

**Gippsland Lakes**

**Ramsar site**

**Ecological Character Description**

March 2010

Acknowledgements, contents and executive summary only

Other chapters can be downloaded from:

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**Introductory notes:** This Ecological Character Description (ECD Publication) has been prepared in accordance with the National Framework and Guidance for Describing the Ecological Character of Australia’s Ramsar Wetlands (National Framework) (Department of the Environment, Water, Heritage and the Arts, 2008).

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*Note: There may be differences in the type of information contained in this ECD publication, to those of other Ramsar wetlands.*

**Use of terms and information sources:** All definitions and terms used in this report were correct at the time of production in February 2011. Refer to the References (Section 8) for works cited and Glossary (Section 9) for a list of key terms and terminology used.

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List of Abbreviations

|  |  |
| --- | --- |
| ANZECC/ARMCANZ: | Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand |
| ASFB: | Australian Society of Fish Biologists |
| ASS: | Acid Sulfate Soils |
| AWSG: | Australian Wader Study Group |
| CAMBA: | China-Australia Migratory Bird Agreement |
| CEPA: | Communication, Education, Participation and Awareness |
| CMA: | Catchment Management Authority |
| CMS: | Convention on the Conservation of Migratory Species |
| DEWHA: | Former Department of the Environment, Water, Heritage and the Arts (Australian Government) |
| DoD: | Department of Defence |
| DSE: | Department of Sustainability and Environment (Victoria) |
| DSEWPaC | Department of Sustainability, Environmental, Water, Population and Communities (formerly DEWHA) |
| ECD: | Ecological Character Description |
| EGCMA: | East Gippsland Catchment Management Authority |
| EGSC: | East Gippsland Shire Council |
| EMP: | Ecological monitoring program |
| EPA: | Environment Protection Authority (Victoria) |
| EPBC: | *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)* |
| ESO: | Environmental Significance Overlay |
| EVC: | Ecological Vegetation Class |
| EWR: | Environmental Water Reserve |
| FIS: | Flora Information System |
| GCB: | Gippsland Coastal Board |
| ICOL: | Intermittently Closing and Opening Lagoon |
| IMCRA: | Integrated Marine and Coastal Regionalisation of Australia |
| IUCN: | International Union for Conservation of Nature |
| JAMBA: | Japan-Australia Migratory Bird Agreement |
| LAC: | Limit(s) of Acceptable Change |
| NES: | (matter of) National Environmental Significance |
| NRM: | Natural Resource Management |
| RIS: | Ramsar Information Sheet |
| ROKAMBA: | Republic of Korea- Australia Migratory Bird Agreement |
| SEPP: | State Environment Protection Policies |
| sp.: | Species (singular) |
| spp.: | Species (plural) |
| TSS: | Total Suspended Solids |
| VWCS: | Victorian Wetland Classification System |
| WGCMA: | West Gippsland Catchment Management Authority |

Executive Summary

The Gippsland Lakes Ramsar site is one of 64 wetland areas in Australia that is listed as a Wetland of International Importance under the Convention on Wetlands of International Importance especially as Waterfowl Habitat or, as it is more commonly referred to, the Ramsar Convention (the Convention). Gippsland Lakes was listed as a Ramsar site under the Convention in 1982 in recognition of its outstanding coastal wetland values and features.

This report provides the Ecological Character Description (ECD) for the Gippsland Lakes Ramsar site, prepared in accordance with the *National Framework and Guidance for Describing the Ecological Character of Australia’s Ramsar Wetlands 2008* (the National ECD Framework). In parallel with the preparation of the ECD, the Ramsar Information Sheet (RIS) for the site has been updated for submission to the Australian Government and Ramsar Secretariat. This report updates and replaces an unpublished draft ECD document for the site prepared by the Ecos Consortium in 2008 hereafter referenced as Ecos (unpublished).

