Recognizing the Needs of the Aquatic Environment

June 22, 2012 | Andri Bryner
Topics: Drinking Water | Pollutants | Biodiversity | Society

The aquatic environment provides us with many valuable services, including a supply of drinking water and fish as well as various means of transportation and places of recreation. Attempts to provide these services with technological solutions would be futile or prohibitively expensive. This is why it is essential to recognize the needs of aquatic systems such as natural bodies of water and to preserve them by limiting their exploitation and protecting them from pollutants and the excessive nutrient inputs.

Sufficient Water - Intelligent Residual flow Management

The planned phase-out of nuclear power has put pressure on the residual flow regulations provided for in the newly revised Swiss Water Protection Act. Indeed, many cantonal representatives and power plant operators would prefer to expand their use of surface waters to increase power production. However, in one case study, which began 12 years ago on the Spöl river in the Swiss National Park, Eawag has demonstrated a means of improving the ecology of downstream stretches of river without adversely affecting hydropower production. Prior to the construction of the Livigno Dam (1970), the Spöl's flow rate typically fluctuated between 6 and 12 cubic metres per second, with peak flows ranging up to 120 m3/s. After construction, the constant residual flow was set to 0.55 m3/s in the winter and 1.45 m3/s in the summer. The ecological impact of this reduction was catastrophic. Dense layers of sediment formed on the river bed as particulate matter settled instead of being washed away. Moreover, many organisms typical of mountain-stream environments were replaced by organisms prevalent in still waters at lower elevations. In the context of the Eawag study, the constant residual flow has been interrupted by a regime of controlled flooding one to three times a year for periods ranging from a few hours to a few days. In exchange, the hydropower plant has been allowed to discontinue the ecologically ineffective increase in the residual flow during the peak tourist season. This makes the new residual flow cost-neutral. The latest study data show that the river ecosystem below the Livigno Dam (e.g. in terms of species composition) has reverted in the direction of a comparable natural alpine stream. The number of brown trout spawning sites, for instance, has nearly tripled since 2000, populations of non-native, large-bodied amphipods have declined and alpine specialists such as the small-bodied mayfly have reappeared.

Endocrine Disruptors: Effective below the Detection Limit

As durable chemical compounds from various household, agricultural, pharmaceutical and construction products have ineluctably made their way into the environment, researchers have begun to focus on substances that are thought to be hormonally active or to disrupt natural hormonal processes. These substances include oral contraceptives, flame retardants, anticorrosives and plasticisers, to name just a few. Some substances are so potent that they can have a demonstrable impact on organisms at concentrations that are so low (< one billionth of a gram per litre) they defy detection with modern equipment. Biological tests (e.g. using yeast cells) are much more sensitive and also offer data on the cumulative effect of multiple substances. The Centre for Applied Ecotoxicology, an affiliate of Eawag and the Lausanne-based EPFL, has therefore undertaken to identify the biological tests that are capable of reliably measuring and assessing micropollutants in aquatic environments. These tests can

then be deployed to evaluate the effectiveness of additional purification stages in wastewater treatment plants of the sort currently proposed by the Swiss Parliament. Despite a growing awareness of the problem, however, no sound and specific criteria have yet been introduced in Switzerland or the European Union to control levels of endocrine disruptors in streams, rivers and lakes.

The research being conducted at the Ecotox Centre therefore also aims to establish a certification standard for biological tests. When used routinely in the future by private or cantonal laboratories, such tests are to deliver comparable data. This will enable the effective monitoring of waterway contamination and facilitate the task of arriving at reliable precautionary measures.

Nutrients Have an Impact on Biodiversity

The expansion of wastewater treatment plants and the ban on phosphates in detergents have led to a significant reduction in the eutrophication of Swiss rivers, lakes and streams. Eawag researchers have now succeeded in demonstrating how this has enabled the recovery of endemic species compositions in individual lakes. However, members of the fishing community have called for reductions in the practice of phosphorus removal. Their hope: more phosphorus in Swiss lakes will translate into larger fish. Genetic analyses of water fleas – one the most important sources of food for fish – now show that the period of excessive fertilisation in the 1970s and 1980s led to a proliferation of invasive species and that these species have also merged with endemic species to form hybrid species. Moreover, this process, which could take millennia to reverse, can also be seen at the level of fish (e.g. the native whitefish). These developments have led Eawag researchers to warn against the proposed reductions in phosphorus removal. Fish and other water organisms that have developed since the last ice age in the unique (and often nutrient-poor) Swiss alpine lakes – and only here – deserve special protection, especially in light of the fact that Switzerland is also home to many nutrient rich lakes offering greater productivity for commercial fishing.

Sufficient residual flow levels, monitoring of endocrine-disruptor contamination and maintaining phosphorus reduction in the face of adversity are three examples of how we can respond to the functional needs of the aquatic environment. When asked about Eawag's commitment, its director Director, Prof. Janet Hering, puts it this way: «Our research provides a basis for the practical implementation of sustainable approaches to the vital resource water – approaches that will meet the needs of society and safeguard the proper ecological functioning of the water environment.»

Contact

Andri Bryner

Media officer

Tel. +41 58 765 5104

andri.bryner@eawag.ch

https://www.eawag.ch/en/info/portal/news/news-archive/archive-detail/recognizing-the-needs-of-the-aquatic-environment