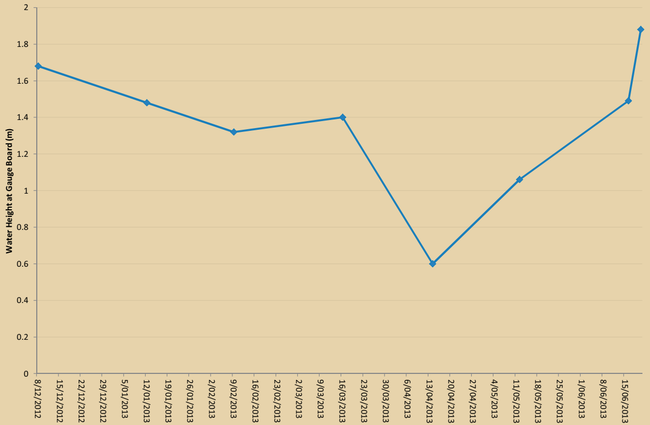
Reduction in estuary water levels

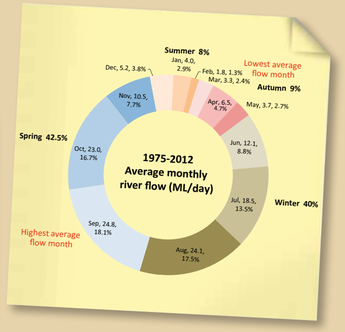
On many occasions the Painkalac Creek Estuary experiences dramatic reductions in water level during summer. This occurs at times when the estuary is closed to the sea with little or no river flows entering the estuary for an extended period.

The reductions in water level in the estuary during summer to autumn are due to evaporation. The rates of evaporation depend on variables such as temperature, solar radiation, cloud cover and wind. From December 2012 to April 2013 the water level dropped from 1.68m to 0.6m resulting in a water level drop of 1.08m.

The Bureau of Meteorology (BOM) estimate the average evaporation from a Class A evaporation pan for this area within Victoria to be, December (175mm), January (175mm), February (175mm), March (150mm) and April (100mm). For the period from December to April this results in a total average evaporation if 775mm (0.78m).

Considering the shallowness, substrate colour, slight turbidity and capillary effect on the estuary's edges are likely to increase evaporation rate. It is conceivable water level reductions are due to evaporation; the increase in salinity sometimes observed during this period also indicates evaporation is the main driver in water level reductions.





Estuary condition monitoring method

The EstuaryWatch program volunteers collect data at six locations in the Painkalac Creek Estuary that they enter on the web-based database. The map shows the five water quality monitoring sites (P1-P5) and one observational mouth condition assessment (Pp1). The water quality data amounts to a profile at 50 centimetre intervals from the surface, including depth, temperature, dissolved oxygen, salinity and electrical conductivity. Turbidity and pH is sampled from the surface and bottom of the water column. This methodology enables vertical water profiles and an assessment of changes in the measured water quality parameters, salinity stratification in the estuary and halocline location. Some water column profiles are also collected when estuary managers are considering artificially opening the estuary mouth using methods and sites consistent with EstuaryWatch.

River flow and rainfall data is collected from a number of river flow gauge stations on the Painkalac Creek and the Aireys Inlet weather station.

Where can you find more information?

Corangamite Catchment Management Authority
www.ccma.vic.gov.au

EstuaryWatch
www.estuarywatch.com.au/CCMA

OzCoasts
www.ozcoasts.gov.au

Surf Coast Shire
www.surfcoast.vic.gov.au

Barwon Water
www.barwonwater.vic.gov.au

DEPI
www.depi.vic.gov.au

Rainfall
www.bom.gov.au

River flow
data.water.vic.gov.au/monitoring.htm

CORANGAMITE CMA

EstuaryWatch

GSDM_11451

PAINKALAC CREEK ESTUARY

An interpreted summary of data

Extract from Painkalac Creek Estuary Data Analysis and Interpretation 2007-2013

CORANGAMITE CMA

Summary

This is a summary of the key elements of a Corangamite Catchment Management Authority Painkalac Creek Estuary data report. It includes analysis of data from the EstuaryWatch database and local rainfall and catchment river flow data.

