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IMPACTS OF WATER CHARACTERISTICS CHANGES ON THE DISTRIBUTION OF WATER PLANTS IN LAKE BURULLUS, EGYPT

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ABSTRACT:

This study was conducted to evaluate the impacts of water characteristics changes on the growth and distribution of water plants present in lake Burullus protected area. *Najas armata, Ceratophyllum demersum, Pistia stratiotes and Myriophyllum spicatum* growth rate were declined and completely disappeared from the eastern part of the lake and became very rare across the lake as a results of clearing and shallwing process of this part of the lake which leads to increasing in water salinity, depth, dissolved oxygen and decreasing in biological oxygen demand with changeable pH values. Water depth, TDS, salinity, ammonium and phosphate were the key factors that control the growth and distribution of aquatic macrophytes in lake burrullus.

Keywards : Lake Burullus, aquatic plants , water characteristics, salinty , water depth , nutreints

INTRODUCTION

Egypt has five lakes or lagoons in the northern coast. These lakes are: Bardawil, Manzala, Burullus, Edku, and Mariut, and considered the most important sites in the Egyptian Mediterranean coastal water. Lake Burullus is located between the two main Egyptian Delta Rosetta and Damietta branches and is a Ramsar site which declared as a protected area since 1998. Because of the presence of habitat variety of Lake Burullus, a variety of biodiversity inhabits the lake.

In the recent years, the amounts of agricultural and sewage wastewater entering the lake through several drains at the southern part changed their physico-chemical and limnological features and decreasing the levels of salinity across the Lake, which caused shifting in their biodiversity. The Egyptian Ministry of Environmental Affairs and Egyptian Environmental Affairs Agency updated the National Biodiversity, Strategy and Action Plan (NBSAP). One of the important goals of this strategy is to minimize the rate of lake degradation and improve the water quality. The major concern in Lake Burullus toward achieving the National Biodiversity Strategy is to decreasing the anthropogenic activities and land runoffs by restoring salinity level by clearing and shallower the eastern part of the lake to make water current and increasing salinity, the mechanical removal of reeds form 50 cm under water surface causing recycling of water across the lake, maintain the sea outlet (El-Boughaz) open and clear to ease seawater and fish enter the lake.

Water quality and consequent Macrophytes growth are continuously affected by physical, chemical and biological variables including nutrient availability, water flow, turbulence, water salinity, temperature, depth, sediments characteristics and epiphytic growth (Duarte et

al., 1994; Wetzel, 2001). The abundance and biomass production of several plant species in according to physico-chemical variation were observed by Lacoul&Freedman, (2006) and Rolon & Maltchik (2006). Such studies provide the opportunity for species richness assessment in relation to environment in particular the factors that determine aquatic plant diversity (Murphy *et al*., 2003).

Biotic factor such as competition and herbivores can also be considered as one of significant factors that affect the abundance and distribution of macrophytes (Titus & Stephen, 1983; Rasch *et al*., 2004). On the other hand macrophytes communities have their impacts on the aquatic habitats by influences the ecosystem functions through modifying , flow pattern (Sand-Jensen & Pedersen, 1999), sediment process (Clarke & Wharton, 2001), oxygen dynamics (Uehlinger *et al.*, 2000) and nutrients cycles (Wilcock *et al*., 2004). The extent to which macrophytes could affect the aquatic system is by their interaction in physical, chemical and biological process depending mainly on; biomass density, composition, and species morphology (Sand-Jensen & Mebus, 1996). The understanding of the interaction between aquatic environment and macrophytes is essential if the macrophytes community includes a rare or highly valued (environmentally and/or economically) species, for example, *Najas aramata, Pistia stratiotes* and *Lemna gibba* as they are vital for fish feeding and water treatment, Younis & Nafea (2014), *Potamogeton pectinatus* is important tool for water purification from heavy metals (Nafea &Zyada, 2015). *Najas armata* can help to retain soil moisture for short periods before it rots down, so, ironically, it helps promoting the early growth of grass (Belal *et al*., 2009). Natural and anthropogenic impacts put macrophytes under pressure and reduce in many ways their growth and productivity in shallow water areas in Lake Burullus.