The Gippsland Lakes Ramsar site is located in coastal Victoria in the Southeast Coast Drainage Division, situated east of the Latrobe Valley and south of the Eastern Highlands. It consists of a group of coastal lagoons and marsh environments that are separated from the sea by a barrier system of sand dunes and fringed on the seaward side by the Ninety Mile Beach.

Eleven Ramsar wetland habitat types have been identified as occurring within the boundaries of the site. These include, most notably, coastal lagoons (Type J), subtidal seagrass and algal beds (Type B), and a range of saline, brackish and freshwater marsh environments (Types Sp and Tp).

The ecosystem processes that underpin the habitats of the Gippsland Lakes Ramsar site include hydrology and hydrodynamics (with the site heavily influenced by both freshwater riverine inputs and marine saline inflows), water quality and sediment nutrient dynamics, geomorphology, climate, shoreline and coastal processes and a range of biological processes.

The site supports a broad range of ecosystem services/benefits including nationally and internationally threatened wetland species, waterbird breeding and fish spawning sites. Cultural and socio-economic values are equally diverse, noting the particular importance of the site in a regional context in terms of recreational activities such as boating, recreational fishing and holiday tourism.

As part of the site overview, the ECD has reviewed the Ramsar Nomination Criteria under which the site was listed as a Wetland of International Importance and the applicability of the revised and new criteria under the Convention that have been added since the site was originally listed in 1982. In this context, the site is now seen as meeting six out of the nine Nomination Criteria recognising its representative wetland habitats at a bioregional level, vulnerable wetland species, support for key ecological life-cycle functions such as waterbird breeding, its importance for supporting waterbird abundance and diversity and its fish nursery and spawning habitats.

Following the methodology set out in the National ECD Framework, Table E-1-1 summarises the critical ecosystem components, processes and services/benefits for the site. The assignment of a given wetland component, process or service/benefit as critical was guided by the following considerations:

* the component, process or service/benefit is an important determinant of the uniqueness of the site
* the component, process or service/benefit is important for supporting one or more of the Ramsar Nomination Criteria under which the site was listed
* a change to the component, process or service/benefit is reasonably likely to occur over short to medium term time scales (less than100 years), and/or
* the change to the component, process or service/benefit will cause significant negative consequences if the change occurs.

In addition to critical components, processes and services/benefits, a range of other elements were identified as being important to the maintenance of the morphological, physio-chemical and biological processes. These supporting components, processes and services/benefits (also shown in Table E-1-1), while important to wetland functioning, were not considered to directly address the criteria listed above.

There are three descriptive groupings of wetland habitats for the site that form the basis for the conceptual models of the wetland. These habitat groupings include:

* marine subtidal aquatic beds (which contain seagrass or macroalgae)
* coastal brackish or saline lagoons (which are phytoplankton-dominated system)
* fringing wetlands, which are generally brackish in character but sometimes freshwater and sometimes hypersaline, and are vegetated with a wide range of vascular and non-vascular plants.

Conceptual models have been prepared for each of these, in order to represent the relationships between the critical components, processes and services/benefits.

The study has sought to define the natural variability and limits of acceptable change (LAC) for the critical components, processes and services/benefits identified. A summary of the limits of acceptable change is shown in Table E-1-2.

The study has also examined:

* current and future threats to ecological character
* ecological character changes that have been observed or documented since listing of the site in 1982.

Recent or continuing threats that are notable in the context of the site and that may affect future ecological character have been identified in the Ramsar Site Strategic Management Plan (DSE 2003) and other plans and strategies that apply to the site. Key threats include altered water regimes, salinity, pollution, pest plants and animals, natural resource utilisation, dredging, activation of acid sulfate soils, recreation and tourism usage, fire and erosion. Contemporary threats include the prevalence and severity of recent algal blooms and the implications of climate change – particularly sea level rise – on the Gippsland Lakes.

