(Center) Schematic diagram of an *ideal* HAB monitoring mooring instrumentation package and photographs of: (a) anti-fouling copper shutter system on a Satlantic, Inc. MiniSpec hyperspectral radiometer, (b) WET Labs, Inc. single-wavelength ECO fluorometer with copper shutter (on left), (c) marine bioluminescence bathyphotometer (MBBP), (d) WET Labs, Inc. single-wavelength backscattering sensor, and (e) Satlantic, Inc. MiniSpec hyperspectral radiometer.

An automatic data transmission network using cables, radio frequency modems, or satellite telemetry should be used for real-time data collection and transmission. The instruments should be interfaced to a mooring data logger and the communication system (e.g., radio frequency transmitter) attached to the cable or located on the mooring buoy. The data logger will digitize the data before transmission then communicate the data to a shore-based data file management system (Figure X.13). Computing resources should automatically process the data from its digital format to engineering units. Lastly, a graphical program should automatically convert the data into viewable images and transfer the images onto the World Wide Web (Figure X.13). The data stream from all instruments listed above should also be sent hourly to the World Wide Web. A web-based data management system, using JavaScript, will allow users, e.g., scientists, government health officials (local, state, and federal), students and teachers (K-12, college, and graduate), and non-governmental organizations to download and view real-time, archived, and historical HAB and complementary data. For example, see the Dalhousie University Lunenberg Bay, Nova Scotia coastal observatory data access and visualization site (http://www.cmep.ca/bay).

Data communication should utilize a system capable of two-way communication from mooring to shore-based computers and *vice versa* (e.g., Woods Hole Oceanographic Institution, Martha's Vineyard Coastal Observatory; http://www.whoi.edu/mvco/). Therefore, during times of HAB formation, persistence, and cessation, adaptive sampling can be employed to enhance the sampling efforts and ship-based sampling can be coordinated. Sampling rates and instrument gains can be changed when prompted by simple computer commands from shore. Another advantage of real-time data transmission is the ability to check for biofouling of data to schedule diver servicing or instrument/mooring turnarounds.

Figure X.13
Schematic diagram of suggested data communication system: data collection, transmission, processing, graphing, and presentation on the World Wide Web. [RF = radio frequency, METs = meteorological sensors, $E_d(\lambda)$ and $L_u(\lambda)$ = radiometers measuring (hyper)spectral downwelling irradiance and upwelling radiance, CTD = conductivity-temperature-depth sensors, ac-x = (hyper)spectral absorption-attenuation meter, ECOflx = (spectral) fluorometer, ECObbx = (spectral) backscattering meter, MBBP = marine bioluminescence bathyphotometer, NUTs = optical-based nutrient analyzer, and dO = dissolved oxygen sensor]