The water plants of Lake Burullus have been investigated by Younis & Nafea (2012) and Shaltout & Khalil (2005) and Al-Sodany (1992). The number of the recorded aquatic plants in Lake Burullus, as estimated by Nafea (2005) was 26 species: 4 submerged species, 8 floating species, and 14 emerged species. The salinity and water depth of water of Lake Burullus appears to be the most important factor affecting the distribution and abundance of hydrophytes communities in the lake. Younis & Nafea (2012) stated that water plants in Lake Burullus can grouped into three categories, some are restricted to the more saline water e.g. *Ruppia maritima*, while others occur more abundantly in freshwater and slightly brackish water, e.g. *Myriophylum spicatum, Pistia stratiotes* and *Najas armata* and others have wide salinity tolerance e.g. *Potamogeton pectinatus, Phragmites australis,* and *Typha domingenssis*. High drainage water from agricultural and aquaculture projects at south of the lake caused reduction of many species to one or two populations with few individuals on the shores of Lake Burullus (Khedr & Lovett-Doust, 2000). Freshwater origin species *Myriophylum spicatum* was recorded in front of Brimbal Canal and around the outlets of southern drains where the water salinity was relatively low. (Younis &Nafea, 2012).

This work aimed mainly to evaluate the water variables that positively and negatively impact the

growth and distribution of water plants in Lake Burullus.

MATERIALS AND METHODS

The study area

Lake Burullus is one of the delta lakes located between Rosetta and Damietta branches and between longitude 30° 30` and 31° 10`E, and latitude 31° 21` and 31° 35` N. It is elongated in shape and connected to the sea through a narrow (50 m wide) opening called Boughaz Al-Burullus. This lake is a Ramsar site and has been declared as a protected area since 1998. Fig (1).

