A contribution to

An analysis of medium to long-term impacts on the Australian Oceans

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1.1 Seawater desalination

As Australia is the driest inhabitable continent in the world (Australia.gov.au), water supply needs to be managed effectively to sustain for an increasing population in the context of climate change. Seawater desalination is a sustainable solution to the scarcity of water. Alongside recycled wastewater, it is a rainfall-independent source of freshwater (Fischetti, 2007). This "non-conventional" (not part of the hydrological cycle) option can contribute to meet the Sustainable Development Goal (SDG) 6 which is the availability of clean water to current and future generations (Jones et al., 2019). Currently around 95 million m^3/day of desalinated water are produced for human consumption (Jones et al., 2019) and the production is expected to reach 192 million m^3/day by 2050 (Bashitialshaaer et al., 2011). While desalination is well established in the Middle East and North Africa, it is increasingly common in other regions of the world, such as the United States, Europe, China and Australia (Jones et al., 2019; Roberts et al., 2010).

Prior to the 1980, thermal technologies (i.e. multi-stage flash distillation, multi-effect distillation) were predominant but use of membrane technologies, particularly reverse osmosis, have risen post 1980s to gradually become dominant (Jones et al., 2019).

Desalination provides advantages but also challenges, including reducing energy demands, waste products and public health concern. In particular the release of hypersaline discharge (brine) into the environment appears as a major threat to marine ecosystems (Jones et al., 2019; Roberts et al., 2010). The energy demand issue can be addressed by producing desalinated water in association with renewable energy. Another, not well covered in literature, challenge is the low levels of essential minerals, such as sodium, potassium, magnesium and calcium, in desalinated water which could lead to electrolyte disorders (Darre & Toor, 2018).

With the increase in clean water demand, the future of desalination should be strongly related to the future of water consumption. Projections of water consumptions prepared by the Australian Bureau of Statistics (ABS) are presented in Figure 1 (WSAA, 2010). They are presented for three series of population projections. Series A projects a population of 45.5 million, for series B the population would be 35.5 million and series C, 31 million, in 2056, with series B and C being the most plausible. The projected population growth is multiplied by the projected per capita consumption, estimated by experts, and the projected commercial and industrial demand is incorporated. Desalination will be able to supply a significant proportion of the additional water required. At the exception of Darwin, all mainland coastal capital cities have at least one desalination plant.

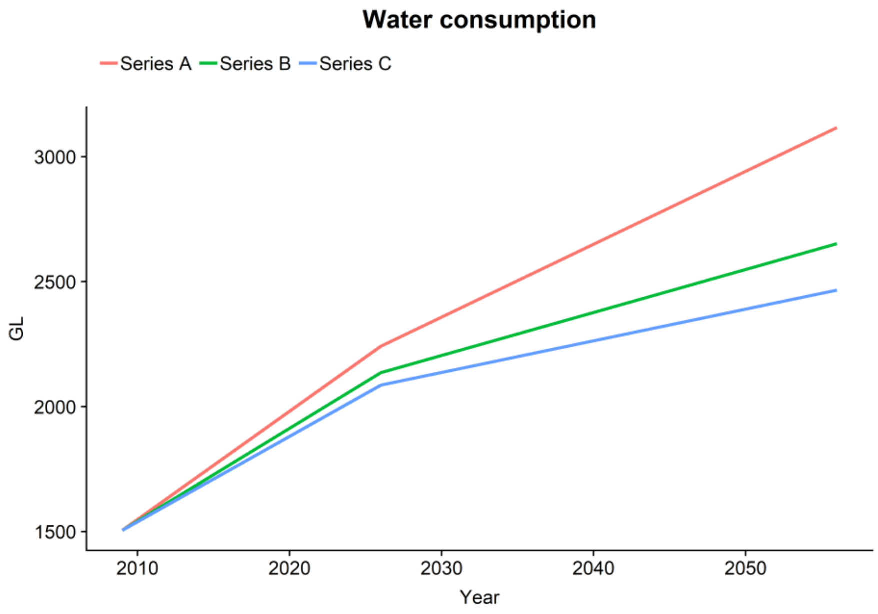

Figure 1. Projected total urban water consumption.

1.2 Sector-specific conceptual model

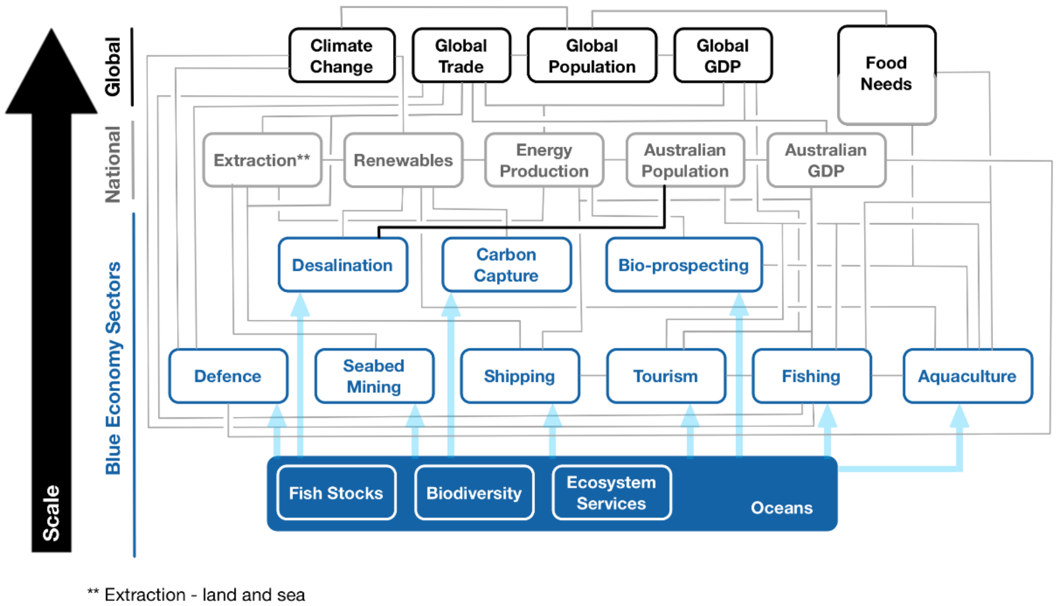

Figure 2. The initial conceptual model in Figure 1 in the main document, complemented with information about sector-specific drivers obtained from the analysis of sector projections. See main text for more information.

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