Figure X.10
Photographs of (a) a copper-shuttered hyperspectral radiometer, (b) biofouled (macro-fouling) interdisciplinary instrument packages, including optical sensors, recovered after a 4-month deployment from May until September 2004 in 25 m water depth in the Santa Barbara Channel, and (c) a close-up of the non-biofouled copper shutter of a hyperspectral radiometer. The shutter opens every hour on the hour between 6 am and 6 pm local time just prior to sampling and closes after a few minutes of sampling. This prevented any biological growth on the irradiance detector.

Another advantage of these nearshore observational facilities is in the development and implementation of data telemetry methods using radio frequency technology for real-time or near real-time HAB-related measurements (e.g., the MEPS-Bay system in Nova Scotia, Canada; www.cmep.ca/bay). This is necessary for alerting authorities to the formation and persistence of HABs and for mitigation purposes. Recently, oceanographers have begun to explore the possibilities of using cabled networks for power and communications (fiber optics) to provide researchers and coastal managers with HAB data in real-time or near real-time (e.g., Glenn and Dickey, 2003; National Research Council, 2003). Cabled observatories will provide virtually unlimited power and data communication capabilities, which are especially important for novel biological, optical, and chemical sensors that are now being engineered (see Scholin et al., 2005) and commercialized. Cables also afford a means for two-way data communication, which facilitates adaptive sampling, e.g., increasing sampling rates when HABs are detected. The primary disadvantages of cabled networks are (1) costs of laying cable and (2) obtaining permits through coastal zones to onshore data and power control facilities. To circumvent these limitations, several researchers are exploring the potential for utilizing retired telecommunication cables for ocean observing systems.

Benthic processes related to HABs may be studied and monitored using instrumentation deployed on bottom tripods in the coastal ocean. Bottom tripods and their instrumentation may be placed in the same environments as moorings using similar suites of sensors, samplers, and communication systems deployable from moorings. Geological, biological, physical, and optical systems mounted on tripods have been used to investigate sediment and detrital resuspension and settling, bedform formation and movement, bioturbation, and flocculation/deflocculation of organic particles (Figure X.3; Trowbridge and Nowell, 1994; Chang et al., 2001; Hill et al., 2001). *In situ* chemical sensors are currently being deployed near the ocean bottom to investigate nutrient upwelling and resuspension during HAB events. The feasibility of interdisciplinary detection systems on stationary platforms for HAB monitoring and research has been discussed by Johnsen and Sakshaug (2000), Cullen et al. (1997), Schofield et al. (1999), Cullen (2005), and Malone (2005).

Drifters and floats

Drifters and floats can provide high-resolution spatial data by following water parcels (Abbott et al., 1990; Dickey, 2001a). The Lagrangian platforms can provide data in portions of the time-space domain that are inaccessible by satellites, ships, and other *in situ* platforms, e.g., under clouds and ice in the Southern and Arctic Oceans. Profiling