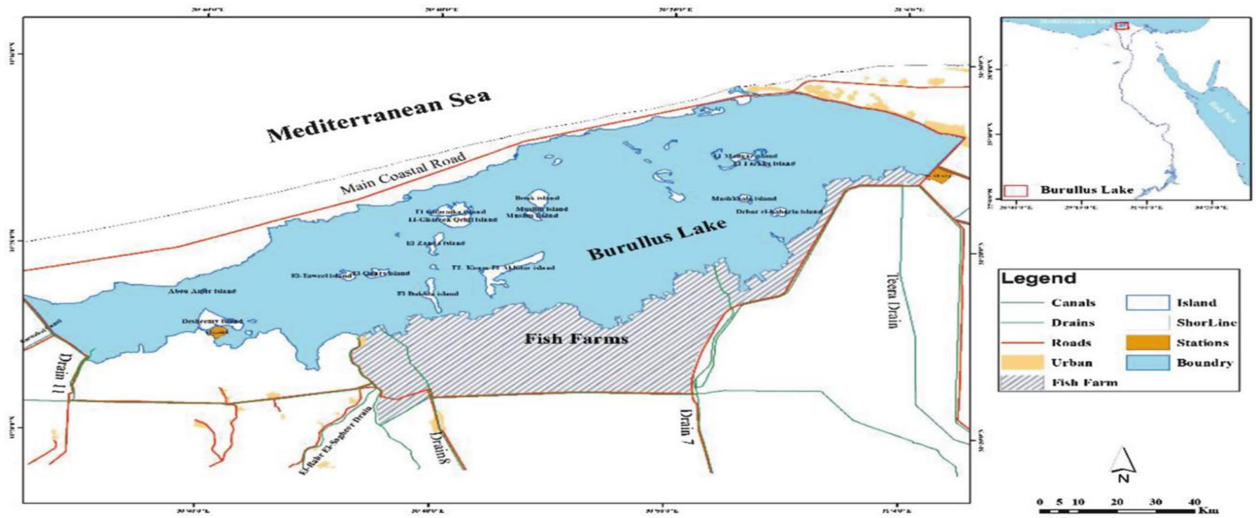

Fig (1) Map represent the lake burullus

Table (1): The studied sites in lake Burullus protected area

no	Section	Location description	position
a-	Eastern section		
1	El-Boughaz area	Boughaz bridge connect the Medit. and the lake Burullus	N=31º 34´ E=30º 59´
2	Emade	Beside the international road receive domestic waste water	N=31º 33´ E=30º 59´
3	Mouth of drain El-Burullus	Mixed Drainage water of El-Burullus drain	N=31º 33´ E=31º 04´
4	Mouth of El-Gharbia drain	Mixed Drainage water of El-Gharbia drain	N= 31º 31´ E=31º 04´
5	Mishkhilah	Mixed Drainage water of Terra drain	N=31º 30´ E=30º 57´
b-	Middle section		
6	shallow	Area covered with hydrophytes	N=31º 32´ E=30º 58
7	El-Kom El-Akhder	Mixed Drainage water of Drain 8 .	N=31º 24´ E=30º 43´
8	El-Zanka	Near El-Zanka island brackish water at lake center.	N=31º 32´ E=30º 47´
9	Kodaa	Mid. northern section area covered with hydrophytes.	N=31º 36 ´ E=31º 01´
10	El-Maksabah	Mixed drainage waterof El-Maksabah village	N=31º 29´ E=30º 45

c-	Western section		
11	Deshemi	Near Deshemi islands area covered with hydrophytes	N=31º 20´ E=30º 37
12	El-Tawilla	Near El-Tawilla island at the mid. of the lake	N=31º 26´ E=30º 44´
13	Abo-Amer	Area covered with hydrophytes near Abo-Amer island	N=31º 25´ E=30º 40´
14	Sakkarana	Near Sakkarana village and covered with hydrophytes.	N=31º 24´ E=30º 37´
15	Brimbal canal	mixed fresh water form Brimbal canal.	N=31º 24 ´ E=30º 35´

FIELD SURVEY AND FLORISTIC COMPOSITION

15 sampling sites were set up across the lake as; five sites on the eastern section, five in the middle and five in the western one. The vegetation survey was carried out in three trips from March 2018 to April 2019, where most of water plants were sufficiently developed. Sites were selected randomly representing all most aquatic habitats in the lake. The location of each site was determined by a Garman GPS. Plant species were identified after Boulus (1999, 2000, 2001, 2005 and 2009).

All aquatic species were listed and the cover percentage for each species was estimated. The cover of macrophytes species was calculated using one square meter quadrate. (Murphy *et al.*, 1981). The results were represented by tables and figures. In all the selected sites detailed studies including floristic composition and physico-chemical properties of water were carried out.

PHYSICO - CHEMICAL VARIABLES OF WATER

The pH values and temperatures (°C) were determined using Misuraline model ML 1010. Depth (m) and transparency were measured using a Secchi disc. Total dissolved salts (mg l-1) and conductivity (µS/cm-1) were measured with an electronic TDS meter (HANNA, model HI 99300). Dissolved oxygen (mg/l-1 and saturation percentage) was measured using the model HI 9146 by HANNA. Soluble reactive phosphate was determined by the molybdate blue method (Allen et al., 1986). Nitrate was determined by means of chromic acid method (APHA, 1985). Sodium salicylate is added to an aliquot of filtered water samples. Nitrite was determined by the modified Griess-Ilosvary method (APHA, 1985). Ammonia was determined by Nessler's method, in which an alkaline solution of mercury chloride is used as a reagent for the colourimetric determination (APHA, 1985). Sulphate was determined by the turbidimetric method using NaCl/HCl - glycerol-ethanol reagent and barium chloride crystals (Rossum and Villarruz, 1961).

RESULTS AND DISCUSSION

The obtained results revealed that 28 water plant species belonging to 21 genera and 17 families were recorded in the Lake Burullus during the period from March 2018 to April 2019 from which; 7 submerged, 8 floating and 13 emerged species.

It was observed that the clearing and shallower process in the eastern section of Lake Burullus leads to an increase of water characteristics as ; depth, pH , salinity, aeration, Dissolve Oxygen percentage from the northern to southern part of the lake, but the western and

middle section still shallow with dense growth of macrophytes and relatively low salinity. Table,(1).