A review of available data and specific studies on the site (and comparison against relevant LAC) demonstrate that an ecological character change is possible for some critical components since site listing in 1982. Relevant studies show a possible reduction in abundance and density of waterbirds (mainly those species that rely on or regularly use freshwater habitats), a possible reduction in abundance of key fish species such as black bream (based on commercial catch data only), possible reduction in density of seagrass assemblages and long term changes to vegetation communities in the fringing marsh wetlands of Lake Wellington (for example from *Phragmites* wetland to *Melaleuca* and swamp scrub dominated wetlands in Dowd Morass). The extent to which the changes are a result of natural and/or anthropogenic change (or a combination of both) is not able to be determined based on the current data set.

There is no clear or demonstrable evidence that the limits of acceptable change (LAC) defined for the site have been exceeded since listing. On this basis, it is determined that an empirical change to ecological character of the site cannot be established.

Information gaps, monitoring needs and recommendations in relation to communication, education, participation and awareness messages are also identified in the ECD. Thematic information gaps identified as being most important for consideration in future monitoring for the site include:

* Additional research and monitoring to establish an ecological character baseline for the key waterbodies/wetland habitats, with a priority on the transitional freshwater and brackish marshes that support important flora, fauna and life stage habitats (for example, breeding sites, roosting sites, spawning sites, etc.) and are at most risk of future ecological change from increasing salinity.
* The need for better information and data sets about the presence and natural history of critical wetland species and their habitats including for example, surveys of threatened plant species, aquatic fauna species such as Australian grayling and more systematic surveys of important avifauna and fish species and populations.
* Better information and understanding about the natural variability of wetland fauna populations and key attributes and controls on those populations.
* The ecological character threshold of particular habitats and communities to changes in key attributes/controls such surface and groundwater hydrology and salinity need additional investigation. Noting that the LAC stated in the ECD should be reviewed and revised as improved information becomes available.
* More specific assessment of the vulnerability of the site to the impacts of climate change, and adaptation options that could be explored to reduce the future impacts.

In accordance with the above, monitoring needs and recommendations presented in this ECD relate broadly to obtaining data to assess future changes to ecological character as defined by the critical components, processes and services/benefits and associated LAC for the site. In this context, it should be recognised that the site requires more detailed broad-scale monitoring of ecological health in order to provide for a more sound understanding of natural variability and future ecological character changes.

A combined set of communication, education, participation and awareness messages relevant to the ECD have been presented and can be used to communicate the importance of the site, why it was listed, possible changes to ecological character, the threats to the site and future actions required. These messages should be considered as part of existing objectives and strategic actions about community awareness in the Ramsar Strategic Management Plan (DSE 2003).

Table E‑‑ Summary of critical components, processes and services/benefits for the Gippsland Lakes Ramsar site

| **Critical components** | **Critical processes** | **Critical services/benefits** |
| --- | --- | --- |
| **Wetland habitats:** grouped as follows   * (C1) marine subtidal aquatic beds (seagrass/aquatic plants). * (C2) coastal brackish or saline lagoons(open water phytoplankton-dominated habitats). * fringing wetlands that can occur within the site as–   + (C3) predominantly freshwater wetlands   + (C4) brackish wetlands   + (C5) saltmarsh/ hypersaline wetlands.   **Wetland flora and fauna:**   * (C6) abundance and diversity of waterbirds. * (C7) presence of threatened frog species (green and golden bell frog; growling grass frog). * (C8) presence of threatened wetland flora species. | **Hydrological regime:** (P1) patterns of inundation and freshwater flows into the wetland system, groundwater influences and marine inflows that affect habitat structure and condition.  **Waterbird breeding functions:** (P2) critical breeding habitats for a variety of waterbird species. | **Threatened species:** (S1) the site supports an assemblage of vulnerable or endangered wetland flora and fauna that contribute to biodiversity.  **Fisheries resource values:** (S2) the site supports key fisheries habitats and stocks of commercial and recreational significance. |
| **Supporting Components** | **Supporting Processes** | **Supporting services/benefits** |
| **Other wetland habitats:** supported by the site(sand/pebble shores, estuarine waters, etc.)**.**  **Other wetland fauna:** supported by the site(for example, fish, aquatic invertebrates). | **Climate:** patterns of temperature, rainfall and evaporation.  **Geomorphology:** key geomorphologic/ topographic features of the site.  **Coastal and shoreline processes:** hydrodynamic controls on coasts and shorelines through tides, currents, wind, erosion and accretion.  **Water quality:** water quality influences aquatic ecosystem values, noting the key water quality variables for Gippsland Lakes are salinity, dissolved oxygen, nutrients and sediments.  **Nutrient cycling, sediment processes and algal blooms:** primary productivity and the natural functioning of nutrient cycling/flux processes in waterbodies.  **Biological processes:** important biological processes such as primary productivity. | **Tourism and recreation:** the site provides and supports a range of tourism and recreational activities that are significant to the regional economy.  **Scientific research:** the site supports and contains features important for scientific research. |

