Reclaimed water quality in the distribution networks of Lloret de Mar and Tossa de Mar (Costa Brava, Girona, Spain)

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INTRODUCTION

Tossa de Mar and Lloret de Mar are two touristic municipalities located in southern Costa Brava. As presented in **Figure 1**, the population inhabiting both municipalities has increased over the years. Since 1975, population has doubled in Tossa de Mar and is five times higher in Lloret de Mar, whereas the number of touristic beds has more or less remained stable over the last 30 years. Because of this, water demand in the area has increased in the recent decades, as could be seen in **Figure 2**.

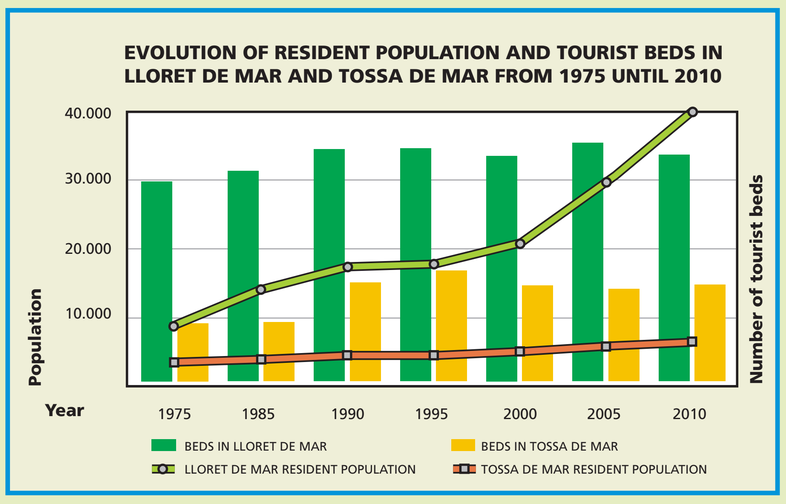


***Figure 1** . Evolution of the resident population and tourist beds in Lloret de Mar and Tossa de Mar, between 1975 and 2010.*

