

ABSTRACT

Sustainability of fish farm production in floating cages requires, between other things, the improvement of environmental management and the reduction of environmental impact that this activity generates. For that reason, it is important to have a good understanding of the effects that organic enrichment has on the ecosystem and understand the recovery processes when the activity ceases.

This study was carried out in a gilthead seabream (*Sparus aurata*) fish farm off the Mediterranean coast of Spain. Measurements were taken under the central cage of the fish farm and in a control station. These included benthic fluxes of oxygen and nutrients *in situ*, different parameters in water column and sediments, and benthic macrofauna. Eight sampling campaigns were carried out covering two phases: one while functioning and the second after the permanent closure of the fish farm.

During the functioning phase, organic matter and total phosphorus were accumulated in the sediment under the cages and the sediment became more reductant, reaching the maximum levels in summer. Macrofauna had a less specific richness and a higher abundance, due to the dominant species *Capitella capitata*. Sediment under the cages functioned as a sink of dissolved oxygen and as a source of dissolved inorganic nitrogen and phosphate due to the mineralization of organic matter. However, silica fluxes did not seem to be affected by the fish farm activity. In the water column, there was a reduction of the dissolved oxygen concentration and an increase of dissolved inorganic nitrogen and phosphate, modifying, on occasions, the stoichiometric ratios between the nutrients, and the limiting nutrient for primary production. Despite having found higher concentrations of nutrients around the cages, there was not an increase in the levels of chlorophyll *a*, probably due to the utilization of nutrients, particles and phytoplankton by marine biofouling attached to the submerged structures of the fish farm.

Recovery was made after the permanent cessation of the activity, through partial recovery signs of the different abiotic and biotic parameters at different time scales. The benthic flux of ammonium was the first parameter to recover, followed by benthic fluxes of phosphate and dissolved oxygen and the % organic matter in the sediments, which 3 months after the cessation of the fish farm already showed levels similar to those in the control station. At 9 months after the cessation, the other abiotic parameters of the sediments disturbed by the activity had recovered, such as the % coarse fraction, total phosphorus concentrations, and redox potential measurements. The recovery of the macrofauna was slower than the abiotic parameters. 3 months after the cessation, the abundance of *Capitella capitata* had descended drastically in the area that was affected by the fish farm, but similar levels of specific richness were not observed between the two sampled zones until 2 years after the cessation of the fish farm.