Table E‑‑ Limits of acceptable change (LAC) – Gippsland Lakes Ramsar site

| **Number** | **Indicator for Critical Component / Process/Service for the LAC** | **Relevant timescale[[1]](#footnote-1)** | **Limit(s) of Acceptable Change** | **Spatial scale/temporal scale of measurements** | **Underpinning baseline data** | **Secondary critical C,P,S addressed through LAC** |
| --- | --- | --- | --- | --- | --- | --- |
| **Critical components** | | | | | | |
| C1 | Marine sub-tidal aquatic beds  (for example, within Lake King, Lake Victoria, Lake Tyers, Bunga Arm and Lake Bunga) | Long Term | * Total seagrass extent will not decline by greater than 50 per cent of the baseline value of Roob and Ball 1997 (that is, 50 per cent of 4330 hectares = 2165 hectares) in two successive decades at a whole of site scale. * Total mapped extent of dense and moderate *Zostera* will not decline by greater than 80 per cent of the baseline values determined by Roob and Ball (1997) in two successive decades at any of the following locations:   + Fraser Island   + Point Fullerton, Lake King   + Point King, Raymond Island, Lake King   + Gorcrow Point – Steel Bay, Lake Victoria   + Waddy Island, Lake Victoria | Sampling to occur at least twice within the decade under consideration.  Baseline mapping against which this LAC can be tested is within Roob and Ball 1997.  Note that the seagrass assessment by Hindell (2008) did not produce mapping but did use similar sampling sites to Roob and Ball. | Level B - Recent quantitative data describes seagrass condition at various sites but over a limited timeframe. There is no available seagrass condition data prior to listing. | P1 |
| C2 | Coastal brackish or saline lagoons  (for example, Lake King, Lake Victoria, Lake Wellington, Lake Tyers) | Long Term  Long Term  Short Term | * No change in wetland typology from the 1980 classification of Corrick and Norman (1980), as presented in . * A long-term change in ecosystem state at Lake King, Lake Victoria or Lake Tyers from relatively clear, seagrass-dominated estuarine lagoons to turbid, algae dominated system (characteristic of Lake Wellington) will represent a change in ecological character. * No single cyanobacteria algal bloom event will cover greater than 10 per cent of the combined area of coastal brackish/saline lagoons (that is, Lake King, Victoria, Wellington and Tyers) in two successive years. | To be determined based on expert review.  To be determined based on expert review.  Algal bloom extent (per cent lakes area and location) and number should be reported annually, but assessed on an ongoing basis. | Level B - VMCS mapping data describes wetland extent. This is coarse scale mapping and should be considered as indicative only.  Level A - The occurrence of cyanobacteria algal blooms are well documented. The extent of algal blooms historically has not been assessed, including at the time of site declaration. | P1, S2 |
| C3 | Fringing wetlands – predominantly freshwater marsh  at Macleod Morass and Sale Common | Long Term  Short Term | * No change in wetland typology from the 1980 classification (Corrick and Norman 1980; See Figure 2-3). In this regard, the conversion of vegetation communities at Sale Common and Macleod Morass from a predominantly freshwater character (for example, giant rush, common reed, cumbungi) to those of a brackish water character (brackish or swamp scrub/saltmarsh species) will represent a change in ecological character. * The total mapped area of freshwater marshes (shrubs and reed wetland types) at Sale Common and Macleod Morass will not decline by greater than 50 per cent of the baseline value outlined in VMCS for 1980 (that is, 50 per cent of 402 hectares = 201 hectares) in two successive decades. * In existing freshwater wetland areas, the annual median salinity should not be greater than one grams per litre in two successive years. *Note that where ambient water quality characteristics fall outside the range of these baseline levels, and ecosystem health indicators shows no signs of impairment, the LAC may need to be adjusted accordingly.* | To be determined based on expert review.  Sampling to occur at least twice within the decade under consideration.  Annual median based on at least eight sampling periods per year, encompassing wet and dry periods. | Level B - VMCS mapping data describes wetland extent during 1980. This is coarse scale mapping and should be considered as indicative only. There is no available community data prior to listing.  Level C - No available baseline data. Value based on species salinity tolerances. | P1, P2, C6, C7, C8 |
| C4 | Fringing wetlands – brackish marsh  (for example, Dowd Morass; The Heart Morass; Clydebank Morass, Lake Coleman {Tucker Swamp}) | Long Term  Medium Term  Long Term | For all fringing brackish wetlands:   * No change in wetland typology from the 1980 classification (Corrick and Norman 1980).   For Dowd Morass and the Heart Morass:   * The annual median salinity will be less than four grams per litre in five successive years. *Note that where ambient water quality characteristics fall outside the range of these baseline levels, and ecosystem health indicators shows no signs of impairment, LAC may need to be adjusted accordingly.* * The total area of common reed at Dowd Morass will not decline by greater than 50 per cent of the 1982 baseline value (that is, 50 per cent of 480 hectares = 245 hectares) outlined in Boon et al. (2007) in two successive decades. | To be determined based on expert review.  Annual median based on at least eight sampling periods per year, encompassing wet and dry periods.  Sampling to occur at least twice within the decade under consideration. | As for C3.  Level C - No available baseline data. This value is based on species tolerances and requirement for salinity to be less than four grams per litre to allow reproduction (refer Tilleard and Ladson 2010).  Level A - Boon et al. (2007) provides good quality mapping data relevant to time of listing. | P1, P2, C6, C7, C8 |
