*Upper Mississippi River Basin Association Project Summary*

**February 2012**

# *Upper Mississippi River Aquatic Life Designated Uses: Improving Protection under the Clean Water Act*

## Background: Clean Water Act Designated Uses and the Upper Mississippi River

Designated uses are a foundational component of Clean Water Act (CWA) water quality standards. Water quality criteria are developed, monitoring is conducted, and assessments are made to determine whether waterbodies attain designated uses. Designated uses are thus central to characterizing and protecting water quality under the CWA.

The states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin assign a variety of designated uses to the Upper Mississippi River (UMR). These uses vary among the states, though there is commonality in the major uses assigned (i.e., aquatic life, drinking water, and contact recreation).

However, the application of current designated uses does not always reflect the UMR's unique character as a large, diverse, and modified floodplain ecosystem – nor does it capture the UMR's diversity in water chemistry, physical conditions, and biological communities. As a result, these uses may not provide for optimized, or even adequate, UMR water quality protection.

**The UMR's structural and functional complexity presents a challenge to designated use application.**
Photo courtesy of Wisconsin DNR.

Recognizing this situation, the Upper Mississippi River Basin Association (UMRBA) Water Quality Task Force (WQTF) has initiated efforts to enhance the effectiveness of UMR CWA use designations.

## Focus on Aquatic Life Designated Uses

In its first major project under this effort, the WQTF focused on *aquatic life designated uses*, seeking to identify opportunities for improved interstate consistency and water quality protection.

**Designated Uses on the Interstate UMR**

| MINNESOTA | MISSISSIPPI RIVER | WISCONSIN |
|---|---|---|
| **Aquatic life and recreation**<br>**Industrial consumption**<br>**Agriculture and wildlife**<br>**Aesthetic enjoyment and navigation**<br>**Other** | | **Fish and other aquatic life** (warm water sport fishery)<br>**Recreation**<br>**Public health and welfare**<br>**Wildlife** |
| **IOWA** | | **ILLINOIS** |
| **Warm water aquatic life**<br>**Primary contact recreation**<br>**Human health protection** (fish consumption and drinking water)<br>**Drinking water supply** (intake areas only)<br>**General use** (includes livestock and wildlife watering, aquatic life, non-contact recreation, crop irrigation, industrial, domestic and other water withdrawal uses) | | **General** (includes aquatic life, agricultural, secondary contact, industrial, primary contact where physical configuration permits such use)<br>**Public and food processing water supply** |
| **MISSOURI** | | |
| **Protection of aquatic life** (general warm water fishery)<br>**Whole body contact recreation**<br>**Human health protection** (fish consumption)<br>**Irrigation**<br>**Livestock and wildlife watering**<br>**Secondary contact recreation**<br>**Drinking water supply**<br>**Industrial process and cooling water** | | |

The WQTF chose an aquatic life focus because: 1) the states all designate an aquatic life use for the UMR, 2) aquatic life use assessments are typically the most broadly-based CWA assessments and therefore often act as drivers of assessment in general, and 3) this appears to be where the greatest need exists to better reflect the UMR's diverse characteristics in the states' regulatory approaches.

The key question for the WQTF in this project was: *"Are the aquatic life communities on the UMR distinct enough in their characteristics to merit differentiation of aquatic life uses in a Clean Water Act context?"*

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## Project Process and Report

In this project, the WQTF: 1) reviewed the states' current approaches to UMR aquatic life uses, including associated water quality criteria, monitoring, and assessment methodologies; 2) looked at what is being done in other large aquatic ecosystems; 3) examined UMR data and literature to identify patterns in chemical, physical, and biological characteristics; and 4) made recommendations for next steps related to UMR aquatic life uses.

The WQTF's work on this project is documented in the report *Upper Mississippi River Aquatic Life Uses: Improving Protection under the Clean Water Act*, which is summarized here and can be found online at: www.umrba.org/wq.htm.

