

Why aquatic plants are important

Aquatic plants of the Southern Coorong include *Ruppia tuberosa*, *Althenia cylindrocarpa* and *Ruppia megacarpa*. They are grouped together as a community of aquatic plants because it's difficult to distinguish these species when they are not flowering. All three species are small, submerged aquatic plants with very fine leaves. This aquatic plant community is often referred to simply as 'Ruppia'.

Aquatic plants are essential for a range of animals and the health of the Coorong. The formation of a dense canopy of aquatic plants creates a habitat for small and juvenile fish and invertebrates. These are in turn eaten by medium and large-sized fish such as Congolli and Mulloway. Herbivores and detritivores eat all parts of aquatic plants, including leaves, roots and even seeds.

Aquatic plants have other important but hidden roles to play in the Southern Coorong. The plants photosynthesise during the day, producing oxygen. The plant's vascular system carries oxygen from the leaves to plant roots where it is released into the sand or mud. This creates a layer of oxygen-rich sediment around the plant roots where bacteria and other microbes use oxygen to turn ammonium into nitrate. Nitrate can then be converted into a nitrogen gas and released into the atmosphere; reducing the levels of nitrogen in the water and sediment.

The leaves of aquatic plants are rich in nitrogen. As the leaves grow, nitrogen is taken up from the water and sediment to supply the leaves. These nutrients are stored in the leaves until the plant leaves are eaten, or they become detritus and break down over longer periods of time. Nutrients stored in plant leaves are locked away so that they are not available to nuisance filamentous or planktonic algae, reducing nutrients available for algal growth. This is another reason that aquatic plants are good for the eutrophication status of the Coorong.

The extent and amount of aquatic plant communities have been low in the Southern Coorong since the Millennium Drought. The extent of aquatic plants has shown some slow recovery in recent years, though the plants remain in poor condition, which exacerbates current poor sediment and water quality conditions. Given plants are key primary producers within the Coorong foodweb, improving their current condition will benefit food and habitat availability for native invertebrates, fish and birds.



Image: Aquatic plants provide important food and habitat in the Coorong

Further reading

Asanopoulos, C., and M. Waycott. 2020. The growth of aquatic macrophytes (*Ruppia tuberosa* spp and *Althenia cylindrocarpa*) and the filamentous algal community in the southern Coorong. Goyder Institute for Water Research, Adelaide.

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Ye, Q., G. Giatus, S. Dittmann, R. Baring, L. Bucater, D. Deane, D. Furst, J. Brookes, D. J. Rogers, and S. Goldsworthy. 2020. A synthesis of current knowledge of the food web and food resources for waterbird and fish populations in the Coorong. Goyder Institute for Water Research, Adelaide.

Acknowledgements

The Healthy Coorong, Healthy Basin Action Plan is part of the South Australian Government's overarching Project Coorong initiative.

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The Goyder Institute for Water Research is the delivery partner for research components of Healthy Coorong, Healthy Basin, providing independent research to inform future management decisions for the region.

Glossary

Ammonium — A dissolved form of nitrogen readily taken up by algae and aquatic plants.

Anoxic — Lacking oxygen.

Aquatic plants — A phrase used to describe the mixed submerged aquatic plant community that includes *Ruppia tuberosa*, *Ruppia megacarpa* and *Althenia cylindrocarpa*. Where otherwise stated, the phrasing will be referring to either species independently or the genus.

Bacteria — A unicellular microorganism with simple internal structures.

Bioturbation — The reworking of sediments by animal activities including burrowing, ingestion, and defecation of sediment grains. It has a profound effect on sediment condition and the environment.

Connectivity — A mechanism that allows for the movement of water, materials and animals between areas, including between the north and south lagoons of the Coorong, between the sea and the Coorong through the Murray Mouth, and from the River Murray or south east flows to the Coorong (but not typically vice versa). It is an important element of hydrodynamics, has a strong influence on water quality (through exchange of salt and nutrients) and is essential for some ecological processes, such as migration of fish at different times of year and for the transport of zooplankton from freshwater inflows to support food webs of the Coorong.

Detritivore — An animal that feeds on dead material, especially plant parts.

Denitrification — The process by which nitrate is converted to nitrogen gas bubbles, which are released to the atmosphere. If the sediment is anoxic, then nitrification-denitrification cannot occur and the nitrogen remains in the nutrient cycle.

