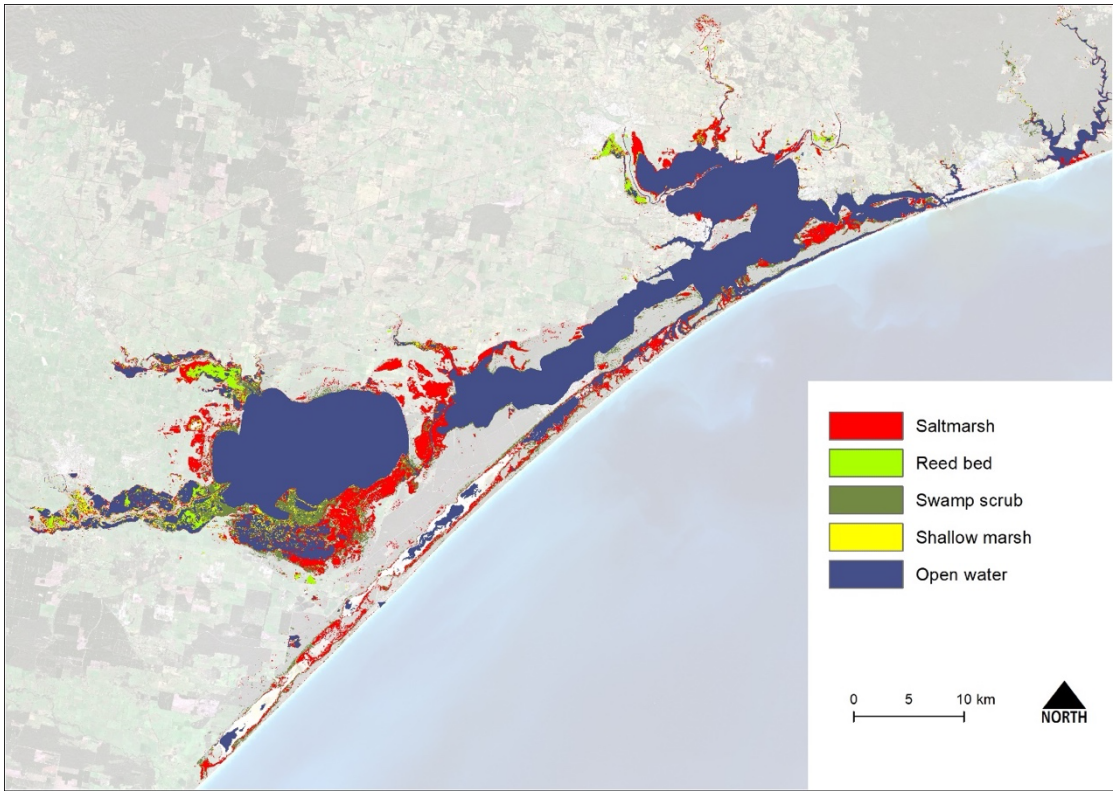

Figure 1: Fringing wetland vegetation mapping around the Gippsland Lakes (Brooks and Hale 2021b).

There are data available for wetland habitat extent in Dowd Morass from two points in time, 2015 (derived from intense ground surveys) and 2021 (mapped by remote sensing from satellite imagery). The small differences in extent most likely reflect the differences in mapping method, rather than actual changes in habitats. The two assessments indicate a habitat mosaic has been maintained and are representative of "good" condition.

Table 1. Areas of wetland habitat in hectares (%) in the portion of Dowd Morass within the Ramsar site in 2015 (Frood et al. 2015); and 2020 (Brooks and Hale 2021b).

	2015	2020
Open water	299 (35%)	321 (37%)
Reed bed	322 (38%)	234 (27%)
Swamp scrub	224 (26%)	267 (31%)
Other	5 (<1%)	34 (4%)

Quantitative data on vegetation composition and structure were available only for two variably saline wetlands around the lower Latrobe River: Heart Morass and Dowd Morass (Frood *et al*. 2015). Heart Morass is spatially very complex, and Frood *et al*. (2015) reported over 60 spatially discrete vegetation patches. The EVC scores of these patches ranged from highs of 19 for a patch of Wet Sedgy Herbland (EVC A116) and 18 for a patch of Tall Marsh (EVC 821), to a low of 6 for a patch of Floodplain Riparian Woodland (EVC 56). The calculation of an IWC score requires integration not only of different measures in different EVCs, but also considers the extent of each vegetation community in a wetland. The total score for Heart Morass, from all vegetation communities assessed was 16, indicating good condition.

Dowd Morass received scores for various EVC components in different mapping units ranging from 19 for a patch of coastal saltmarsh aggregate (EVC 9) to a low of 8 for a patch of Brackish Wetland (EVC 565). The overall score was 16, indicating vegetation was in *Good* condition. This ranking, however, must be set against the large number of earlier research reports on Dowd Morass, which indicate that the Swamp Paperbark component of this wetland is in poor condition, stressed by high salinity and prolonged flooding (e.g. Raulings *et al*. 2010, 2011; Salter *et al*. 2007, 2010a, b).

