ID: W2889243269

TITLE: First large-scale ecological impact study of desalination outfall reveals trade-offs in effects of hypersalinity and hydrodynamics

AUTHOR: ['Graeme F. Clark', 'Nathan A. Knott', 'Brett Miller', 'Brendan P. Kelaher', 'Melinda A. Coleman', 'Shinjiro Ushiama', 'Emma L. Johnston']

ABSTRACT:

Desalination is an increasingly common method of meeting potable water demands, but the associated ecological risks are not well understood. Seawater desalination plants discharge large volumes of hypersaline brine directly into the ocean, raising concerns about potential impacts to marine life. In order to reduce impacts of brine, newer desalination outfalls are often fitted with high-pressure diffusers that discharge brine at high velocity into the water column, increasing the mixing and dilution of brine with ocean water. However, there are few published studies of marine impacts of desalination brine, and no well replicated before-after designs. Here we report a six-year study testing for impacts and subsequent recovery of sessile marine invertebrate recruitment near a desalination outfall with high-pressure diffusers. We used a Multiple Before-After-Control-Impact (MBACI) design to test for impacts and recovery at two distances (30 m and 100 m) from a 250 ML/day plant outfall, as well as a gradient design to test the strength of impacts relative to distance from the outfall. The diffusers achieved the target of less than 1 ps? salinity difference to surrounding ambient waters within 100 m of the discharge outfall, but sessile invertebrates were nonetheless impacted. Polychaetes, bryozoans and sponges reduced in cover as far as 100 m from the outfall, while barnacles showed the opposite pattern and were more abundant near the discharging outfall. Ecological impacts were disproportionate to the relatively minor change in salinity (?1 ps?), suggesting a mechanism other than salinity. We propose that impacts were primarily driven by changes in hydrodynamics caused by the diffusers, such as higher near-bed flow away from the outfall. This is consistent with flow preferences of various taxonomic groups, which differ due to differences in settlement and feeding abilities. High-pressure diffusers designed to reduce impacts of hypersalinity may inadvertently cause impacts through hydrodynamics, leading to a trade-off in minimizing combined salinity and hydrodynamic stress. This study provides the first before-after test of ecological impacts of desalination brine on sessile marine communities, and rare insight into mechanisms behind impacts of a growing form of human disturbance.

SOURCE: Water research

PDF URL: None

CITED BY COUNT: 32

PUBLICATION YEAR: 2018

TYPE: article

CONCEPTS: ['Outfall', 'Desalination', 'Salinity', 'Environmental science', 'Brine', 'Seawater', 'Water column', 'Hydrology (agriculture)', 'Oceanography', 'Environmental engineering', 'Ecology', 'Geology', 'Biology', 'Chemistry', 'Genetics', 'Geotechnical engineering', 'Organic chemistry', 'Membrane']