Eutrophication — The process of nutrient enrichment and the increase in the supply of organic matter. Eutrophic systems typically have excessive plant and algal growth, which become internally produced organic matter loads as they decay. They grow excessively in response to nutrient enrichment such as nitrogen and phosphorus inputs. Eutrophication has cascading effects for the entire ecosystem. The hyper-eutrophic state in the Southern Coorong is characterised by high concentrations of chlorophyll-a (>50 mg/L), total nitrogen (>4 mg/L) and total phosphorus (>0.2 mg/L) in the water.

Evapo-concentration — The concentration of solutes such as salt and contaminants as water evaporates. The effects of evapo-concentration increase with increasing water residence time, and at higher temperatures in summer.

Filamentous algae — The green filamentous algal community which occurs in the Coorong, consisting of *Ulva paradoxa*, *Rhizoclonium sp.* and *Cladophora sp.*

Herbivore — An animal that eats plants.

Hyper-eutrophic — An extremely high-nutrient state due to eutrophication.

Hyper-saline — Salinities that are greater than that of normal seawater.

Macroinvertebrate — Invertebrate fauna that are greater than 0.5 mm.

Mesotrophic — Intermediate levels of nutrients, common in healthy estuaries. A mesotrophic Coorong would be fairly productive (with plant and animal life), but could be at risk of having water quality problems.

Millennium Drought — An Australian drought which impacted the Murray-Darling Basin over the period 1996–2010, and substantially impacted the Coorong over the period 2001–2010. The period from 2007–2010 was particularly extreme with extended periods of no flow through the barrages to the Coorong.

Monosulfidic black oozes — Monosulfidic black oozes (MBOs) form when there is an excess of organic matter, and sediments become anoxic as the bacteria consume all the oxygen to decompose the organic matter. Iron (III) and sulfate are converted by bacteria to iron (II) and hydrogen sulfide, because there is no oxygen. The iron typically comes from iron oxide minerals in the sediment that are reduced, whereas sulfate comes from water (it is plentiful in seawater and saline groundwaters)

Nitrogen — A nutrient that is essential to plants and animals and forms compounds such as amino acids and proteins. Nitrogen can be found in aquatic environments in dissolved, particulate, inorganic, organic and gaseous forms. Too much nitrogen can be associated with eutrophication.

Nitrate — A dissolved form of nitrogen.

Glossary

Nitrification — Nitrification is the process by which ammonium is converted to nitrite and then nitrate. It can also take place in the sediment and requires oxygen. Denitrification is the process by which nitrate is converted to nitrogen gas bubbles, which are released to the atmosphere. If the sediment is anoxic, then nitrification-denitrification cannot occur and the nitrogen remains in the nutrient cycle.

Nutrient cycle — The movement or exchange of nutrients, such as nitrogen, from inorganic and organic forms into organic matter, including plants and animals, and back again.

Oxygenate — Supply or enrich with oxygen. Sediments in aquatic systems need to be oxygenated in order for healthy nutrient cycling and nutrient exchange from sediment to water and to the atmosphere to occur. Oxygenation of sediments can occur through biological processes (e.g. animal movement, pumping through plant roots), or physical processes such as water turbulence and currents moving sediments around.

Phosphorus — A nutrient essential to life and strongly influencing water and sediment quality in the Coorong. Phosphate is the dissolved form of phosphorus, which is uptaken by plants and algae.

Photosynthesis(e) — The conversion of light energy to organic compounds, can be referred to as carbon fixation.

Phytoplankton — Small plankton algae that is essential to aquatic food webs.

Respiration — Respiration is a chemical reaction which takes place in all living cells and releases energy from glucose. Anaerobic respiration occurs without oxygen and releases less energy but more quickly than aerobic respiration.

Ruppia — A genus of aquatic plant, referring to the species *Ruppia tuberosa* in the Southern Coorong.

Salinity — Salinity can be defined as the concentration of dissolved mineral salts present in waters and soils on a unit volume or weight basis.

Southern Coorong - The Southern Coorong is defined here as the area ranging from Parnka Point in the north and south to 42 Mile Crossing, approximately 65 to 105 km from the Murray Mouth that connects the estuary to the sea.

Turion — Reproductive structure of *Ruppia tuberosa* (Type I and Type II) and *R. polycarpa* (Type I) produced underground that is capable of forming into a new plant

Water quality — The condition of water or some water-related resource as measured by biological surveys, habitat-quality assessments, chemical-specific analyses of pollutants in water bodies, and toxicity tests.

Zooplankton — Animals (often microscopic) that either move by water currents or are weak swimmers in the water column.

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