The Painkalac Creek Estuary environment includes a range of bird, plant, reptile, frog, small mammal and fish communities that depend on the estuary's dynamic variable nature, e.g. river flow, flooding, variable salinities and salt wedge movement. The summary of estuary data will assist the community to improve their understanding, and estuary managers to make informed management decisions to protect and restore the estuary's environmental, social and economic values.

A healthy and functioning estuary system allows a multitude of uses to be enjoyed and sustained. Indigenous communities have a long association with the Painkalac Creek Estuary. The Painkalac Creek has also supported generations of social and economic uses and users, since European settlement in the early 1800s. This includes recreational fishers, campers, walkers and picnickers, township residents, school groups and day trippers, and rural landholders and agriculture. The river also provides drinking water to the Fairhaven and Aireys Inlet townships.

In terms of system management the summary identifies the Painkalac Creek Estuary system to be highly regulated due to water contained in the Painkalac Creek reservoir reducing flows to the estuary, combined with artificial estuary mouth openings to reduce the flooding threat to houses and other infrastructure. This potentially disrupts the breeding and spawning of native fish and limits native plant communities developing. The Corangamite CMA will use this information to inform future management decisions.

Estuary Fact File

Type of Estuary:	Riverine (Wave dominated)
Location:	144°6'2.8945"E 38°28'8.6204"S
Nearest Town:	Aireys Inlet
Landscape Zone:	Thompsons
Catchment Area:	6.133Ha
Estuary Area:	16.2Ha
Estuary Length:	3.6km
River Length:	20.3km
Mouth State:	Intermittently open
Tributary:	Distillery Creek
Estuary Management Plan:	Yes - Written 2005
Description:	The Painkalac Creek begins in the north-eastern end of the Otway Ranges at an elevation of 430m in the deeply-dissected rolling hills. It flows in a mostly easterly direction for 20.3km and enters Bass Strait, on the south-west side of Aireys Inlet.

EstuaryWatch is a community based estuarine monitoring program, aiming to:

EstuaryWatch

'Raise awareness and provide educational opportunities to the community in estuarine environments, and enable communities and stakeholders to better inform decision making on estuarine health'.

Since 2007, when the Corangamite CMA set up the EstuaryWatch program 415 data records have been stored on the EstuaryWatch database for the Painkalac Creek Estuary, including 84 profiles from the P2 site on the Great Ocean Road bridge.

EstuaryWatch website: www.estuarywatch.com.au

Stratification, dissolved oxygen and fish

In a closed estuary, salinity stratification and subsequent available dissolved oxygen (DO) can have severe impacts on saltwater dependent fish species. The generation of anaerobic conditions or environments free of oxygen, occurs predominately in the bottom waters. Habitat preference resigns some fish species to certain salinity levels and confines them to that layer. While other fish species depend on estuarine and freshwater environments, and are able to move between the levels to more favourable locations.

Unfavourable DO conditions are generally less than 5mg/l and to as low as 0mg/l. The decline in DO levels in the bottom waters of the Painkalac Creek Estuary begins when river flow increases, resulting in a rise in water level within the closed estuary.

The DO in the water below the halocline is consumed by oxygen dependant organisms and microbial activity and depending on the closure duration may continue until the bottom waters are fully depleted of DO.

This is a natural process and in the Painkalac Creek Estuary these conditions would have occurred repeatedly prior to European settlement. The volume of river inflows usually determines the duration of these conditions in the Painkalac Creek Estuary. Estuary water level is a trigger for artificial estuary mouth openings due to potential flooding of houses and other infrastructure such as the Great Ocean Road.

Estuary Closures and Openings

The Painkalac Creek Estuary is predominantly closed to the sea much of the time. This is mostly due to very low river flows, when the estuary is closed on many occasions sea water enters the estuary over the berm.

