The detection and monitoring techniques for algal toxins and the causative harmful algal blooms (HABs) are essential for the protection of aquatic lives, shellfish safety, drinking water quality, and public health. Toward the development of fast, easy, and reliable techniques, much progress has been made during the last decade for the qualitative and quantitative analysis of algal toxins. This review highlights the recent progress and new trends of these analytical and monitoring tools, ranging from in-situ quick screening protocols for the monitoring of algal blooms to mass spectrometric analysis of trace levels of various algal toxins and structural elucidation. Solid-phase adsorption toxin tracking (SPATT) deployed in the field for the passive sampling of algal toxins has been recently validated, and improved ELISA-based methods with lower detection limits for more toxins have become commercially available for both screening and routine monitoring purposes. Liquid chromatography-mass spectrometry with several recent mass spectrometric innovations has expanded our understanding of traditional toxins, their metabolites along with newly discovered toxins of ecological importance. Several established in vivo and in vitro bioassays will continue to be used as benchmark toxicological testing of algal toxins; however, newly emerged molecular probing techniques such as real-time quantitative polymerase chain reaction (qPCR) have extended our ability to trace algal toxins from causative organisms at the molecular level. New chemical and biological sensors, lab-on-chip and remote sensing of blooms being developed will hold promise for early warning and routine monitoring to better manage and protect our freshwater, coastal and marine resources from adverse impact by harmful algal blooms