The freshwater origin species *Ceratophyllum demersum, Najas armata, Myriophyllum spicatum* and *Pistia stratiotes* prefer more sheltered areas at the southern and western margins of the lake around the outlets of drains where the water salinity is relatively low.

Table (2): Floristic list and mean cover % of aquatic Macrophytes in lake Burullus
E=Eastern section M=Middle section W= Western section

no	species	cover % Nafea (2005) before clearing and shallower			cover % in 2019 after clearing and shallower		
a-	Submerged species	E	M	W	E	M	W
1	*Ceratophyllum demersum*	95	90	85	5	85	95
2	*Ceratophyllum submersum*	70	75	65	0	20	35
3	*Potamogeton pectinatus*	95	98	95	10	75	95
4	*Potamogeton crispus*	60	70	75	0	35	35
5	*Myriophylum spicatum*	35	30	65	0	35	75
6	*Najas armata*	55	65	75	0	30	45
7	*Najas minor*	30	25	55	0	15	20
b-	*Floating species*						
1	*Eichhornia crassipes*	35	40	65	0	55	65
2	*Lemna gibba*	45	65	60	5	65	70
3	*Lemna minor*	30	35	30	5	35	30
4	*Nymphaea caerulea*	10	5	35	0	15	15
5	*Pistia stratiotes*	15	5	20	0	3	2
6	*Marsilea aegyptiaca*	15	10	30	0	15	35
7	*Azolla filiculoides*	10	10	15	1	15	25
8	*Spirodela polyrrhiza*	15	10	15	0	15	10
c-	*Emerged species*						
1	*Phragmites australis*	90	95	75	10	75	85
2	*Typha domingensis*	85	75	50	15	78	90
3	*Panicum repens*	50	45	55	5	65	70
4	*Ludwigia stolonifera*	55	65	65	5	65	90
5	*Persicaria salicifolia*	50	35	55	4	45	55
6	*Persicaria senegalensis*	15	55	65	0	35	45
7	*Saccharum spontaneum*	35	45	40	0	25	35
8	*Echinochloa stagnina*	30	35	30	5	10	15
9	*Scirpus maritimus*	35	35	40	3	25	25
10	*Scirpus littoralis*	25	25	30	5	25	65
11	*Juncus rigidus*	55	45	30	5	35	55
12	*Juncus subulatus*	55	20	15	8	35	45
13	*Cyperus articulatus*	20	5	5	5	35	35

Some of aquatic plants were disappeared and not recorded in the eastern section and became very rare in the middle and western section after the process of clearing the Boughaz and eastern section due to the increasing salinity level, lake depth and decreasing the nutreints sources and the eastern section became clear and seemed to be open water with no hydrophytes except near the shore and around the ilands , This agreed with William *et al.* (1974), who stated that increase of salinity reduced the growth of macrophytes where it is toxic to most of them as, *Pistia stratiotes, Eichhornia crassipes, Myriopyllum specatum*, *Najas aramata* and *Azolla filiculoides.* Younis and Nafea (2012), documented that freshwater origin species *Myriophylum spicatum, Ceratophyllum demersum, Najas armata,* and *Panicum repens* were recorded in front of Brimbal Canal and around the outlets of southern drains where the water salinity was relatively low and they prefer more sheltered areas at the southern and western margins of the lake Table (1). Stoler *et al.* (2018) documented that salts from roads and turbidity have negative impacts on the productivity and growth rate of *Ceratophyllum demersum* and *Myriophyllum spicatum* species and have a positive impacts on the growth and productivity of other water plants as *Lemna gibba*. Hadad *et al*. (2017) confirmed that floating plants (*Pistia sratiotes* and *Eichhornia crassipes*) cannot tolerate the high range of salinity (2,000; 3,000; 4,000; 6,000; and 8,000 mg/ L and high range of pH (8, 9, 10 and 11) while emerged macrophytes (*Typha sp*. and *Phragmites australis*) can tolerate the high ranges of pH and salinity.