| C5 | Fringing wetlands – saltmarsh/hypersaline marsh  (for example, Lake Reeve) | Medium Term | * No change in wetland typology from the 1980 classification (Corrick and Norman 1980). * The total mapped area of salt flat, saltpan and salt meadow habitat at Lake Reeve Reserve will not decline by greater than 50 per cent of the baseline value outlined in VMCS for 1980 (that is, 50 per cent of 5035 hectares = 2517 hectares) in two successive decades. | To be determined based on expert review.  Sampling to occur at least twice within the decade under consideration. | As for C3. | P1, C6 |
| C6 | Abundance and diversity of waterbirds | Medium Term | * The number of standard 20 minute searches (within any ten year period) where waterbird abundance is less than 50 individuals will not fall below 50 per cent of the ‘baseline’ value (based on Birds Australia count data – 1987-2010), for the following species:   + black swan = 15 per cent of surveys   + chestnut teal = 10 per cent of surveys   + Eurasian coot = 11 per cent of surveys. * The absence of records in any of the following species in five successive years will represent a change in character: red-necked stint, sharp-tailed sandpiper, black swan, chestnut teal, fairy tern, little tern, musk duck, Australasian grebe, grey teal, Eurasian coot, great cormorant, red knot, curlew sandpiper. * Median abundance (derived from at least three annual surveys {summer counts} over a 10-year period) falls below the 20th percentile baseline value. *Note: An adequate baseline will need to be established to assess this LAC (for example, at least three annual surveys (summer counts) over a 10-year period).* | Sampling to be undertaken at least twice a year over any 10 year period at stations containing favourable habitat for these species (see Table E8 for locations). Surveys should consist of standardised 20 minute counts.  Sampling to be undertaken at least twice a year (during summer) at stations containing favourable habitat for these species (see section 3.4.1 for important locations).  Recommended baseline monitoring program should include:   * A combination of aerial and ground surveys. * Representative coverage of primary habitats within the site. | Level A - Birds Australia data, while standardised in terms of sampling effort per site, is not standardised in terms of frequency of sampling events at any given sampling location. Data should be considered indicative only.  Level A - Records for these species are reliable. Birds Australia and DSE data can be used to assess this qualitative LAC.  There are no baseline data available for this LAC. | P1, P2 |
| C7 | Presence of threatened frogs | Medium Term | * The site will continue to support suitable habitat for growling grass frog and green and golden bell frog. In this regard, the LAC for Component 3 applies. * There is insufficient data to develop a LAC relating directly to site usage by these species, which represents a critical information gap. Should baseline data become available in the future, the following LAC will apply: a significant reduction (greater than 25 per cent over a period of 5 years) in the local adult population within the site, especially for important local populations (for example, within Macleod Morass, Sale Common, Ewings Marsh, Roseneath wetlands (Morley Swamp and Victoria Lagoon), the Heart Morass and freshwater pools on Rotamah Island). | Refer to C3.  Recommended baseline monitoring program should comprise a minimum two annual sampling periods separated by at least one year (and within a 5 year period). | Level C - Surveys for these species have been opportunistic. The most recent record for growling grass frog is 2007, whereas the green and golden bell frog was recorded at the site in 1998. There are no empirical data describing abundances at the site. | P1 |
| C8 | Presence of threatened wetland flora species | Long Term | * The three threatened flora species (*Rulingia prostrata*, *Thelymitra epipactoides* and *Xerochrysum palustre*) continue to be supported within the boundaries of the Gippsland Lakes Ramsar site. | Based on opportunistic searches. | Level C - Setting of empirical limits of acceptable change is not possible at present, given the absence of quantitative estimates of population size of threatened species within the site, and more importantly the viability of populations (and their key controls) within the site. | P1 |
| **Critical processes** | | | | | | |
| P1 | Hydrological regime | Short Term – Medium Term | Wetland wetting frequency, flushing frequency and flushing volume are maintained as follows:   |  |  |  |  | | --- | --- | --- | --- | | Wetland | Wetting Frequency | Flushing Frequency | Required Flushing Volume | | Sale Common | Annual with 100 per cent reliability | 2-3 times/decade | 4 GL | | Dowd Morass | 5-7 times/decade | 2-3 times/decade | 15GL | | The Heart Morass | 5-7 times/decade | 2-3 times/decade | 15GL |   From Tilleard and Ladson (2010); note that larger flushing volumes (~20GL) are identified as being needed for Dowd and the Heart Morasses following saline flood events in the Lake Wellington system (for example, when the wetlands are filled with saline water from Lake Wellington and this corresponds with low flows in the Latrobe River). | Refer to LAC for details. Values measured at existing gauging stations in the lower reaches of the Rivers or otherwise in the wetlands themselves. | LAC have been identified for these wetlands on the basis that they are the best indicators of freshwater flows into the broader Gippsland Lakes system.  Level C - LAC based on Tilleard and Ladson (2010) ‘Hydrological Analyses to Support Determination of Environmental Water Requirements in the Gippsland Lakes’. This is a threshold-based LAC that is based on modeling and ecological assessments. Note that these values should be considered as indicative only at this stage, and should be constantly reviewed.  Tilleard and Ladson (2010) indicate no work has been done for wetlands on the Mitchell (Macleod Morass); McLennan Straits (Morley Swamp, Lake Betsy); or Jones Bay. | C1 – C8  S1, S2 |

