

**SHORT-TERM AND LONG-TERM EXPOSURE IMPACTS OF DILUTED DESALINATION BRINE
DISCHARGE TO VARIOUS BIOLOGICAL RECEPTORS**

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ABSTRACT: Available disposal options for the high-salinity sidestream generated during the desalination process (i.e. brine) is a key limiting factor with construction of seawater desalination plants. If there is not a nearby or co-located wastewater treatment plant generating fresh water effluent available to blend with a high salinity brine stream, then a desalination plant must rely on ambient seawater to dilute the brine to an ecologically innocuous salinity level. This is commonly accomplished by blending brine with either receiving water intake or cooling water discharge from a co-located power plant. Seawater reverse osmosis desalination plants are typically designed for recovery of 45% to 55% as fresh water, leaving a brine discharge salinity of approximately twice that of marine receiving waters. The operational costs for seawater desalination plants is therefore influenced by the volume of ambient seawater necessary to dilute the brine to a level that does not pose any significant threat to marine life within the discharge environment. Although it has been demonstrated that salinity levels up to 57 parts per thousand have not caused statistically significant changes to the overall function and quality of the aquatic environment in the discharge area, most desalination plants are restricted by discharge permit criteria that are based on toxicological impacts to single sensitive receptors. This study evaluates the impacts of varying brine discharge dilutions to critical life stages of several biological receptors in both short-term and long-term exposure scenarios. The suite of receptors was a mix of species accustomed to either hard surface or sandy bottom substrates in order to represent the two most common marine discharge environments. In addition to a comprehensive assessment of short and long-term exposure impacts to brine diluted with ambient seawater, the study also investigated potential effects of different ion ratios within the standard suite of Total Dissolved Solids (Ca, Mg, Na, Cl and SO₄). This component was included to assess the differences in ecological impact between brine discharges diluted with ambient seawater and those diluted with effluent from wastewater treatment plants. In general, the occurrence of significant impacts was driven primarily by the type of life stage evaluated.

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