Evaluation of Historic Water Quality Information and HAB Events: Technical Guidance for Routine Monitoring Programs

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USACE Harmful Algal Bloom Research & Development Initiative

Delivering scalable freshwater HAB prevention, detection, and management technologies through collaboration, partnership, and cutting-edge science.

Problem

The occurrence and geographic distribution of cyanobacterial harmful algal bloom (HAB) events is increasing. USACE districts need efficient data informatics to evaluate water quality in the context of historical observations to understand trends and disturbances in the systems they monitor.

Objective

To identify high value water quality and phytoplankton parameters and maximize the information contained in the Enterprise Water Quality Database (EWQD) for understanding the occurrence of HABs at USACE projects through standardized analysis accessible to any USACE district.

Approach

This project adds on-demand analysis capability to the EWQD (under development) to deploy standardized workflows and a HAB vulnerability index. The EWQD is being created to compile and archive water quality data collected at USACE projects in a discoverable format. Additional functionality for assessing water quality with relevance for HABs is being created through search functions, data visualizations, derived variable and index calculations, graphing functions, built-in statistical analysis, and standardized data extraction tools. The tools under development are deployed with the web services that provide access to the database so they are available for any USACE water quality observation site stored in the database. District enrollment is ongoing.

Figure 1. *Project concept for water quality informatics.*

Results

Several new web service functionalities were added to the EWQD. In a dashboard view, users can access recorded water quality data by parameter and instantly see where the most recent value falls in the long-term data set using a box and whisker plot. Heat maps show when samples have been collected in a graphical format. Single parameter and composite eutrophication indices are calculated and plotted by date to examine long-term trends on lake health. Biological samples can now be stored in the database and recalled for plotting in multiple methods to examine sample biodiversity.
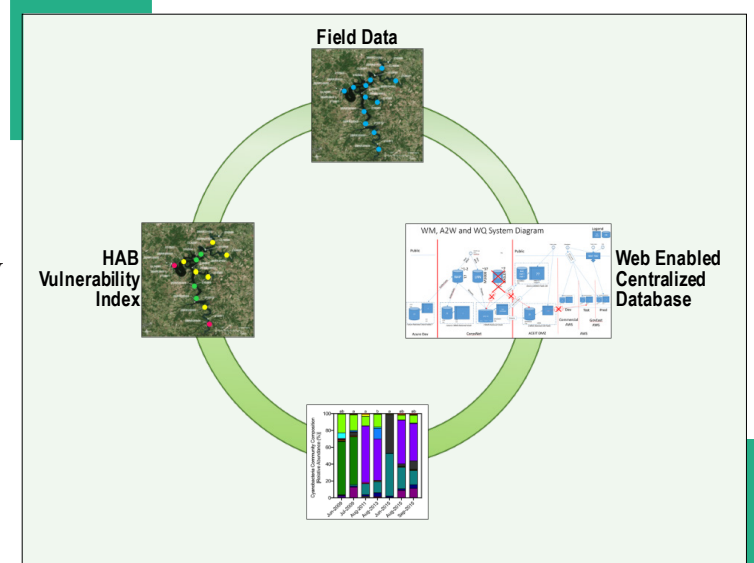
Trends at Barkley

Sample Year	Parameter	Units	Lowest Minimum	Highest Minimum	Lowest 25th	Highest 25th	Lowest Median	Highest Median	Lowest 75th
2018	CHLRPHYL B UG/L	ug/L	0.1	1.06	0.11	1.29	0.495	1.565	0.97
2018	CHLRPHYL C UG/L	ug/L	2.03	3.27	2.13	3.44	2.535	4.705	3.73
2022	WATER TEMP CENT		7	7	7	7	7	7	7
2022	TRANSP SECCHI METERS		7	7	7	7	7	7	7
2022	DO SATUR PERCENT	%	80	100	80	100	80	100	80
2022	DO SATUR PERCENT		81	81	81	81	81	81	81

Figure 2. *An example of the on-demand analysis tools being deployed in the web service access to the Enterprise Water Quality Database to facilitate interpretation of routine water quality data. This figure shows one exportable report available in the system.*
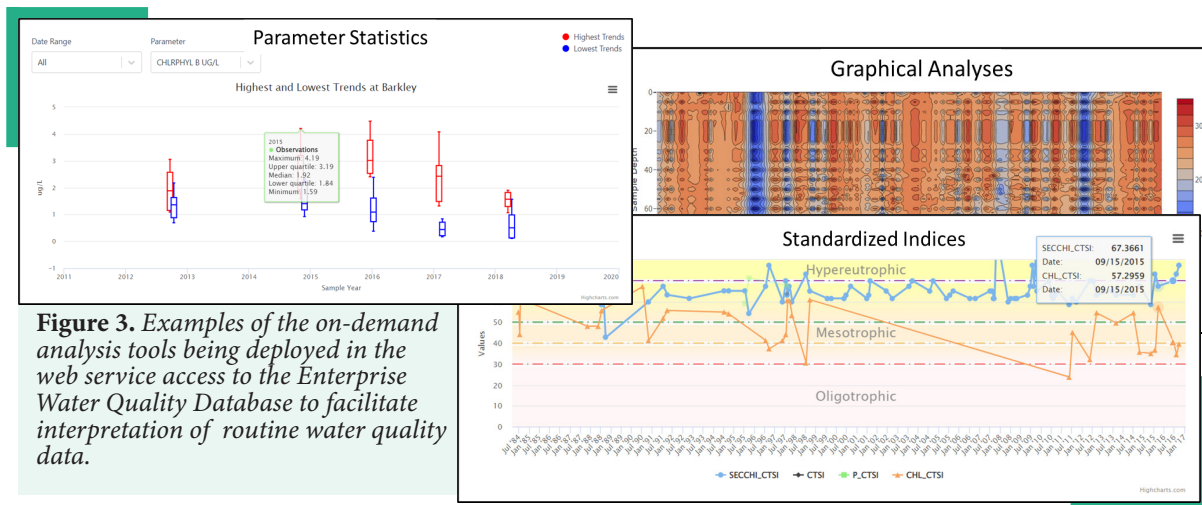
EL ENVIRONMENTAL LABORATORY

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Figure 3. *Examples of the on-demand analysis tools being deployed in the web service access to the Enterprise Water Quality Database to facilitate interpretation of routine water quality data.*

Major Milestones

Deliverable	Description
Tech Transfer	**Technology:** Minable HAB database **Technology:** HAB Vulnerability Index algorithim and method **Technology:** Prototype map interface for the visualization of HAB Vulnerability Index (in progress)
Publications	**Technical Note:** "HAB Vulnerability Index Using Routine Water Quality Data" (in progress) **Technical Note:** "User Guidance for HAB Relevant Data in the USACE Enterprise Water Quality Database" (in progress) **Technical Report:** "Use of the USACE Enterprise Water Quality Database to Visualize HAB Vulnerability" (in progress)
Documents	**Conference Submission:** "HAB Vulnerability Index Case Study" (in progress)

Partnership/Leveraging Opportunities

This work leverages the "Enterprise Water Quality Database" development effort and is leveraged by "Operational Strategies for HABs Management in Inland Reservoirs and Universal Algorithm Development for the Detection of HABs and Water Quality Parameters Using Satellite Remote Sensing" project.

Value to USACE Mission

The project aims to maximize the value of routine water quality data by enabling rapid processing of historic and newly input data in the Enterprise Water Quality Database.

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