# Leveraging satellite Earth observations in the monitoring strategy for tracking the health of Lake Victoria

Sustainable and affordable operational monitoring is critical for keeping track of the health of aquatic environments that support the *blue economy*, or the reasonable use of water resources for economic growth, improved livelihoods, and jobs, while preserving the healthy state of these ecosystems. In Lake Victoria, the blue economy includes activities that exploit aquatic resources (e.g., fisheries, mining, petroleum, biotechnologies) or use aquatic environments (e.g., maritime transport, coastal tourism), ideally in an integrated, fair, and circular manner. The blue economy in this region's context supports over 40 million people's livelihoods and US$1.14 billion through fisheries to the riparian governments.

For Lake Victoria, scientists and managers from Uganda, Kenya, and Tanzania have regular ship-based sampling programs to monitor the fisheries and water quality of the lake to help manage the resources. While classic monitoring from research vessels does offer valuable data, the information gathered tends to be limited in geographic and temporal coverage, restricting scientific, evidence-based understanding of biogeochemical and physical dynamics in water bodies. One complementary monitoring strategy is satellite remote sensing, offering frequent wide-area observations over water and estimates of *indicators-of-change* (e.g., total suspended matter, color of water, algae levels, temperature). Open-access satellite imagery and derived maps of indicators-of-change are operationally available through various space agencies (e.g., EU Copernicus Sentinel, USGS Landsat, and NASA VIIRS and PACE missions).

To support capacity development for application of remote sensing to Lake Victoria, a group of academic and research organizations have offered workshops in the region since 2021, providing an introduction to optical water quality methods and satellite data processing for more than 50 trainees from across the African Great Lakes. Collaborators include the African Center for Aquatic Research and Education, IEEE Geoscience and Remote Sensing Society, Rochester Institute of Technology, Kings College London, Makerere University, Lake Victoria Fisheries Organization, Kenya Marine and Fisheries Research Institute, Ugandan National Fisheries Resources Research Institute, Tanzania Fisheries Research Institute, Jaramogi Oginga Odinga University of Science Technology, Carl von Ossietzky Universität Oldenburg, Science Systems and Applications, Inc./ NASA Goddard Space Flight Center, and University of Wisconsin. Trainees have gained experience in operating and processing ship-borne hyperspectral radiometric observations along with validation data such as Secchi disk depth, Forel-Ule color index, chlorophyll-a, and total suspended sediment concentrations. Satellite data processing was introduced through Google Earth Engine to give lessons in data access, mapping, cloud masking, and estimating water surface indicators-of-change. Advancing the knowlege base of the next generation of experts will foster a better interdisciplinary understanding of these resources for the blue economy and the millions whose livelihoods depend on Lake Victoria.



Future water quality experts undergo practical training of determining the color of water using a classical tool, the Forel-Ule scale. Photo by Shungu Garaba.

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