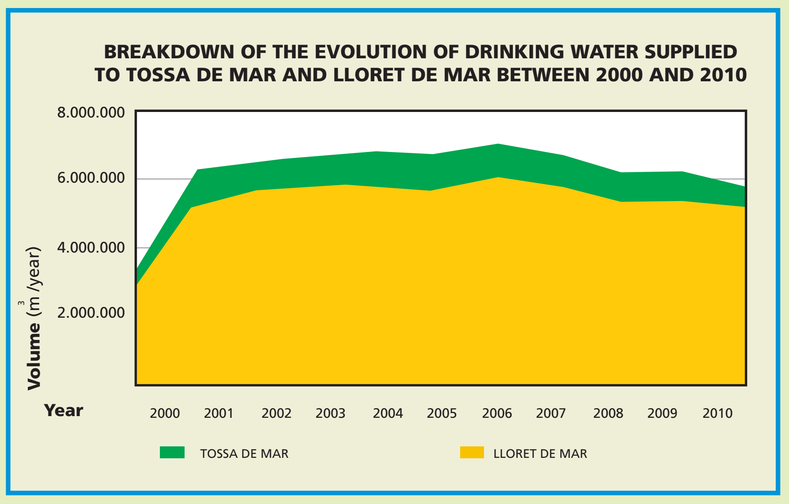


***Figure 2** . Breakdown of the evolution of drinking water supplied to Tossa de Mar and Lloret de Mar since 2000.*

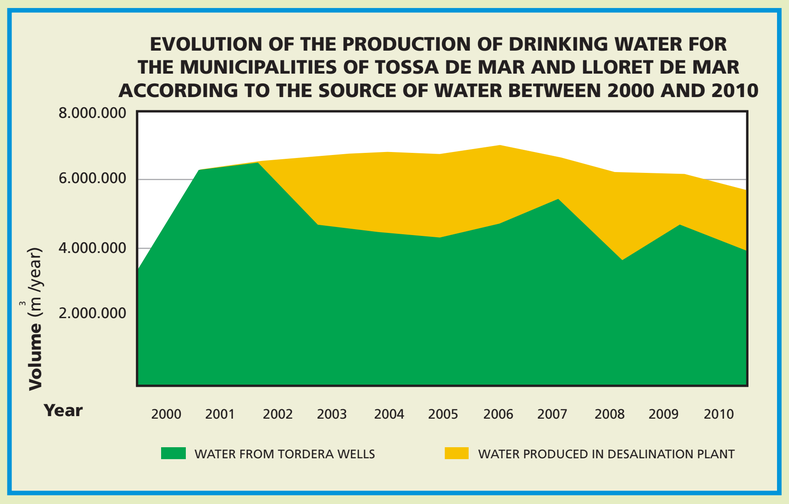
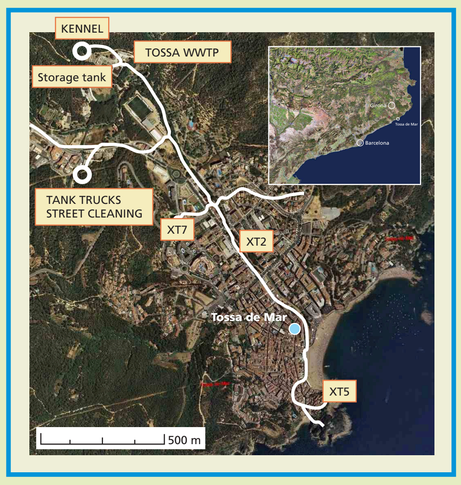


***Figure 3** . Evolution of the production of drinking water for Tossa de mar and Lloret de Mar according to the source of water, since 2000.*

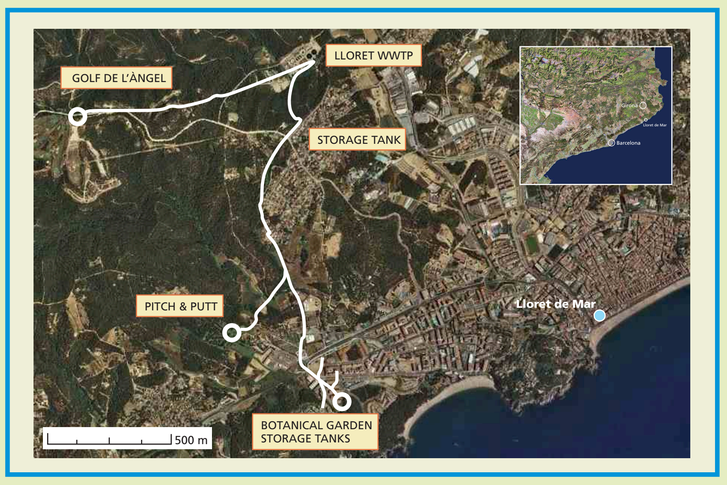
The cost of drinking water in Lloret de Mar and Tossa de Mar has increased due to the infrastructure needed for the production and transport of a high percentage of the total water demand, which includes the use of the Blanes desalination plant. Since 2002, 30% of the water furnished was from the desalination plant and 70% was from wells of Tordera, as it shows **Figure 3**. Because of this, a new water resource was needed, located closer to the place where it will be used and with a lower energy cost. Consequently, the solution has been the development of the use of reclaimed water for this kind of uses. This activity began with the supply of reclaimed water in Lloret de Mar and Tossa de Mar, in spring 2007. Since then, an intensive analytical monitoring in the reclaimed water distribution networks has been made. The analytical parameters that have been determined are suspended solids, redox potential, pH, electrical conductivity, turbidity, transmittance at 254 nm, dissolved oxygen, total residual chlorine, *Escherichia coli*, total aerobic bacteria and somatic coliphages.

