UNIFYING CONCEPTS IN ENVIRONMENTAL MONITORING

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ABSTRACT

Environmental monitoring activities in all major areas of inquiry share several common elements, or "unifying concepts", that are applied to the data collection and reporting process. These concepts have been applied to water quality monitoring (e.g., sample collection and analysis) for decades, but they also apply to biological monitoring and physical habitat assessments, and recognizing them is essential for integrated information management. For example, all monitoring activities are done to obtain **Monitoring Results;** this is the primary unifying concept, and it is associated with the common elements that are descriptors of the Results, i.e., **Result types** and –for a subset of these - **Endpoint types**. Endpoints vary in complexity, from simple endpoints (e.g., % survival, flow discharge, or % EPT) all the way to compound endpoints such as 'Human disturbance index' or 'Index of biological integrity'. The concept of a **Measurement System** that spans the entire 'quantitation' process is applied to, e.g., sampling, identifying, and counting of benthic macroinvertebrates, or to elevation measurements to generate thalweg profiles, in the same way it has been applied to sampling and analyses for chemicals. Each area of inquiry may develop its own set of **Performance/acceptance criteria**, but all need to develop those criteria and to integrate requirements for an array of **Quality checks** into the protocol**.** Similarly, every protocol includes **Selection criteria**, e.g., for the riffle rectangle used to collect the benthic macroinvertebrates sample, or the location within the channel and the water column for collection of the water sample for suspended sediment analysis. The concept of **Quality objectives**, e.g. for reproducibility or accuracy, is an integral part of any planning effort, whether it is about tolerance for closing a survey loop or recovery of PAH surrogates in the lab. Similarly, **Sampling design principle** (e.g., directed/ targeted, systematic, or random) are part of any planning process, and so are the concepts of **Study Intent** and **Units of Representativeness** (e.g., Station visit). Other unifying concepts include a list of **Tracking and linking entities** (e.g., Sample ID, Lab Batch ID, Sub-station ID, Organization ID), which are necessary for any data management and data quality management effort**.** The paper explores ways to identify and implement these and other unifying concepts to facilitate the integration of data elements from diverse areas of inquiry, to enhance data comparability, and to enable streamlined data exchange.

KEYWORDS

Integrated information management, data elements, interdisciplinary, areas of inquiry, unifying concepts, data exchange