## Major Findings

### States' Current Approaches to Aquatic Life Protection and Opportunities for Improvement

- The states do not share common aquatic life use definitions, water quality criteria, monitoring strategies, or assessment protocols on the UMR.
- Although there are similarities in the states' approaches to UMR aquatic life use protection, accumulated differences in use definitions, criteria, monitoring, and assessment methodologies frustrate the states' efforts to comprehensively and consistently characterize UMR aquatic life health.
- Because the states' approaches are not adapted to the unique characteristics of the UMR, and biological measures are largely absent from UMR CWA assessments, the states' current approaches may not accurately portray the health of the UMR's aquatic life.
- Opportunities for improvement include:
  - Seeking greater consistency in aquatic life use definitions and more explicit aquatic life protection goals in these definitions.
  - Addressing spatial and temporal variations in chemical, physical, and biological characteristics within UMR aquatic life designated uses.
  - Evaluating how monitoring, including biological monitoring, could be restructured to better support UMR aquatic life use assessment.
  - Considering relevant elements of Chesapeake Bay, Delaware River, and Ohio River programs in refining UMR aquatic life use approaches.

**The Upper Mississippi River supports a variety of biological communities in its diverse aquatic habitats.**
Photos courtesy of Minnesota DNR (upper left), US FWS (lower left), and USGS (upper and lower right).

### Patterns in Chemical, Physical, and Biological Data

Readily available information indicates significant physical, chemical, and biological diversity on the UMR in both spatial and temporal contexts, as follows:

*Longitudinal Patterns*

- Longitudinal distinctions exist for a number of chemical, physical, and biological parameters. Specifically:
  - Upper UMR reaches (i.e., Pools 4, 8, and 13) are distinct from lower reaches (i.e., Pool 26 and Open River) with regard to several chemical, physical, and biological parameters.
  - Excursions from "threshold values" (used for comparison purposes within this project) are more common in the UMR's lower reaches for parameters, including temperature, turbidity, total suspended solids, and total phosphorus. However, the thresholds may not necessarily be the most relevant benchmarks in these reaches.
  - Cluster analyses of chemical and physical data, as well as ordination analyses of biological data show that the UMR can be grouped longitudinally into 3 or 4 reaches, each sharing common traits.
  - Lake Pepin has a unique effect in reducing suspended solids and associated contaminants due to settling, creating a notable discontinuity in longitudinal water quality gradients.

*Lateral Patterns*

- There are differences among strata for a number of chemical and physical parameters, and in some cases between groups of strata (e.g., contiguous backwater and impounded versus main channel and side channel). Biological communities, both fish and vegetation, also show differences among strata for several metrics. Specifically:
  - Excursions from threshold values for temperature, dissolved oxygen, and pH occur most often in backwaters and impounded areas.
  - Cluster analyses of chemical/physical data and ordination analyses of biological data indicate distinctions among UMR strata (main channel, side channel, contiguous backwater, and impounded).
  - Of the strata, the main channel and side channel demonstrate the most similarities, particularly in terms of chemical and physical parameters.

*Temporal Patterns*

- Temporal patterns, both seasonal and year-to-year, are prominent. In general:
  - Water quality characteristics and trends can vary greatly by season and flow condition.
  - Extreme and periodic events such as floods and droughts can temporarily and markedly affect water quality. Many of the UMR's biological assemblages have adapted to these types of periodic disturbances. These dynamics are relevant in developing and using water quality criteria to assess UMR aquatic life use attainment.
  - Long term system changes (e.g., due to invasive species or climate change) may trigger a need to revisit aquatic life use expectations regarding biological assemblages and associated water quality criteria.

*Relationships Between Chemical, Physical, and Biological Parameters*

Several key parameters (e.g., suspended solids, transparency, temperature, velocity, nutrients, depth, and dissolved oxygen) greatly influence the occurrence and health of UMR biological communities. Of note:

- The most important parameters vary by the type of community and by location on the River.

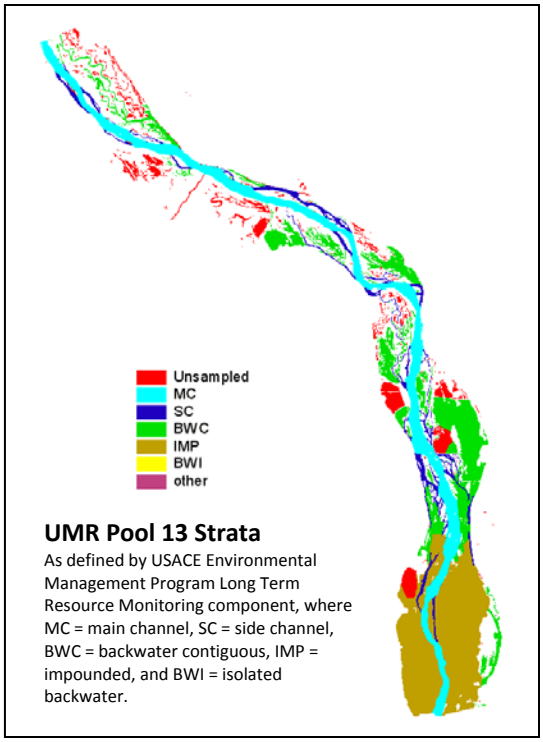


**Illustration of UMR aquatic strata. Note that the classification structure recommended by the WQTF does not include all of the strata noted above.**
Image courtesy of USACE-EMP LTRM.