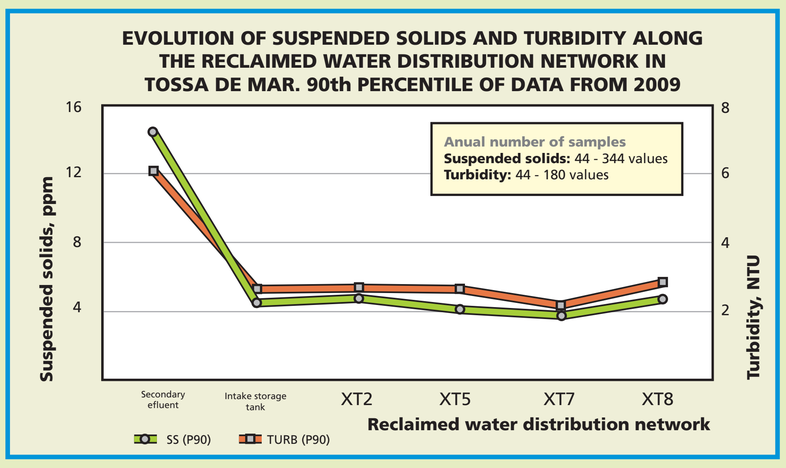
RESULTS AND DISCUSSION

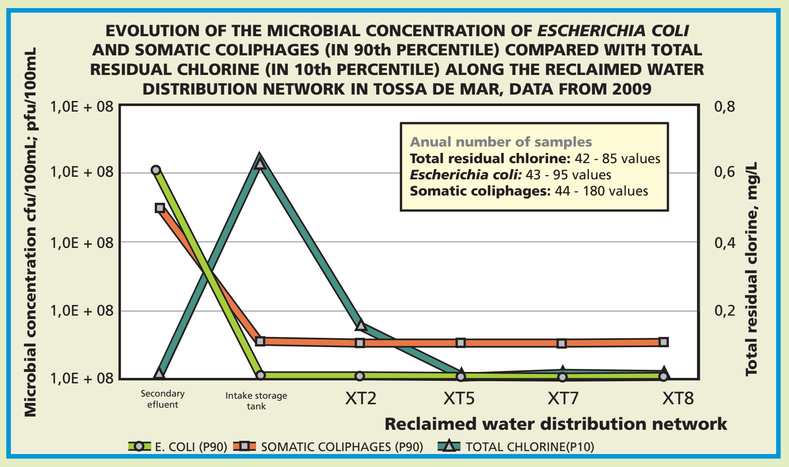
The reclaimed water distribution network of Tossa de Mar consists of a polyethylene pipeline and the total length is 5.5 km. It has 6 hydrants, and several hoses and drip irrigation systems. It supplies water for non-potable uses to the local kennel, parks and urban gardens, and also for the tank trucks that use reclaimed water for street cleaning and for firefigthing.

