

Shifting the discharge mindset from harmful to habitat: exploring inventive designs and benefits of underwater discharge structures

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ABSTRACT

A zero discharge seawater desalination approach still appears to be very optimistic, especially when it comes to the large volumes of product water and associated brine (concentrate) that requires appropriate disposal. In addition to this, and although the technology advancements of mining for precious metals from brine show promising potential, it is still a challenge to use a single method to selectively extract valuable minerals from complex brine matrices. These two alternatives, (i) zero discharge and/or (ii) mining for minerals (from brine) may not be the best selections when designing underwater discharge structures (at least for the foreseeable future). With the aim to protect the marine environment, regulations have been set to regulate the brine discharges and defining environmental criteria in the area close to the outfall. It was however noted, that such criteria are often adopted from generic benchmarks and sometimes from unadoptable locations. Robust and *in situ* research on the effects of the brine effluent on the marine environment is also lacking. Recent surveys, however, suggest that the ecological impact of brine outfalls can be very limited or even result in an improvement of biodiversity and marine abundance on the outfall structure. Such observations suggest that some environmental criteria may be archaic, which may result in needlessly expensive outfall designs. Additionally, the hard substrate that the outfall structure provides appears to be a good habitat for the enhancement of marine growth. We therefore propose, instead of only aiming to minimize impact, also to promote the ecological habitat function by optimizing the design criteria of underwater discharge structures. Our paper presents first guidelines/examples (of shapes and material use (e.g., Coating with eco concrete)) to promote coral growth, nursery ground for fish, etc. Furthermore, we provide initial ideas for the treatment of the desalination effluent to help the advancement of such marine habitats.

Keywords: Desalination, Underwater discharge structures, Habitat, Environmental impact assessment, Mitigation, Building with nature

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