Figure 2: A variably saline wetland, Dowd Morass. Photograph by Paul I. Boon

Trend

There is no information available to allow trends in the composition or structure, or the total area, of the variably saline wetlands of the Gippsland Lakes to be determined. Boon *et al*. (2008) indicated that there had been a steady loss of Common Reed (*Phragmites australis*) and encroachment into former reed-vegetated areas of Dowd Morass by Swamp Paperbark (*Melaleuca ericifolia*) since the 1950s, but whether similar patterns have taken place in other variably saline wetlands is unknown. The mapped extent of broad vegetation communities in 2021 (Brooks and Hale 2021) will provide a benchmark against which future changes in extent can be assessed.

Influencing factors and threats

The variably saline wetlands of the Gippsland Lakes provide one of the iconic features of the Gippsland landscape. Almost all have been modified in one way or another since European colonisation of the region, mainly for agriculture (e.g. Heart Morass and large parts of Clydebank and Dowd Morasses) and in some cases for discharge of waste waters (e.g. Lake Coleman). In some cases, they appear to have deepened as a result of land use change, which may influence their salinity and hydrological regimes.

As with all coastal wetlands, changes to salinity or hydrological regimes will have very great impacts on the variably saline wetlands of the Gippsland Lakes. The dominant woody plant in these wetlands is the Swamp Paperbark *Melaleuca ericifolia*, and whilst it is tolerant of waterlogging it cannot withstand permanent inundation. Similarly, while it is tolerant of slightly saline conditions, it cannot withstand highly saline conditions. Climate change, responsible for both increases in sea levels and in storm surges, will likely have major impacts on the

variably saline wetlands. In some places a co-dominant plant species is Common Reed *Phragmites australis*, and there is good evidence that for over the past 40-50 years it has become less extensive in the variably saline wetlands (Bird 1961b; Boon et al. 2008; Boon et al. 2016).

The vegetation of the variably saline wetlands is expected to vary strongly with long-term changes in climate, for example prolonged dry or wet periods. These long-term climatic patterns will influence what types of vegetation that grows best under prevailing conditions: dry periods might see the contraction of paperbarks and the expansion of salt-tolerant plant species and wetter periods might see the rapid expansion of species better suited to wet and fresher conditions. Episodic intrusions of saline water are also likely to decrease vegetation condition, possibly for periods of as long as a decade after the event (Raulings *et al*. 2010).

References

Bird, E.C.F. (1961b). Reed growth in the Gippsland Lakes. Victorian Naturalist 77, 262−268.

Boon, P.I., Cook, P. and Woodland, R. (2016). The challenges posed by chronic environmental change in the Gippsland Lakes Ramsar site. Marine and Freshwater Research 67: 721–737.

Boon, P.I., Raulings, E., Roache, M. and Morris, K. (2008). Vegetation changes over a four-decade period in Dowd Morass, a brackish-water wetland of the Gippsland Lakes, south-eastern Australia. Proceedings of the Royal Society of Victoria 120: 403–418.

Brooks, S. and Hale, J. (2021b). Gippsland Lakes Fringing Wetland Vegetation Mapping. East Gippsland CMA, Bairnsdale, Victoria

Frood, D., Boon, P., Oates, A., Reside, J., and Maxwell, R. (2015). Benchmarking Wetland Flora in the Lower Latrobe Wetlands. West Gippsland CMA, Traralgon.

Raulings, E., Morris, K., Roache, M. and Boon, P.I. (2010). The importance of water regimes operating at small spatial scales for the diversity and structure of wetland vegetation. Freshwater Biology 55: 701–715.

Raulings, E., Morris, K., Roache, M. and Boon, P.I. (2011). Is hydrological manipulation an effective management tool for rehabilitating chronically flooded, brackish-water wetlands? Freshwater Biology 56: 2347−2369.Reeves, J.M. and Trewarn, A. (2016). Assessment of Heavy Metals and Other Contaminants of the Gippsland Lakes. Federation University Australia, Mt Helen, Victoria.

Salter, J., Morris K., Bailey, P.C.B. and Boon, P.I. (2007). Interactive effects of salinity and water depth on the growth of seedling Swamp Paperbark (*Melaleuca ericifolia* Sm). Aquatic Botany 86: 213–222.

Salter, J., Morris, K., Read, J. and Boon, P.I. (2010a). Impact of long-term, saline flooding on condition and reproduction of the clonal wetland tree, *Melaleuca ericifolia* (Myrtaceae). Plant Ecology 206: 41–57.

Salter, J., Morris, K., Read, J. and Boon, P.I. (2010b). Understanding the potential effects of water regime and salinity on recruitment of *Melaleuca ericifolia* S. Aquatic Botany 92: 200–206.