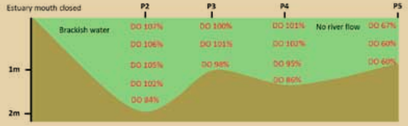
Artificial estuary openings occur when there is a threat of floodwaters inundating houses on the Painkalac Creek Estuary's natural flood plain and the Great Ocean Road. These openings occur due to rising water levels and are closely monitored along with weather patterns and river flow to reduce the risk of flooding. They are often classified as an 'emergency opening'. The result of such an event is estuary water levels rarely reach a level suitable for a natural opening.

Artificial openings also regulate water quality in the estuary, and not necessarily in a bad way. As the water level in the estuary rises from rain and river flow the estuary starts to stratify. The scale of reduction in dissolved oxygen levels in the bottom waters of the estuary depends on the duration of the stratified layer. After approximately two weeks, dissolved oxygen levels in the bottom waters is greatly reduced, this usually coincides with significant rainfall and increased river flow. Heightened estuary water level triggers a need to artificially open the estuary mouth.

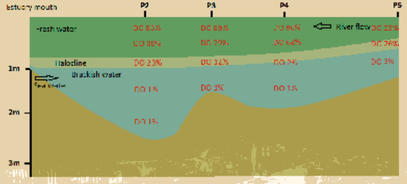
Upon opening the estuary mouth the freshwater layer is the first layer drained off out to sea. The reintroduction of seawater into the estuary on the returning high tides results in a stratification breakdown in the estuary and re-oxygenates the water column.

Additionally, the artificial estuary mouth opening alters the degree and duration of floodplain inundation, and associated salt marsh communities; impacting on the habitat salt marsh communities creates when flooded. The consequences of altering natural seasonal flooding and duration of inundation is likely to impact on native fish species spawning and recruitment, and developing and recruiting salt marsh communities.

The Painkalac Creek Estuary closed and fully mixed on 14/04/2013



Stratification and low dissolved oxygen levels in the bottom waters of the Painkalac Creek Estuary on 14/07/2013



Stratification process

Characteristics of a stratified estuary include a distinct increase in salinity with depth, where less dense freshwater overlays denser seawater and little or no mixing between the layers. This boundary layer, or halocline, marks salinity increase/decrease.

The volume of seawater entering an estuary depends on several factors, including river flow, entrance channel width and depth, tidal range and storm surge.

Dense seawater sinks below less dense freshwater and slowly moves to the bottom of the estuary. As the tide recedes, the freshwater flows over the seawater trapping it in the deeper parts of the estuary. Some mixing may occur creating a brackish layer. The returning high tide begins the process again and more seawater enters the estuary.

In the Painkalac Creek Estuary the stratification process is commonly observed when rainfall and river flow increase. The influent freshwater enters the estuary forming a layer of less dense freshwater overlaying denser brackish/salt water. The effect of this results in the formation of a halocline as little as 0.5m below the surface restricting the mixing within the water column, isolating the denser salt water from the atmosphere and reducing the diffusion of oxygen into the waters below the halocline.

Quality Assurance and Quality Control (QA/QC)

EstuaryWatchers collect consistent and accurate data to produce reliable estuary information. Painkalac Creek EstuaryWatchers attend QA/QC refresher training every six months. They catch up over morning tea and fine tune their estuary monitoring skills and knowledge.

Volunteers at work

Painkalac Creek EstuaryWatch volunteers have collected one of the most comprehensive data and information sets of the Victorian EstuaryWatch program. The Painkalac Creek EstuaryWatch group has nine dedicated volunteers who share the monitoring when they meet every second Saturday or Sunday of the month.

Artificial estuary opening

The Corangamite CMA use the Estuary Entrance Management Support System (EEMSS) to advise of socio-economic and ecological risks associated with artificially opening an estuary.

Natural Wonder

Painkalac Creek is a beautiful spot on the Surf Coast. The extensive dune system between its lagoon and the sea provides shelter for young families visiting the beach and it's a perfect spot for an early morning walk. When the water is still, reflections of the lighthouse and headland are projected across the estuary.