WATER RESEARCH 70 (2015) 325–336

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/watres

Benthic community recovery from brine impact after the implementation of mitigation measures

Yoana Del-Pilar-Ruso[*], *Elena Martinez-Garcia*, *Francisca Giménez-Casalduero*, *Angel Loya-Fernández*, *Luis Miguel Ferrero-Vicente*, *Candela Marco-Méndez*, *Jose Antonio de-la-Ossa-Carretero*, *José Luis Sánchez-Lizaso*

Dpto. de Ciencias del Mar y Biología Aplicada, Universidad de Alicante, Campus de San Vicente del Raspeig, Ap. 99, E-03080, Spain

ARTICLE INFO

Article history:
Received 13 June 2014
Received in revised form
20 November 2014
Accepted 21 November 2014
Available online 10 December 2014

Keywords:
Polychaete assemblage
Brine discharge
Mitigation measures
Recovery
Soft bottom
Mediterranean

ABSTRACT

In many regions, seawater desalination is a growing industry that has its impact on benthic communities. This study analyses the effect on benthic communities of a mitigation measure applied to a brine discharge, using polychaete assemblages as indicator. An eight-year study was conducted at San Pedro del Pinatar (SE Spain) establishing a grid of 12 sites at a depth range of 29–38 m during autumn. Brine discharge started in 2006 and produced a significant decrease in abundance, richness and diversity of polychaete families at the location closest to the discharge, where salinity reached 49. In 2010, a diffuser was deployed at the end of the pipeline in order to increase the mixing, to reduce the impact on benthic communities. After implementation of this mitigation measure, the salinity measured close to discharge was less than 38.5 and a significant recovery in polychaete richness and diversity was detected, to levels similar to those before the discharge. A less evident recovery in abundance was also observed, probably due to different recovery rates of polychaete families. Some families like Paraonidae and Magelonidae were more tolerant to this impact. Others like Syllidae and Capitellidae recovered quickly, although still affected by the discharge, while some families such as Sabellidae and Cirratulidae appeared to recover more slowly.

1. Introduction

Over the last few decades we have faced a global water crisis due to the increase in domestic, industrial and agricultural water demand. The rapid growth in human population and industrial–scale activities has contributed to this water scarcity (Medina, 2001). As a result many countries have pursued alternatives to conventional resources to supply the additional water (Zhou et al., 2013). Desalination of seawater is predominantly used for alleviating the problem of water scarcity in dry coastal regions. It accounts for a worldwide production capacity of 24.5 million m^3/day (IDA, 2006; Lattemann and Höpner, 2008). In the Mediterranean Sea, the total production from seawater is about 4.2 million m^3/day (17% of the worldwide capacity) (Lattemann and Höpner,

* *Corresponding author*. Tel.: +34 965 903400x2916; fax: +34 965 909897.
E-mail address: yoana.delpilar@ua.es (Y. Del-Pilar-Ruso).
http://dx.doi.org/10.1016/j.watres.2014.11.036
0043-1354/

