

### 3. A HYDROLOGICAL INDEX APPROACH

An attempt to develop a suitable hydrological index for biomonitoring studies should be based upon a clear understanding of the relationships between streamflow and biotic response and should be able to be estimated at a wide range of sites (regardless of whether existing historical flow data exist or not). However, it is apparent that a clear understanding of the relationships, although available for some rivers that have been intensively studied in the past, is not readily available in a generic form (i.e. applicable to all rivers). It is possible that the biomonitoring programme will contribute to this understanding and therefore to the further refinement of the approach and to establishing a more suitable hydrological index in the future. In the meantime, it has been necessary to base the development of an index on a broad conceptual view of how streamflow variations affect biotic response. The interpretation of such index values by individual biomonitoring teams will have to be carried out carefully and in a site-specific manner as it is not possible, at this stage of the development of the approach, to provide generic guidelines. It is therefore important that the biomonitoring specialists develop a critical understanding of the hydrological basis for the design of the index.

As explained within previous sections, a hydrological index which provides the ‘context’ in which biomonitoring sampling takes place has to account for the flow conditions at the time of sampling as well as over the recent past. An index made up of three components has been suggested (Uys, et al., 1996):

- ‘ Index A : A measure of the ‘general’ antecedent conditions over the three month period prior to sampling.
- ‘ Index B : A measure of the antecedent flood conditions for the three months prior to sampling.
- ‘ Index C : A measure of the flow conditions at the time of sampling.

A three month period has been specified, although it is recognised that the length of this period could be open to debate and could vary from one type of river to another.

The purpose of these components is to approximately quantify how ‘typical’ flow conditions have been, and are at the time of sampling, to indicate the extent to which the biota is currently stressed, or has been in the recent past. ***The necessary assumption is that non-typical conditions will lead to greater levels of stress through lower availability of ideal habitats.*** The basis of this statement is the further assumption that instream biotic systems can be stressed by both high and low flow conditions and that they will take some time to respond and recover after a return to less stressful conditions. Therefore, while it may be possible to identify a level of ‘instantaneous stress’ associated with a particular flow (and interpreted through hydraulic relationships into velocity and depth conditions), the level and health of biotic activity will also be a function of the antecedent conditions.

Until such a time when relationships between biotic stress and flow conditions are better defined,

it will be necessary to rely on nominal scales of measurement. As more data are collected on biotic health and flow conditions at specific sites, these relationships should become clearer.

Clearly, the estimation of the three components of the hydrological index relies upon the availability of a suitable time series of flow data (see next section for more details). This availability will vary from site to site and the most appropriate approach to adopt will similarly vary, suggesting that the advice of a hydrologist will be required to establish most biomonitoring sites. The two issues involved are the requirement for *historical time series* with which to define the characteristics of the flow regime against which to compare the *real time data* that will be collected, or generated, during the period of the biomonitoring programme.