

Temperature - assessing divergence from natural temperatures in running waters

Status of the method according to the expert's report and further action

The method published in the expert's report is not equivalent to an official module as part of the Modular Stepwise Procedure (BUWAL 1998). Based on the experiences from the test-phase and plausibilisation it will be not developed further to a module. Individual aspect of the methodology can be on one's individual discretion applied to approach the topic of water temperatures in Swiss rivers and streams. For this the report summarizing the experiences from the test-phase can give advice for potential further development, and illustrates were possible which aspects could be adjusted and complemented.

Temperature regime: a determinant of habitat conditions

The temperature regime in water-courses is influenced by a wide variety of natural and anthropogenic factors and is itself of critical importance for aquatic ecology. Various natural (climatic and site-specific) factors produce a natural temperature regime, with annual and diurnal temperatures following a typical, sinusoidal pattern. Natural temperature regimes can be altered in various ways by different anthropogenic interventions.

The temperature regime has a direct effect on the metabolism and immune system of aquatic organisms. In addition, the water temperature has indirect effects on aquatic communities, e.g. by affecting oxygen concentrations or the spread of diseases. Aquatic organisms adopt various strategies in response to temperature changes (e.g. avoidance, behavioral or physiological adaptation,). A near-natural temperature regime is thus an important ecological goal of surface water protection.

Development of a temperature module

As part of the Modular Stepwise Procedure, a temperature module was intended to provide a method for a regional assessment of the temperature regime in streams and rivers. By assessing divergence from natural temperatures, such a module can only indicate the extent to which temperature conditions are a risk to the ecological functioning of a water course. However, this alone is insufficient for assessing the ecological status of surface waters, since ecological functioning is determined by the complex interaction of factors such as water quality, morphology and hydrology.

The development of a temperature module was initiated in 2010. As a first milestone, a basis and an initial proposal for such a method were elaborated in an expert report. As the next step, experiences with the application of the proposed method has been accumulated in a test phase, in order to review and investigate the plausibility of the developed assessment approaches. Based on the results from this assessment the method has been classified not feasible for a routine application. Therefore, it was decided that the method will be not developed further to a temperature module as part of the Modular Stepwise Procedure (BUWAL 1998).

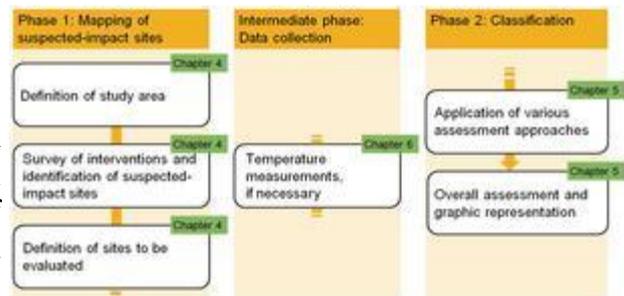
Despite this several aspects of the developed method can be of use by providing to approach the topic of water temperature in rivers and streams of Switzerland. For this reason it was concluded to assemble the experiences and recommendations in a report. This report aids user

to better understand which aspect of the methods can provide support for specific questions, or what could be complemented to render the method more applicable.

Method proposed in the expert report

The expert report proposes a method for a regional assessment of the temperature conditions in watercourses, taking into account relevant interventions and their impacts on the temperature regime. The divergence from natural temperature conditions is estimated using a selection of assessment approaches (annual temperature variation and two short-term approaches) based on ecological considerations.

The method involves two principal-phases: mapping of potentially impacted sites, based on a survey of interventions, and the actual classification, based on a number of assessment approaches followed by a final overall assessment.



Overview of procedure for applying the method

If data for an assessment are lacking or deemed inadequate, an intermediate phase for data collection is required. As results the method yields an overview of human interventions relevant to temperature conditions (potentially impacted sites) and an assessment of the "degree of naturalness" of the temperature regime for the watercourse system of a river basin.

The proposed method has been classified not feasible for a routine application. Therefore, it was decided that it will be not developed further to a temperature module as part of the Modular Stepwise Procedure (BUWAL 1998).

Experiences from the test phase

To validate the developed method and to provide the basis for an eventual update and further development, a plausibility check was conducted over several years using practical examples and theoretical tests. These three aspects were assessed: operational questions to develop a better understanding about the applicability of the procedure; methodological questions to assess if the results reflect the real conditions in a river sufficiently, and finally sensitivity analyses to evaluate the degree to which the method responds to variability of the input data, e.g. related to the applied measurement technology.

These tests demonstrated that from a technical point of view the method can be applied. The 13 river-types and the related reference curves were, however, found to be not sufficiently representative and robust. They further conceived to be not sufficient to represent the diversity of Swiss water courses. Depending of the water course and catchment the tests further indicated insecurities regarding the assignment of the river-types, the assessment of the thermal regime, data collection as well as the assessment results and their interpretation.

The proposed method has been thus classified not feasible for a routine application. Therefore, it was decided that the method will be not developed further to a temperature module as part of the Modular Stepwise Procedure (BUWAL 1998).

The experiences from the testing-phase that lead to this decision, critical comments to individual aspects of the proposed methodology and its applicability, as well as recommendations for a further development are now available in a report.