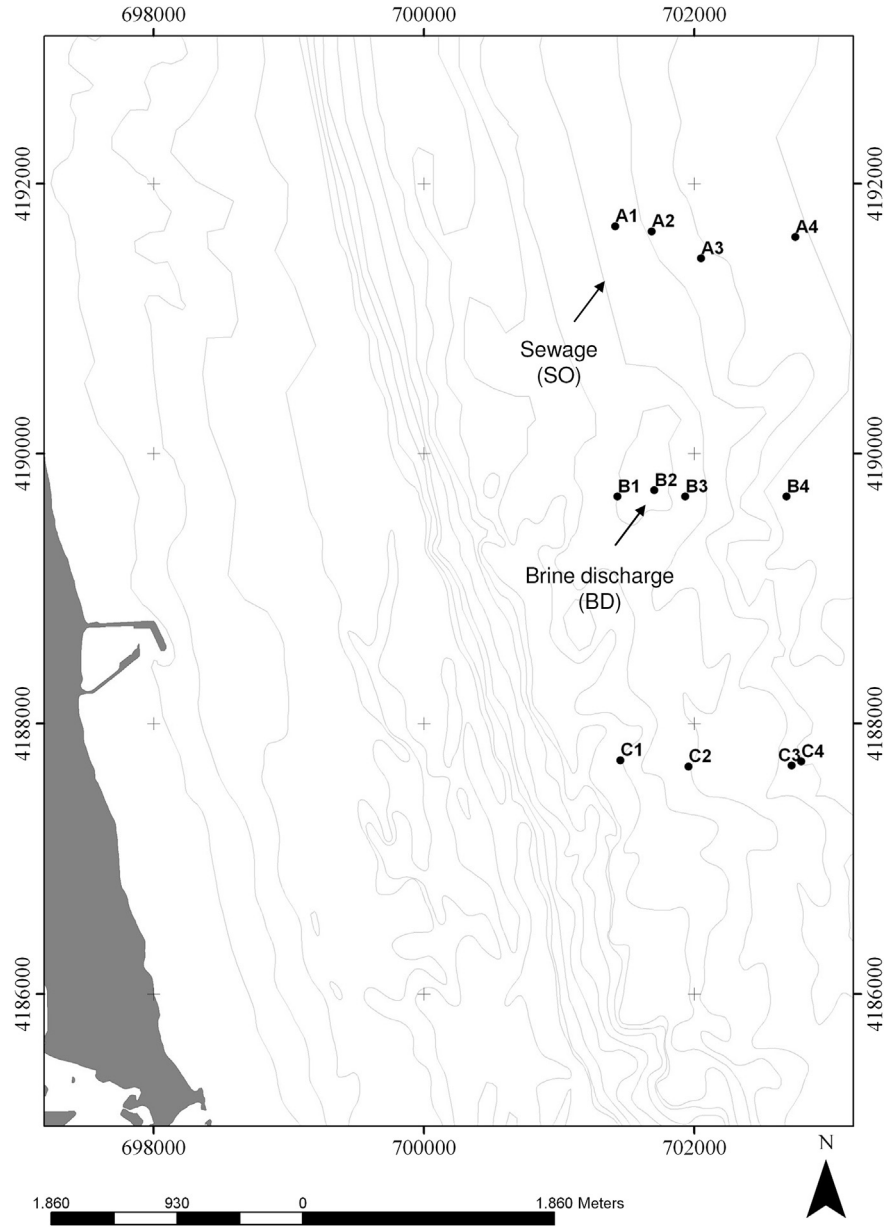

Fig. 1 – Map of the study area showing the sampling stations around the brine discharge. The distances between 1 and 2 and between 2 and 3 were 250 m. The distance between 4 and 2 was 1 km. The distance between C3 and C4 was shorter due to sampling problems (UTM coordinate system. Grid zone 30S) (SO: sewage outfall; BD: brine discharge).

2008). Spain is considered a water-stressed country (European Environmental Agency, 2005); with 7% of the worldwide capacity it is the largest producer in the region, with about 70% of its desalting plants located on the Mediterranean coast (Lattemann and Höpner, 2008). Among the different technologies used, reverse osmosis is the most common, mainly due to its low energy and space consumption and the reduction in the cost of producing potable water (Einav et al., 2002). Nevertheless, such facilities may give rise to several potentially adverse environmental impacts (Höpner and Windelberg, 1996; Fernández-Torquemada et al., 2005; Sadhwani et al., 2005; Del-Pilar-Ruso et al., 2009). The main impact of seawater reverse osmosis (SWRO) desalination plants on marine communities is caused by the discharge of high salinity effluent (Einav et al., 2002). This brine, characterised by high salt concentration and low nutrients (Fernández-Torquemada et al., 2004), is usually returned to the sea. It can have a detrimental effect on the marine environment, mainly on benthic communities that are not adapted to these high salinities (García and Ballesteros, 2001; Sánchez-Lizaso et al., 2008). The high-salt effluent remains on the bottom due to its greater density and principally affects marine benthic communities adapted to a lower or more stable salinity environment (Lattemann and Höpner, 2003). The magnitude of the impact reached in an area close to the discharge will depend on the salinity, speed of dilution and sensitivity of the ecosystem that receives it (Höpner and Windelberg, 1996; Fernández-Torquemada et al., 2009). To