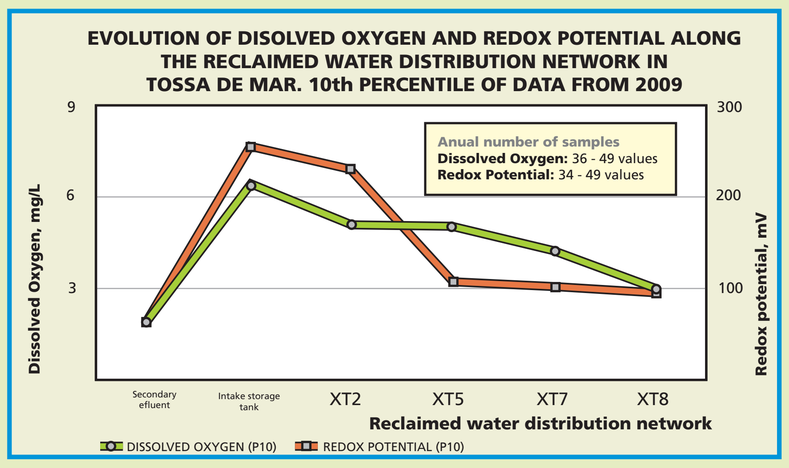


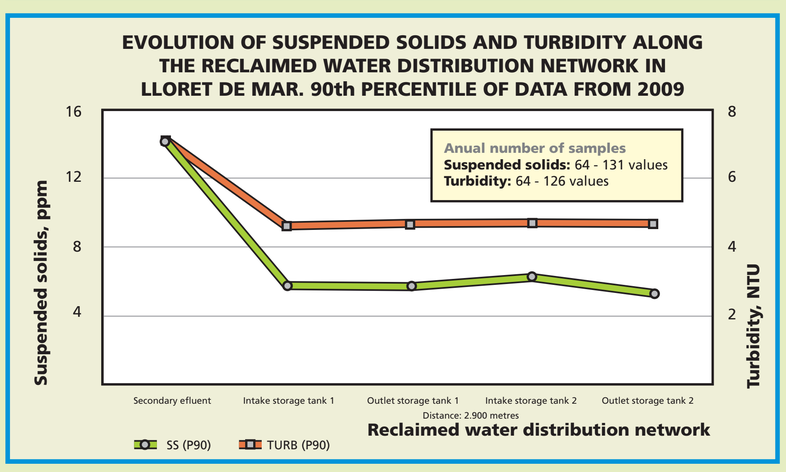
The reclaimed water distribution network of Lloret de Mar starts in a gravity storage tank of 56 m^3 of capacity. The network is made of polyethylene pipeline and it has a total length of 3.0 km. Reclaimed water is delivered to two tanks of 140 m^3 of capacity that supplies water to the Santa Clotilde Botanical Gardens and irrigates landscaped areas of the western part of Lloret de Mar.

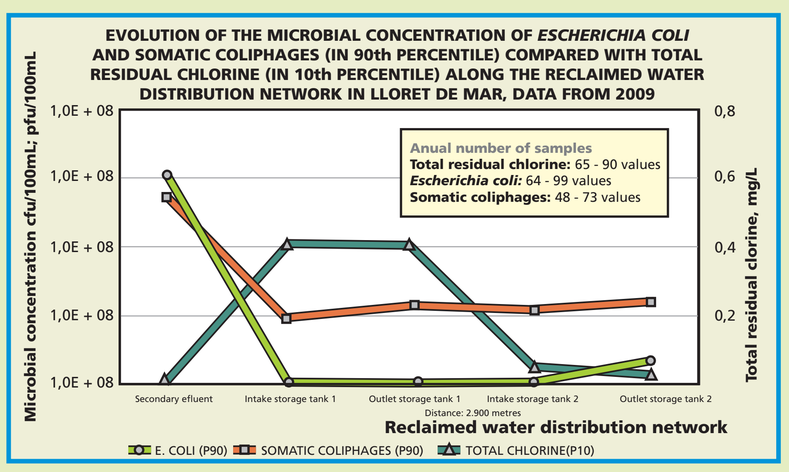


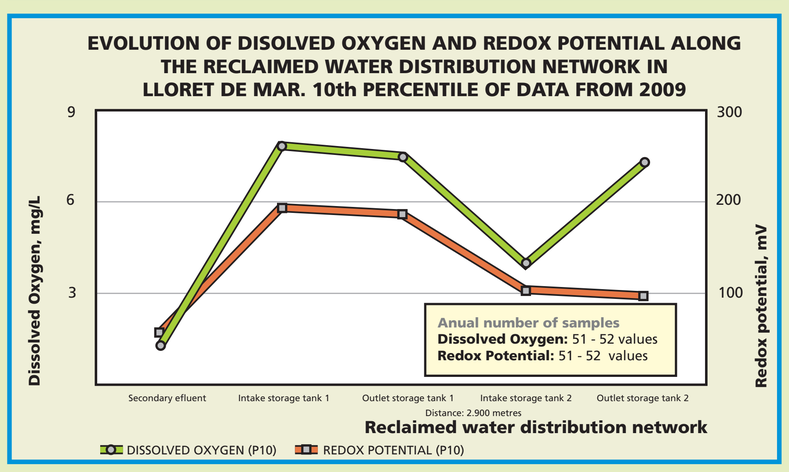












CONCLUSIONS

- Concentration of suspended solids, turbidity and concentration of *Escherichia coli* values remain stable along both reclaimed water distribution networks.
- The concentration of total residual chlorine decreases along both networks, but an increase in the concentration of *Escherichia coli* and of somatic coliphages has not been detected.
- Concentration of dissolved oxygen slightly decreases along the network. An increase has been observed in the storage tanks of the network of Lloret de Mar, due to the turbulence created by the entrance of reclaimed water.
- Concentration of dissolved oxygen is high enough to prevent the formation of unpleasant odours even in the more distant points of both networks.