***Najas armata* is more frequent than *Najas minor* and dominates the middle area of Lake Burrullus where it is present in 6 stations (45 % cover) and *Najas minor* was rare as it is grow only in four sites (20% cover).The fishermen collect and use the *Najas spp*. as a mixture: they call *Najas armata* Horisha Abu Shouk (spiny) and *Najas minor*-Horisha Naema (smooth) self-communication with local fishermen. The maximum growth rate of *Najas armata* was on the middle and western sections of the lake where salinity level is low and the water is not deep, in contrast the *Najas armata* and other Macrophytes became very rare in the eastern section due to it became deep and highly saline water (Stelzer *et al.*, 2005; Torn *et al*., 2006). Also low water velocity (Birket *et al*., 2007) and low nutrients input (Horppila and Nurminer, 2005). *Myriophylum spicatum* is the most frequent species occupying 3 sites in the western section; it forms pure stands in many areas in western parts of the lake and not present in eastern section.**

Table (3): Physico- chemical properties of Lake Burullus water in the studied sites before clearing and shallower after Nafea 2005.

Parameters	Eastern section					Middle section					Western section				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Depth cm	190	180	175	165	140	56	145	115	130	189	120	190	215	225	195
Temperature C	33	32	32	31	32	28	31	32	31	32	29	32	31	32	31
Transparency cm	25	43	45	55	60	20	55	60	70	55	65	50	72	45	55
pH	6.6	8.4	8.7	8.6	7.5	8.5	8.6	8.4	6.3	7.6	7.8	9.5	9.1	8.9	8.7
EC g/ l	9.6	8.6	8.4	5.7	8.2	1.0	3.2	3.7	3.1	3.2	1.0	2.4	1.1	1.2	1.7
TDS g/ l	2.5	2.4.	2.2	1.4	2.3	0.7	1.6	1.4	1.7	1.5	0.4	1.1	0.6	0.7	1.0
DO mg/ l	5.6	6.5	5.7	7.6	6.9	2.5	3.6	5.7	3.6	5.3	6.4	8.4	7.5	8.6	8.3
BOD mg/ l	3.7	3.8	3.8	2.9	2.9	6.3	7.9	4.9	5.3	4.3	2.2	6.6	3.4	2.3	1.8
PO_4 µg/ l	1.9	3.2	4.3	2.2	1.5	1.4	2.3	2.4	1.8	1.4	11.5	19	11	17	16
NH_4 µg/ l	1.8	1.4	1.9	2.6	1.4	1.2	3.1	1.4	1.4	1.3	1.2	1.3	1.4	1.2	1.4
NO_3 µg/ l	1.2	1.4	2.3	1.7	1.3	1.6	1.7	2.4	2.4	3.2	13.4	10.0	8.9	7.4	8.1
NO_2 µg/ l	1.7	0.8	1.2	1.2	1.1	0.5	2.4	1.6	1.9	2.8	8.4	11.3	8	8	7.4
SiO_2 µg/ l	21	31	34	37	27	24	36	43	29	26	34	37	31	21	23

Table (4): Physico- chemical properties of Lake Burullus water in the studied sites in the lake 2019.

