Water Quality and Microalgal Proliferation in Tunisian Watercourses: Implications for Transfer to Coastal Ecosystems

Afef FATHALLI[1] and Oula AMROUNI[2]

(1) National Institute of Marine Sciences and Technologies, Marine Environment Laboratory, Port de pêche La Goulette, Tunisia.
(2) National Institute of Marine Sciences and Technologies, Marine Environment Laboratory, 28 Street 2 March 1934 Carthage Salammbô 2025 Tunis, Tunisia.

Tunisian rivers constitute critical hydrological systems that support drinking water supply, irrigation, and ecological connectivity between inland waters and the Mediterranean coastal zone. However, increasing anthropogenic pressures coupled with climate variability have significantly altered water quality, promoting the widespread growth of microalgae, especially cyanobacteria. This study presents an integrated assessment of physicochemical water quality, microalgal community structure, and nutrient fluxes from river basins to marine environments.

Field investigations conducted in major Tunisian catchments, including the Medjerda River basin—the largest watershed in the country—and selected coastal wadis, partly within the framework of the OMELI (Observatory of the Medjerda to the Coast of the Gulf of Tunis), revealed elevated concentrations of total nitrogen and orthophosphate, particularly during low-flow periods and following storm runoff events. These nutrient enrichments primarily originate from diffuse agricultural inputs, untreated or partially treated domestic wastewater, and soil erosion processes. Such conditions promote eutrophication and stimulate excessive growth of phytoplankton communities.

Phytoplankton analyses using the Utermöhl method, in accordance with the international standard NF EN 15204, indicate an increasing dominance of opportunistic microalgal taxa under nutrient-rich and warm conditions. Chlorophytes and diatoms are commonly observed under moderate nutrient regimes, whereas bloom-forming cyanobacteria dominate in stagnant, nutrient-enriched waters. Potentially toxic genera such as *Microcystis*, *Anabaena*, and *Oscillatoria* have been detected in reservoirs and slow-flowing river sections. Seasonal blooms have been documented in the Sidi Salem reservoir, where nutrient inputs from the Medjerda watershed promote recurrent eutrophic episodes.

These findings highlight emerging public health concerns, especially for communities relying on surface water resources for domestic use and irrigation. Beyond freshwater systems, riverine nutrient exports contribute substantially to coastal enrichment. Elevated nutrient fluxes discharged into the Gulf of Tunis and other nearshore areas may intensify coastal phytoplankton blooms, potentially altering trophic dynamics, oxygen balance, and fisheries productivity.

The results emphasize the interconnected nature of watershed processes and coastal ecosystem responses. Climate-driven factors, including rising temperatures and prolonged drought periods followed by intense rainfall events, further exacerbate nutrient concentration and bloom frequency. Therefore, effective management requires an integrated river basin–coastal zone approach combining nutrient load reduction strategies, improved wastewater treatment efficiency, sustainable agricultural practices, and continuous monitoring of microalgal and cyanobacterial dynamics, including toxin surveillance.

Understanding the ecological drivers of microalgal succession and cyanobacterial proliferation in Tunisian rivers is essential for mitigating eutrophication risks and protecting both freshwater and Mediterranean marine ecosystems under ongoing environmental change.

Keywords : Medjerda River watershed, Eutrophication, Cyanobacteria, Coastal Ecosystems, Tunisia