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Comparing costs of estuary restoration with biodiversity benefits

A new study has investigated the restoration of a damaged estuary in Spain by comparing the costs of installing sewage systems with the associated benefits for water quality and biodiversity in the area. Long-term benefits, particularly in the inner part of the estuary, increased with investment in sewage treatment schemes.

Estuaries provide habitats for diverse range of coastal wildlife and support a variety of ecosystem goods and services for humans, including clean water, food, fishing and recreation. Restoring damaged estuaries is crucial for coastal communities, but to date, few assessments have been made that compare the costs of restoration with the value of improvements in biodiversity over a long period of time.

This study investigated the economic costs and biological benefits of restoring the Nervión estuary on the northern coast of Spain, where Bilbao, one of the major ports in Spain, is located. Over many years, the area has been heavily damaged by pollution from the discharge of domestic sewage, and industrial waste discharges from iron and steel and ship building industries and mining activities. In addition, wetlands and sand dunes have been destroyed as the estuary has been straightened and channelled. The estuary has two distinct parts: the inner area which has been modified into a narrow channel that passes through the city of Bilbao, and an outer semi-enclosed bay area, where the actual port is located.

Partly funded through the EU WISER project[1], the researchers analysed the economic costs associated with sewage treatment programmes during the period 1989 to 2010, and physical and biological changes recorded in the estuary during the same period. Improvements in water quality were estimated from decreases in Biological Oxygen Demand (BOD) (used to measure pollution from organic material) and reduced ammonia loads. In addition, changes in the intrinsic 'biological value' (as opposed to economic value) of four ecosystem components were estimated: zooplankton, macroalgae, macrobenthos (organisms living at the bottom of the estuary) and demersal (bottom-dwelling) fish.

In all, around €658 million was invested in sewage treatment schemes between 1989 and 2010. This has resulted in a fluctuating, but overall improving, trend in water quality since 1990 when physical and chemical treatments of the area started. A significant and rapid improvement in water quality and increase in the biological value of species occurred after a major sewage treatment scheme began in 2001 with the construction of more than 300km of sewer networks and a biological wastewater treatment plant. Other improvements could be linked to a large iron and steel industry shutting in 1996.

Differences were found between the response of the inner and outer areas of the estuary to the investment in sewage schemes over the 21 year period. Improvements in the physical water quality and biological recovery in the inner area of the estuary were directly related to the accumulated level of investment during this time.

In contrast, although there were improvements in the water quality, measured by decreases in BOD and reduced ammonia loads in the outer part of the estuary, improvements in the biological value were not found to be directly related to the accumulated investment in sewage systems during this same period. In the outer part of the estuary, the biological value was negatively affected by dredging works in 2001, as well as port and dock building works. This suggests that the inner and outer areas of the estuary need to be evaluated differently when considering remedial management.

1. WISER (Water bodies in Europe: Integrative Systems to assess Ecological status and Recovery) is supported by the European Commission under the Seventh Framework Programme. See: www.wiser.eu

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