- Some commonly-monitored water quality parameters (e.g., suspended solids and transparency) correlated with biological community health often do not have numeric criteria in state water quality standards.
- In some cases, however, the water quality criteria that do exist are not necessarily accurate predictors of biological community health. For example, several UMR locations demonstrate excursions from water quality criteria in some seasons (e.g., pH and dissolved oxygen in backwaters), but biological monitoring indicates that these same locations often support a relatively natural and healthy fish community.

*Overall, the project's data and literature review indicate that UMR aquatic life communities, as well as associated chemical and physical parameters, are distinct enough in their spatial and temporal variations to merit differentiation of aquatic life use designations in a Clean Water Act context.*

**Recommended UMR CWA Classification Structure**

| | *Lateral Strata* | | | | |
|---|---|---|---|---|---|
| *Longitudinal Reaches* | | **Main Channel** | **Side Channel** | **Impounded** | **Contiguous Backwater** |
| | *St. Croix River* | | | | |
| | **Upper Impounded to Chippewa River** *CWA Assessment Reach 1* | | | | |
| | *Chippewa River (base of Lake Pepin)* | | | | |
| | **Upper Impounded below Chippewa River** *CWA Assessment Reaches 2-6* | | | | |
| | *Lock and Dam # 13* | | | | |
| | **Lower Impounded** *CWA Assessment Reaches 7-11* | | | | |
| | *Missouri River* | | | | |
| | **Unimpounded (Open River)** *CWA Assessment Reaches 12-13* | | | *(Not Applicable)* | |
| | *Ohio River* | | | | |

## Recommendation: UMR CWA Classification Structure

The UMRBA WQTF recommends a new UMR classification structure to address distinctions identified in chemical, physical, and biological data. This structure will aid the states not only in defining aquatic life uses, but also in developing a monitoring strategy, setting criteria, and conducting assessments.

The structure includes four longitudinal reaches reflecting the three "floodplain reaches" used in UMR restoration programs, and adding a fourth reach due to water quality changes at the base of Lake Pepin. The structure also includes four lateral strata, matching four sampling strata used by the US Army Corps of Engineers' Long Term Resource Monitoring (LTRM) component of the Environmental Management Program. Isolated backwaters/wetlands are not included in the WQTF's recommended structure, but may be in the future.

## Next Steps

The WQTF recommends the following next steps to implement the UMR CWA classification structure:

**Incorporate the Classification Structure:** Each state should consider how best to incorporate this structure into its CWA program, and into its water quality standards specifically.

**Create a UMR CWA Monitoring Strategy:** A UMR CWA monitoring strategy is needed that addresses all of the identified classes and includes chemical, physical, and biological metrics. It should support not only CWA assessment and listing, but also water quality criteria development.

**Identify Water Quality Criteria:** Chemical, physical, and biological criteria should be identified for each class, as needed, that are protective of aquatic communities and, in the case of biological criteria, descriptive of aquatic life expectations.

**Develop an Assessment Methodology:** A methodology is needed that reflects the classification structure and describes how monitoring results will be compared to criteria to determine attainment. This methodology can then support comprehensive and consistent UMR aquatic life assessment.

## Considerations Moving Forward

**Need to Revisit and Revise:** As the states gain experience in implementation, they may wish to revisit their aquatic life approaches, including the classification structure itself. However, the fact that future changes may be needed should not deter the states from moving forward at this time.

**Differences Among States:** As the states proceed in integrating the classification structure and related changes in monitoring, criteria, and assessment, they may be at different levels of readiness to proceed. As such, the pace at which individual states move forward will vary.

**Resource Needs and Constraints:** The states and US EPA need to consider whether current resources are adequate to implement the WQTF's recommendations. If they are not, it will be critical to identify resource needs and suggest options to address them.

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