Parameters	Eastern section					Middle section					Western section				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Depth cm	210	180	230	180	165	60	140	120	125	190	190	230	210	230	225
Temperature C	30	33	32	31	32	28	31	32	31	32	29	32	31	32	31
Transparency cm	73	100	65	70	95	20	55	60	70	55	65	50	72	45	55
pH	7.3	8.1	8.3	7.6	7.9	7.5	8.6	8.4	6.3	8.9	7.8	9.3	9.1	8.9	8.7
EC g/ l	25	23	21	16	12	1.0	3.2	3.5	4.1	4.2	1.1	2.6	1.2	1.1	1.4
TDS g/ l	2.3	17.6	10	8	6.4	1.2	1.9	1.4	1.8	1.9	0.6	1.0	1.0	0.9	1.0
DO mg/ l	5.6	9.5	6.4	7.2	8.1	2.3	3.4	5.1	4.6	4.3	6.8	9.4	7.8	9.1	7.6
BOD mg/ l	2.7	2.3	2.8	2.6	1.9	6.3	6.9	4.7	5.9	6.3	1.2	5.6	3.2	2.4	1.9
PO_4 µg/ l	2.7	3.2	4.3	2.2	1.5	1.4	2.3	2.4	1.7	1.8	16.5	21	13	15	12
NH_4 µg/ l	2.1	1.4	1.5	2.3	1.7	1.1	2.3	1.5	1.7	1.3	12	21.5	13	12	14
NO_3 µg/ l	1.1	1.3	2.1	1.4	1.2	1.3	1.9	2.1	2.3	2.1	11.3	9.0	8.7	8.4	9.1
NO_2 µg/ l	1.2	0.9	1.1	1.3	1.2	0.4	2.1	1.4	1.7	1.8	9.0	13.3	10	9.4	7.9
SiO_2 µg/ l	19	21	26	30	24	20	43	22	25	31	34	32.4	22	19	23

The temporal and spatial variations in water depth were clear and highly related to Lake water level. High depth was recorded (230 cm) in western part. The shallow sites were in the middle parts. Water temperature did not varied significantly due to location. In general, lower temperature was recorded in sites located at western of Burrullus which characterized by shallow water and occupied by dense Macrophytes growth, (30 and 31 °C,)

respectively). Maximum mean value of water temperature (33 °C) was recorded in eastern section, while the minimum (30 C), in middle section. Water was alkaline, where the mean pH values were 7.3 and 7.5, respectively. The most alkaline sites in burullus were western part; recording pH values of 9.3 in most sites, pH values were higher in July than in other sampling months.

Total dissolved solids ranged between 1.2 in western and 17.6 g/l, in eastern. There is no certain pattern of spatial variation, but in general it shows reverse variation from pH. Total dissolved solids showed lower values in sites with intensive plant growth in western part. The variation in water conductivity was highly related to water dissolved salts. It was lower in western part and higher in the eastern part of the lake according to direct connection to the sea through the boughaz.

The total dissolved oxygen showed clear spatial variation. Oxygen content ranged between 3.7 to 7.3 mg/l. The highest mean value was recorded in eastern part and the lowest at middle part. In general, water is more aerated in sites with less dense growth of Macrophytes recording 9.4and 9.5 mg/l, respectively. It was observed that site (which recorded lowest oxygen content, 3.7 mg/l) was occupied by damaged and decayed aquatic plants due to fishing boats impact. In most sites, the highest dissolved oxygen values were recorded in July, and the lowest was in May. Water phosphate showed low spatial variation with mean values varying between 0.04 and 0.3 mg/l. Minimum values were in eastern parts, while the maximum was at western. It was noticed during the field work that the two sites of minimum phosphate content were characterized by high epiphytic growth, forming a layer on the macrophytes species. Clear difference in water phosphate was recorded between the three samples. High phosphate content was in July with few exceptions (no difference between the three samplings: 0.04 mg/l).

Ammonia concentrations showed a much clearer spatial variation, Water ammonia content in ranged between the lowest of 1.1 mg/l in most sites and the highest of 40 mg/l in the western section.

It was observed that Macrophytes flourish in July and remarkably reduce in the other sampling months. Migratory water birds like White Pelican, Cormorants, White Stork and Flamingo are one of the causes of aquatic plants decline. The migratory birds are common visitors to Lake Burullus as it is a Ramsar site (Younis and Nafea, 2012; Younis &Nafea, 2015) in dense flocks and resting at the shores of Lake Burullus from November till April. Although previous studies indicated the positive role of water birds on the aquatic habitat e.g. their role for dispersal of plants propagates (Green *et al*., 2002), rising water productivity (Little, 1979); water birds, particularly large ones (White Pelican and Flamingo), caused serious mechanical damage for aquatic macrophytes (by cutting during their movements, feeding and grazing) and dispersion of the bottom sediment, increasing the water turbidity. Our results support those of Agami and Waisel (1984), who found that *Najas armata*, is eaten and exposed to damage by water birds, such as *Gallinula chloropus Linnaeus* 1758 and *Fulica atra Linnaeus* 1758, causing a serious reduction on plant growth, explaining minimum macrophytes

