SOURCE-TO-SEA CASE STUDY | MID - ADVANCED STAGE

Marine and freshwater scientific collaborations in the Tamar catchment

THE SOURCE-TO-SEA CHALLENGE

The Tamar River catchment located in southwest England covers around 1800 km2 and flows into the English Channel. The population of the catchment is an estimated 300 000 inhabitants, with the majority concentrated in the city of Plymouth. The most important economic activities in the area are tourism, with around 11 million visitors per year, and agriculture with farmed land covering 73% of the catchment area. The river catchment provides a vast array of ecosystem services including water quality, water availability, greenhouse gas (GHG) sequestration, recreation and cultural spaces, and functional wildlife spaces. However, economic activities in the catchment area are increasing the pressure on the natural ecosystems and the services they provide. For example, agriculture and animal husbandry substantially increase flows of nutrients and carbon in the water bodies of the Tamar Catchment, including along the coast and in the sea contributing to issues such as eutrophication and an increased release of GHGs.

ADDRESSING THE S2S CHALLENGE

The Tamar Catchment Partnership (TCP) was created in 2011 to guarantee the services provided by the ecosystems in the Tamar catchment. The TCP is a multistakeholder platform formed by landowners, farmers, regulators, recreational users, civil society organizations, national agencies, and research institutes, including the Plymouth Marine Laboratory (PML). This platform works to better understand the impacts of human activities in the river catchment, coast, and sea and to manage these activities in a manner that reduces negative impacts.

The Natural Environment Research Council and the Biotechnology and Biological Sciences Research Council of the United Kingdom are supporting the efforts of the TCP by funding projects such as LOCATE and AgZero+. These two specific projects aim to observe the sources and flows of carbon and nutrients from land to ocean, gather knowledge of the sources and sinks of GHGs, better understand the impacts of agriculture across the source-to-sea continuum and test agricultural practices with reduced impacts. The initiatives brought together several scientific organizations from the United Kingdom including PML, National Oceanography Centre, British Geological Survey, the UK Centre for Ecology and Hydrology, Rothamsted Research, and the National Centre for Earth Observation.

The scientific measurements conducted by the projects have shown that estuary waters can influence water quality from

PROJECT PARTNERS

Plymouth Marine Laboratory

Tamar Catchment Partnership

the coast up to 10 km offshore and that nutrients and organic material from freshwater bodies contribute to the significant release of GHG from estuarine environments. Furthermore, activities on land to reduce GHG emissions from farmlands, such as applying nitrification inhibitors can increase the eutrophication of waterbodies. With this information, the TCP can work together with local communities to improve land-based practices that are affecting the functioning of aquatic ecosystems and advance in achieving national and international policy goals such as the UK Marine Strategy, EU Water Framework Directive, and Sustainable Development Goals 3, 6, and 14.

BARRIERS ENCOUNTERED AND SOLUTIONS

One of the most significant barriers faced by the project was to analyse, in a unified manner, the data gathered from its marine and freshwater research activities due to differences in the units and methods used. For example, when working on dissolved organic matter in water, freshwater chemists measure the mass (grams per litre), whereas marine chemists use molar quantities (moles per litre). Additionally, the accepted limits of dissolved substances differ between the two. For freshwater science, 0.45 µm is the accepted norm while for marine science, it is anything that passes through a 0.2 µm filter. These differences in the basic approaches to marine and freshwater science created challenges in information exchanges and hampered collaboration between the two communities.

To overcome this barrier, scientists engaged in the LOCATE project from both the marine and freshwater communities worked together and developed the UniDOM model that unifies concepts, measures, and parameterisations across the freshwater and marine environments. UniDOM allowed the researchers to have a more complete view of the transport of dissolved material across the source-to-sea continuum by incorporating all ecosystem components. This facilitated a better assessment of how land-based activities impact the catchment, coast, and ocean.

MAIN LESSONS LEARNED

The work by PML and its partners in the LOCATE project highlights how collaborations between the freshwater and marine scientific communities are crucial to gain a better understanding of the linkages along the source-to-sea continuum and the impacts activities on land have on downstream ecosystems. These collaborations can include practical aspects such as the consolidation of methods and synchronization of sampling, which increases the confidence in the comparability of measurements and their applicability across all environments.

Additionally, the project narrowed the science – policy gap by carrying out its activities in synergy with the TCP. The new data gathered through the scientific collaboration was made available for the decision-making process of the TCP where it was more quickly translated into actions that address the sources of pollution.

ADDITIONAL RESOURCES

Project website:

My Tamar | The Tamar is part of us all – and we are part of it (my-tamar.org)

Research:

Unified concepts for understanding and modelling turnover of dissolved organic matter from freshwaters to the ocean: the UniDOM model | Biogeochemistry (springer.com)

More information: siwi.org/source-to-sea-platform