IEC Flora sub-index

Index of Estuary Condition

The Index of Estuary Condition (IEC) integrates information for five key aspects of estuary condition: Physical Form, Hydrology, Water Quality, Flora and Fish. These sub-indices are aggregated to provide an overall 'snapshot' measure of environmental condition at the time of monitoring.

The IEC Flora sub-index has two measures:

1. Fringing Vegetation
2. Submerged Vegetation

Fringing Vegetation

For IEC, fringing vegetation refers to the vegetation which grows above the permanently inundated portion of the estuary. It includes vegetation in intertidal and riparian areas but not subtidal vegetation. Five broad plant communities make up most fringing vegetation in Victorian estuaries: mangroves, saltmarsh, marshlands, ephemeral pools and swamp scrub.

Fringing vegetation is a vital consideration in the assessment of estuary condition. First, fringing vegetation itself is an asset with its own inherent values. These include the organisms that largely inhabit the fringe, some of which are rare or threatened. Aesthetic attributes are also important inherent values of fringing vegetation, and enhance other values including tourism, recreation, education and research.

Second, the condition of the fringing vegetation influences that of the rest of the estuary. Degradation or loss of fringing vegetation impacts estuarine biological function. For example, fringing vegetation filters flows of water, chemicals (e.g. nutrients, toxins) and organisms from the surrounding catchment. It also can intercept some stormwater runoff and reduce lateral erosion and littoral water velocities during flooding. Fringing vegetation contributes to the role that estuaries play in naturally protecting the quality of coastal waters by diluting, filtering and settling out sediments and excess nutrients. Fringing vegetation may also supply energy and material to estuaries, both from primary production when vascular plant detritus is exported and secondary production when herbivores supported by fringing vegetation and/or their spawn enter estuary food webs.

Vegetation of the fringe provides habitat (e.g. snags, roots, branches for perching) for estuarine fauna, some of which are listed as threatened. Many fish species that live as adults in the open water of the estuary or the sea live as larvae in the shallows amongst the vegetation that fringes estuaries. Many birds, both resident and migratory species, also rely upon fringing vegetation.

A rapid assessment approach was used for Fringing Vegetation, with scoring based on averaging across three distinct metrics:

1. Percentage of fringe area that is covered by built structures.
2. Nativeness of the fringing vegetation.
3. Structural complexity of the fringing vegetation.

Reference conditions for Fringing Vegetation were assumed to be the Ecological Vegetation Class benchmarks and the absence of built structures within the 'pre-1750 intertidal zone'.

Natural fringing vegetation along the lower Benedore River estuary (Sean Phillipson, EGCMA)

Submerged Vegetation

For IEC, submerged vegetation refers to aquatic plants attached to bottom sediments that are generally entirely submerged but may be exposed during very low tides.

In Victorian estuaries, submerged vegetation consists primarily of macroalgae and seagrass. Seagrass species recorded from Victorian estuaries include *Zostera*

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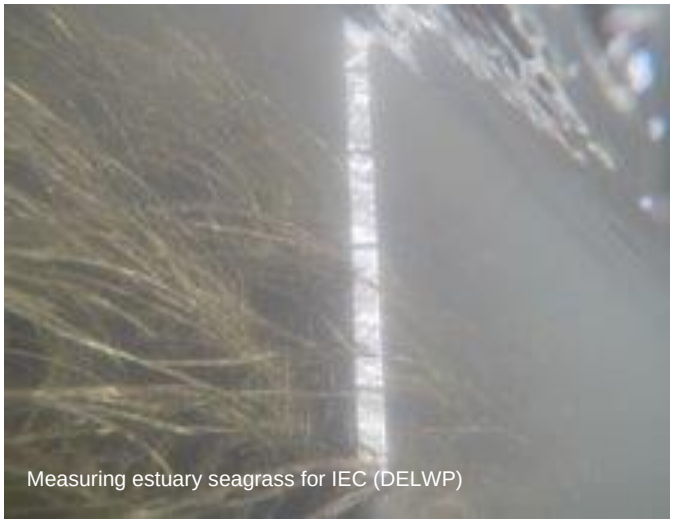
muelleri, Zostera nigracaulis and *Ruppia* spp. Seagrasses are rooted macrophytes that have higher light requirements and slower uptake of nutrients than macroalgae. When nutrient inputs to estuaries are elevated, macroalgae can proliferate due to their capacity for rapid nutrient uptake, and this leads to an increase in the overall biomass and extent of submerged vegetation. Their low light requirements mean that macroalgae can also tolerate higher turbidity associated with the increased sediment inputs that often accompany elevated nutrient inputs. Under these conditions, the proliferation of macroalgae shades seagrasses which further reduces the light needed for seagrasses to grow. Consequently, nutrient enrichment and reduced light availability often lead to the dominance of macroalgae over seagrasses in submerged vegetation communities.

Dominance of macroalgae over seagrasses in response to elevated nutrient loads in estuaries is well-established. This dominance can be measured as the ratio of the coverage (m^2) of macroalgae (MA) to the total area of submerged vegetation (TV) within an estuary (MA:TV).

Table 1: Scoring criteria for Submerged Vegetation

Description	MA:TV	Score
Submerged vegetation dominated by seagrass, minimal (or no) macroalgae present	0 – 0.2	5
Submerged vegetation mostly seagrass with some macroalgae present	>0.2 – 0.4	4
Submerged vegetation represented by approximately equal amounts of seagrass and macroalgae	>0.4 – 0.6	3
Submerged vegetation mostly macroalgae with some seagrass present	>0.6 – 0.8	2
Submerged vegetation dominated by macroalgae, minimal (or no) seagrass present	>0.8	1



Measuring estuary seagrass for IEC (DELWP)

Calculating the Flora sub-index score

Flora score = (((Fringing Vegetation score + (MA:TV score x 2)) – 3) x 9)/17 + 1

State-wide condition assessment programs provide information about the overall environmental condition of Victoria's waterways and are vital for guiding state and regional planning. The current approach is to rotate these assessments among estuaries, wetlands, and rivers at the long time-frames (10 years or more) expected for changes in condition at the broad spatial scales assessed, and in response to changes in threats, management regimes or environmental contexts. In the intervening periods, planning and management will be informed by targeted monitoring of key aquatic values and threats at specific waterway assets, evaluations of the effectiveness of management interventions, and strategic research to fill critical knowledge gaps.

For further details for IEC methods see:
DELWP (2021). Assessment of Victoria's estuaries using the Index of Estuary Condition: Background and Methods 2021.

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