density at seasons of migration compared to other sampling seasons. Field surveys support these findings. On the other side, migratory birds that grazing on Macrophytes may have a positive role of enhance the seeds germination (following exposure to bird's digestive system). Such results are not exclusive related to seeds of aquatic macrophytes, but also to the ones of terrestrial plants (Koller and Cohen, 1959). Growth and distribution of Macrophytes in lake burullus are influenced by natural and anthropogenic environmental conditions. The natural ones include dense growth of epiphytes, invasion of other plants as *Myriophyllim spicatum,* and the impact of water birds. The study confirmed that the high salinity levels reduced the plants growth and caused a decline in macrophytes. The anthropogenic impacts caused a significant variation in water conditions, limiting the growth of many species and providing the opportunity for *Myriophyllum spicatum* to compete with native species. This conclusion is in consistence with Agami and Waisel (1985, 2002), who found that the competitive relationship between *Myriophyllum spicatum* and *Najas armata* developed as a result of resources exploitation and environmental deterioration, where the competition between the two species is usually in the benefit of *Myriophyllum specatum,* causing the reduction of *Najas armata*. Myriophyllum showed a higher flexibility toward unfavorable conditions, making the plant more qualified to survive in such conditions than *Najas spp*. the leaves forms and lacunae of *Myriophyllum spicatum* provide low resistance to oxygen diffusion between leaves and make the plant able to benefit of the low oxygen contents (Laskov *et al.*, 2006).

Ali & Sotan (2006) also indicated that Myriophyllum showed higher production in water with nitrogen compounds and high organic matter in sediment. Myriophyllum spicatum can be an indicator for eutrophicated conditions represented by high concentrations of ammonia, nitrate and phosphate in both water and sediments while Najas armata and Najas minor *were more* tolerant to such conditions, their adaptability to deep and eutrophicated waters was lower than that of *Myriophyllum spicatum*.

Fishing is another form of human activity that creates a destructive impact on Macrophytes from Lake Burrullus. My study concerns with shallow water fishing (*Najas spp.* grew in shallow water) which extends from May to July. The results showed a low growth of *Najas spp*. in May due to boat impacts. One can suggest that Lake Burullus is exposed to constrains, mainly from anthropogenic disturbance, which caused a decline in density and diversity, not only to *Najas armata*, but also to other Macrophytes species.

In conclusion; the increasing water depth and water salinity at the eastern section of lake Burullus leads to disappear of some aquatic Macrophytes from this section as; *Najas armata, Myriophyllum spicatum , Ceratoplyllum demerssum* and *Azolla filiculoides*. The eastern section became an open water with less turbidity suitable for environmental tourism and increase the fish production from this section. So the sustainable management and development of the rest of the lake must be completed and the process of Deeping and shallower Lake Burrullus must be continuously occurring with regular and strategic plans.

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دراسة تاثير التغيرات في خصائص المياة علي انتشارالنباتات المائية في بحيرة البرلس في مصر

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ملخص البحث:

تهدف هذه الدراسة الي تقييم تأثير التغيرات في خصائص المياه علي النمو والانتشار للنباتات المائية في بحيرة البرلس حيث اوضحت النتائج ان زيادة العمق والتطهير في الجانب الشرقي لبحيرة البرلس ادى الي اختفاء بعض الانواع النباتية مثل (نبات الحريشة **Najas armata,** نخشوش الحوت **Ceratophyllum demersum** خس الماء **Pistia stratiotes ,** **Myriophyllum spicatum** وندرة تواجدها في بقية اجزاء البحيرة و هناك انواع قل تواجدها. من الجانب الشرقي للبحيرة

واوضحت النتايج ان الملوحة ارتفعت ارتفاع ملحوظ في البحيرة وخاصة الجانب الشرقي وارتفاع نسبي في بقية اجزاء البحيرة مما ادي الي اختفاء تلك النباتات وندرتها في البحيرة وتغير التركيب الفلوري للبحيرة .