| **Number** | **Indicator for Critical Component / Process/Service for the LAC** | **Relevant timescale[[2]](#footnote-2)** | **Limit(s) of Acceptable Change** | **Spatial scale/temporal scale of measurements** | **Underpinning baseline data** | **Secondary critical C,P,S addressed through LAC** |
| --- | --- | --- | --- | --- | --- | --- |
| P2 | Waterbird breeding | Short Term | Abandonment or significant decline (greater than 50 per cent) in the productivity of two or more representative breeding sites (based on two sampling episodes over a five year period) within any of the following site groupings:   * Lake Coleman, Tucker Swamp and Albifrons Island - Australian pelican. * Bunga Arm and Lake Tyers – little tern and fairy tern. * Macleod Morass, Sale Common and Dowd Morass – black swan, Australian white ibis, straw-necked ibis, and little black cormorant. | Recommended baseline monitoring program should comprise a minimum two annual sampling periods separated by at least one year (and within a 5 year period). | Level C - The use of the site by these species is well documented. However, there are no empirical data describing breeding rates. Baseline data will need to be collected to assess this LAC. | C6 |
| **Critical services/benefits** | | | | | | |
| S1 | Threatened species | N/A  Long Term | No LAC are proposed for painted snipe and Australasian bittern at the current time until greater information is available about patterns of usage and populations in the Ramsar site. Other threatened species are dealt with in the critical components above.  Australian grayling continues to be supported in one or more of the catchments draining into the Gippsland Lakes. | N/A  Setting of more empirical limits of acceptable change not possible at present, given the absence of quantitative population data for this species for any of the rivers and creeks that drain into the site. | Level C - Site records are not recent, uncommon and the location within the Ramsar boundary not known.  Level C - This species has been recorded in the major drainages that drain into the site. Juveniles have an apparent obligate estuarine phase, and therefore must use the site in order for this species to persist in these drainages. There are no data describing the population status of this species in these drainages. | P1, C3  P1, C1, C2 |

