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Effects of organic pollution on environmental conditions and the phytoplankton community in the central Lebanese coastal waters with special attention to toxic algae

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1 **Effects of Organic Pollution on Environmental Conditions and the**
2 **Phytoplankton Community in the Central Lebanese Coastal Waters with**
3 **Special Attention to Toxic Algae**

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9 **Abstract**

10 Organic pollution is a major global environmental issue for coastal ecosystems. In order to assess
11 the effects of this pollution, environmental parameters and phytoplankton community were
12 monitored during a two-year period (from April 2010 till March 2012) in the central coast of
13 Lebanon in the Levantine Sub-basin. Data were collected for temperature, salinity, nutrients,
14 chlorophyll-*a* and phytoplankton community. Temperature followed its normal seasonal and
15 annual cycles, usually noted in the Lebanese coastal waters, whereas salinity varied spatially and
16 temporally presenting sometimes low values due to continental inputs (19.07 - 39.6). Significant
17 fluctuations of nutrients (N-NO₂= 0.004-4.28 μML⁻¹ ; N-NO₃= 0.25-39.15 μML⁻¹ ; P-PO₄=
18 0.014-5.77 μML⁻¹), Chl-*a* concentrations (0.03-8.9 mg/m³) and density of total phytoplanktonic
19 cells (40 383-22.10⁶ cells/L) were observed between the sites and through the years (P < 0.05).
20 Environmental conditions were largely influenced by continental inputs. A perturbation of the
21 natural phytoplanktonic succession and an occurrence of toxic or potentially harmful algae were
22 noticed in the polluted sites, reflecting the influence of wastewater effluents on the coastal
23 seawater equilibrium and thus on the Lebanese marine biodiversity. The overall study provides a
24 good outline on the prevailing condition of few coastal areas which could facilitate the
25 management of their pollution sources.

26 **Keywords:** Organic pollution, phytoplankton community, toxic algae, coastal water quality,
27 Lebanon, Mediterranean Sea.

28 **1. Introduction**

29 Lebanon, like many Mediterranean countries, witnesses an increasing rate of population
30 growth with more than 5.85 million residents in 2015 (World Bank, 2016 ; UNdata, 2016 ;
31 World Factbook, 2016). Around 70% of the Lebanese population lives on the narrow coastline
32 that hosts an increasing rate of urbanization [an estimated annual rate of around 3.18% between
33 2010 and 2015 in the entire country (World Factbook, 2016)], industries, businesses, touristic
34 projects and other activities causing environmental pressures and quality deterioration of the
35 coastal lands and waters. Moreover, Lebanon's coast receives nearly 65% of the total sewage via
36 at least 53 major sewage outfalls spread along the Lebanese coastline (CDR/LACECO, 2000 ;

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