



Report Summary

Report Name:	Desalination and potential marine environmental impacts with a focus on Spencer Gulf
Authors:	Bronwyn M Gillanders and Jackson Stockbridge
Organisation:	The University of Adelaide
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Reference	Gillanders BM, J Stockbridge (2022) Desalination and potential marine environmental impacts with a focus on Spencer Gulf. Report to Infrastructure South Australia. The University of Adelaide, Adelaide. 47 pages.
Purpose:	This report pulls together research into the effects and impacts of desalination from key studies in the Spencer Gulf including those undertaken as part of the Olympic Dam Expansion Environmental Impact Statement and the Spencer Gulf Ecosystem Development Initiative (SGEDI). It also reviews over 160 relevant peer reviewed and published scientific papers on desalination, with a specific focus on the marine environment of this region.
Short Summary	This report pulls together a wide range of existing reports to establish the latest knowledge on potential impacts to the marine environment that could result from a desalination plant in the Spencer Gulf. It also identifies where there are gaps which need to be filled through additional in-depth studies once a study site is selected.
Longer Summary:	<p>What is desalination?</p> <p>As water resources decline globally, desalination is increasingly being used to provide sustainable freshwater supplies to areas which desperately need them. Desalination is the removal of salt and other impurities from saltwater (usually seawater) to create fresh water.</p> <p>The most common desalination process involves forcing seawater through a semi-permeable membrane at high pressure. The membrane separates salts and other suspended solids leaving fresh, clean water which is then used to supply communities and businesses. The separated substances are usually released back into the ocean as 'return water'.</p> <p>Although a desalination plant in the Upper Spencer Gulf may provide a sustainable water supply, there are potential impacts which need to be considered during the planning phase including:</p> <ul style="list-style-type: none"> What happens to the salt which is removed during the desalination process? What other contaminants may be released in the 'return water', for example anti-scalants? What other impacts might there be for the various flora and fauna species which call this region home and the communities and industries that rely on them? <p>Why was this report created?</p>

This report pulls together previous studies including those undertaken as part of the Olympic Dam Expansion Environmental Impact Statement and the Spencer Gulf Ecosystem Development Initiative (SGEDI) along with over 160 relevant peer reviewed and published scientific papers on desalination, with a specific focus on the marine environment of this region.

It looks at what we already know about potential impacts on the marine environment should a desalination plant be built in the region.

It also identifies where there are gaps which need to be filled through additional in-depth studies once a study site is approved.

What are some of the key points?

What happens to the salt which is removed during the desalination process?

Return water from the desalination process often has salt levels (salinity) twice that of seawater. As this water is denser than regular saltwater due to the increased salt levels, it may sink to the seafloor if not properly mixed. This means the greatest impacts are likely to be on seabed communities (known as 'benthic' communities) such as corals and shellfish.

The models also suggest that seawater circulating through the region from the open ocean, would flush the return water out of the Gulf within a year, reducing the long-term increases in salinity to acceptable levels.

Gap – Although results show the marine environment has already adapted to changes in salinity levels due to natural causes such as evaporation, these changes happen across the entire Gulf rather than on a focused point, like around a desalination plant. More detailed investigations into the specific currents and seafloor levels around the study site are recommended.

What other contaminants may be released in the return water, for example anti-scalants?

Ecotoxicology tests on a range of native marine species have been undertaken by three different organisations and the results suggest that the return water would be diluted enough to have a negligible impact on most.

Gap – It is recommended that further ecotoxicology tests are carried out using the exact chemicals which would be used by a desalination plant and on species local to the area chosen for the study site.

What other impacts might there be for the various species which call this region home and the communities and industries that rely on them?

Understanding the footprint of fishing in the Gulf helps us work out if the fishing industry is likely to be affected. For example, existing reports indicate that some commercially important species such as the brown crab or European lobster move away from very salty water so knowing where they are now and where they may move will be important.

Whilst the reports confirm that the impact of high salinity water on fish species is not immediately significant due to the fact fish can change the balance between salt and water in their own bodies, this process does take up increased levels of energy and may impact on populations in the longer term.

The Northern Spencer Gulf is particularly important for the giant Australian cuttlefish which breed each winter on a rocky reef near Point Lowly. The reports show that embryo survival in cuttlefish decreases in highly salty water so this will need to be considered when looking at a study site.

	<p>Research has also been carried out on the cumulative impacts of salinity on important seagrass habitats. Results showed no noticeable relationship between seagrass condition and the cumulative impacts of salinity.</p> <p>Gap - More studies are needed on the impacts of increased salinity on fish egg development and juvenile fish, including cuttlefish.</p> <p>Further investigation is required to ensure the measurements used to assess seagrass condition are adequate and appropriate for the region.</p> <p>Habitat maps have been put together which show what lives where in the region, but these use data from a number of sources so it is advised that an updated map is developed as part of the detailed investigations for the Northern Water Supply project.</p> <p>There are other impacts to consider as well as salinity including changes to heat patterns, acidity and oxygen levels. There are few studies available which provide suitable data on these issues so further detailed research is required to fully understand the potential impacts. We also need to understand the risk of pests and other threats arriving on marine vessels associated with the plant.</p>
Key Recommendations:	<p>After reviewing 162 existing reports, we are left with gaps which need to be filled as part of the detailed investigations at the study site.</p> <p>Studies are needed on the long-term impacts of very salty water at the specific location of the agreed study site.</p> <p>Sampling programs are recommended to establish baseline data for identifying and monitoring impacts as the project progresses.</p> <p>In-depth studies on local water quality and how the return water moves around the Gulf are needed to fully understand which areas may experience less flushing and therefore retain higher levels of salt.</p> <p>Climate change impacts need to be researched so we can fully understand how they might interact with the changes brought about by the desalination plant and lead to effects that we aren't able to predict currently.</p>
Link to report	Desalination and Potential Marine Environmental Impacts, Gillanders and Jackson 2022 Report