ECOLOGICAL STRUCTURE AND DYNAMICS OF THE SEAGRASS *CYMODOCEA NODOSA* IN MONTAZAH BAY OFF ALEXANDRIA, EGYPT

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Abstract

Cymodocea nodosa was sampled from different sites located within a seagrass bed in Montazah Bay, Alexandria, Egypt. Samples were collected at bimonthly during the period from February 2002 to December 2002. Physico-chemical parameters were measured in conjunction with seagrass phenological parameters. Generally, all phenological parameters except rhizome-root biomass showed maximum values in late spring (June), and minimum values during winter. Rhizome-root biomass, showed an opposite trend. It was concluded that although light and temperature are the major factors controlling seasonality of *C. nodosa* growth, during summer the growth is limited by other factors, mainly self-shading and nutrient limitation. Five environmental factors were identified as important in controlling biomass and abundance of *C. nodosa*. These include temperature, salinity, light, water and sediment nutrient concentrations. Qualitative determination of associated epiphytes was also performed.

Key words: Seagrasses; Cymodocea nodosa; Montazah; Alexandria; Egypt

The presence of the two species of seagrasses *Posidonia oceanica* and *Cymodocea nodosa* along the Egyptian Mediterranean waters is largely documented (1, 2,3, 4). Along Alexandria coastal waters, many beds have been badly damaged and seagrasses are reduced to scattered patches in inshore semi-closed bays. In front of Alexandria, seagrass beds are exposed to untreated wastewater pollution and turbidity. Growth of *C. nodosa* is continuous throughout the year with a unimodal cycle. Its foliage started to increase toward spring and became particularly dense in late spring (June), with maximum-recorded shoot density (131shootsm^{-2} ±44) and leaf density (368 leafm^{-2} ±473). These values decreased towards summer. Minimum shoot and leaf densities were recorded during winter (52 shootm^{-2}±8, 113 leafm^{-2}±13). Leaf area index, leaf length, epiphytic area, photosynthetic area and leaf biomass showed the same cyclic pattern as shoot and leaf densities. Rhizome-root biomass showed an opposite cyclic pattern to the other phenological parameters, where maximum values were recorded during winter (23.4gm dwm^{-2} ±6), and minimum values recorded June (4.7gm dwm^{-2}±2). Principal component analysis was used for "*C. nodosa* phenological-Physicochemical parameters relationship". Plotting PC1 against PC2 (Fig. 1) revealed that phenological parameters of the foliar system had positive correlations with temperature and PH, and negative correlations with dissolved nutrients and salinity and insignificant correlation with total sediment organic matter (TOM). Root-rhizome biomass showed completely opposite correlations to those of the foliar system. Seasonal variation of the foliar system of *C. nodosa* could probably be related to changes in temperature and light availability. Changes in temperature over the year seem to play an important role in the reproduction cycle of *C. nodosa*, which influence the leaf growth and production (5). In the meadow under study, a male flower and seeds were recorded at the end of April. It seems to be that seeds were dormant, buried in the sediment until germination started in April, coinciding with the rise in water temperature. It was observed that the potential production set by the incoming irradiance and water temperature was not met during summer. This deviation may be attributed to the following reasons: **a)** Increased epiphytic growth on plant leaves in late spring. **b)** Self-shading by the plants, where maximum leaf length was recorded during late spring. **c)** Higher turbidity observed in the bay during summer **d)** Nutrient limitation of summer growth, where minimum dissolved nutrient concentrations was recorded during late spring. This may be attributed to the active consumption of the seagrass to the dissolved nutrients. The reduction of salinity due to intrusion of fresh water that may carry high concentrations of dissolved nutrients caused the initiation of the foliar system growth in late winter. The opposite correlation between the underground biomass and foliar system biomass may be attributed to the dependence of the rhizome and roots on the extensive foliar system biomass during their growing season in absorption of the nutrients from the surrounding water. After the collapse of the foliar system that occurred in the summer season, rhizome and root system started to increase in biomass to compensate the reduction of dissolved nutrients in seawater by absorption of the nutrients from the sediments. The sediment is the main source for phosphorus in carbonate sediment seagrasses, the acquisition of phosphorus by both seagrasses *P. oceanica* and *C. nodosa* might be limited by sparse supply in water column and their ability of speeding up the uptake of phosphorus from the sediments (6). In Montazah Bay, turbidity caused by water sports and seagrass damaging are a threat to seagrass meadows. Despite these destructive factors, *C. nodosa* is a eurybiontic species tolerates considerable fluctuations in environmental variables. This may explain the dominance of *C. nodosa* over the *P. oceanica* when the conditions are unfavorable for the stenobiontic *P. oceanica* (4).

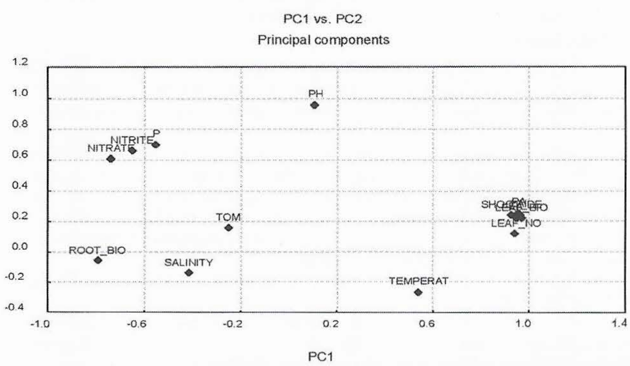

Fig. 1. Components loadings matrix of phenological parameters (leaf area index, leaf density, shoot density, photosynthetic area and epiphytic area and Physico-chemical parameters (salinity, temperature, PH, TOM and dissolved inorganic nutrients).

Cymodocea nodosa epiphytic associations:

Floral epiphytes: Blue green algae: *Anacystis aeruginosa, Oscillatoria lutea.* Red algae: *Audouinella thuretii, A. virgatula, Bangia atropurpurea, Chroodactylon ornatum, Erythrocladia carnea, Hydrolithon farinosum, Melobesia membranacea, Pneophyllum fragile kuetzing, Porphyrostromium ciliare, Sahlingia subintegra, Stylonema aslidii, S. cornu-cervi.* Brown algae: *Giraudia sphacelarioides, Myrionema orbiculare.* Green algae: *Cladophora socialis, Entocladia flustrae, Ulvella len* (Personal comm. Prof. Giusppe Giaccone).

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