| **Number** | **Indicator for Critical Component / Process/Service for the LAC** | **Relevant timescale[[3]](#footnote-3)** | **Limit(s) of Acceptable Change** | **Spatial scale/temporal scale of measurements** | **Underpinning baseline data** | **Secondary critical C,P,S addressed through LAC** |
| --- | --- | --- | --- | --- | --- | --- |
| S2 | Fisheries resource values | Medium Term | * Total annual black bream commercial fishing catch per unit effort will not fall below the 10th percentile historical baseline value of 6.1 (see Section 3.8.2) in a five successive year period. * Sub-optimal black bream spawning conditions should not occur in any successive five year period within key spawning grounds (that is, mid-lower estuaries and adjacent waters of main lakes) during the peak spawning period (October to December). Based on Tilleard (2009), optimal conditions are as follows: * Water column salinity is maintained in brackish condition (for example, between 17-21 grams per litre median value) in the middle of the water column in the mid-lower estuaries and adjacent waters of the main lakes * The salt wedge is located within the mid-lower section of the estuarine river reaches or just out into the main lakes as opposed to far upstream or well-out into the Lakes. | Median measured over five years.  Annual median value for the period October to December.  As above. | Level B - While some commercial fish data has been accessed and reviewed as part of the current study, the abundance and usage of the Gippsland Lakes by key fish species of commercial and recreational significance is not well quantified. The baseline data used in this LAC has limited duration (five years), and is unlikely to be representative of patterns in abundance over longer timeframes. This LAC will need to reviewed and refined.  Level C – based on conditions outlined in Tilleard (2009). | C1, C2, C3, C4, C5 |

1. Short Term – measured in years; Medium Term – 5 to 10 year intervals; Long term – 10+ year intervals. [↑](#footnote-ref-1)
2. Short Term – measured in years; Medium Term – 5 to 10 year intervals; Long term – 10+ year intervals. [↑](#footnote-ref-2)
3. Short Term – measured in years; Medium Term – 5 to 10 year intervals; Long term – 10+ year intervals. [↑](#footnote-ref-3)