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IMPACTS OF PLANKTIVOROUS FISHES SILVER CARP (*Hypophthalmichthys molitrix*) AND GRASS CARP (*Ctenopharyngodon idella*) ON PHYTOPLANKTON COMMUNITY STRUCTURE AND DENSITIES IN NILE WATER

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ABSTRACT: *Planktivorous fishes, Silver and Grass carp, were applied as biologically controlled for Algal bloom in Nile aquatic ecosystem. Different densities of each species inoculated in definite quantities of adapted Nile water. Continues monitoring for water quality including, temperature, pH, dissolved oxygen, electrical conductivity, dissolved inorganic nutrient salts, NO_2, NO_3, NH_4, PO_4 and SIO_2 carried out each 12 h. Phytoplankton Chl a, species composition and density were investigated. The fishes were more effective on phytoplankton structure than its density, and successfully reduced phytoplankton biomass, but nutrient increased with time, and fish density. Cyanophyceae that dominated with Microcystis aeruginosa was the most reduced class with Silver Carp. The applied fishes can be used as biological control in Nile aquatic ecosystems that is environmentally saved than the chemical treatments.*

Key wards: *Biocontrol, Algal Bloom, Planktivorous Fishes, Nile Water.*

INTRODUCTION

The amount of usable clean water is decreasing due to industrialization and algal blooming (Choe and Jung 2002). As productivity of inland waters have been increased causing harmful algal blooms, causing a number of problems in water resources. They impede flow in drainage systems; block pumps and sluices; interfere with navigation, fishing and other forms of recreation; cause taint and odour problems in potable waters; block filters and;in some instances, create a health hazard to humans, livestock and wildlife (Broadmoor *et al.*, 1999).

During the past few decades appearance of algal bloom is repeated within Nile aquatic ecosystems in Egypt, in Lake Nasser 1993, as a result of eutrophication (Abd El-Monem 1996), in the main branches and canals of Nile River, at Port Said Canal during 1994 (Amin 2001) released toxins in the surrounded ecosystems (Gomaa *et al.*, 2000) and in Suez Canal (freshwater canal) a result of human activities, created undesirable conditions (Abd El-Monem *et al.*, 2008). Algal bloom formation damages water resources, alters the functioning of natural ecosystems and may lead to significant economic losses. Blue-green algal toxins pose health problems to human beings (Jochimsen *et al.*, 1998).

Different efforts, chemically, mechanically and biologically, were done for controlling algal bloom. Chemical agents or synthetic compounds are currently used. Chemical treatments exhibited toxic effects on fish (Karan *et al.*, 1998), can induce secondary pollution that increase potential health risks in drinking water supplies (Lam *et al.*, 1995), and in the long run, it have some residual effects in the aquatic food chain (Jhingran 1995). However, chemical treatments are either expensive or environmentally unsaved.

Other wise the uses of mechanical filtration are expensive and inefficient. It is still faced with the problem of disposing of the algae and often the filter medium, once it becomes clogged, is no longer effective. While a biological filter that would carry the algal removal process one step further and convert the algae into a form that could be easily removed from the water and be immediately useful would be ideal.

Biomanipulation of algae bloom through

introduction of suitable herbivorous fishes is the most environmentally sound management proposition in many tropical and temperate lakes. It has emerged as a promising tool for lake restoration (Shapiro *et al.*, 1975). Allelopathy of plant remnants were used in some Nile channel (Abd El-Monem *et al.*, 2008).

Effect of filter-feeding planktivorous fishes on the plankton community were studied with different experimental conditions (He *et al.*, 1994). During the 1990s, several researchers discussed the filter-feeding planktivorous fish impact on zooplankton and phytoplankton communities in the whole lake (Xie *et al.*, 2000), and phytoplankton biomass (Liu and Xie 1997).

Silver and Grass carp constitute important species among the used filter-feeding planktivorous fish. Silver carp were first brought into Africa by a private fish farmer as a potential biological control agent to improve water quality in municipal sewage treatment lagoons and aquaculture ponds and as a food fish (Froese and Pauly 2001). Partitioned Aquaculture System water (Christopher *et al.*, 2004), in lakes, and reservoirs to reduce the prevalence of cyanobacterial off-flavors (Tucker 2006). The food and feeding of Silver carp attracted significant interest in the 1970s because that was considered a potential tool for controlling eutrophication (Lajos *et al.*, 1997).

Silver carp is a native of rivers in the west Asia and Amur River in China, have been introduced worldwide aimed at control of algae or at enhancement of fish production of lakes (Gophen 1990). Also it was recommended to use of Silver carps to reduce municipal sewage treatment plant operational costs and treatment pond size (Henderson 1983). Several non-native filter feeding species including Silver carp, tilapia, and the Asiatic clam *Corbiculafluminea* have been added to aquaculture ponds to increase fish production and crop algal production (e.g. Buttner 1986).

Grass carp have also been successfully introduced for weed control and impact on phytoplankton in North and South America, Africa (e.g., Egypt) and Australia (Opuszynski and Shireman 1995). It prevented the filamentous algae form overgrowing a water body(Pipalova 2002). The effects of herbicides and Grass carp on phytoplankton and macrophyte communities tested (Hestand and Carter 1978). Cassani (1996) recorded that diploid and triploid Grass carp continue to be used as an effective biological control in lakes and ponds, and many states authorize that for biological control of nuisance aquatic ecosystem (Dauwalter and Jackson 2005).

Aim of work: Our goal was to study the successfully use of Silver and Grass Carp as biological control for algal bloom in Nile water ecosystems, to avoid the nuisance problems in potable waters, mechanical problems to water plan systems, block filters, health hazard to humans, livestock and wildlife.

That bio-control is alternative way for using chemical agents, to avoid its harmful impact in the aquatic ecosystems. Lastly, as an additional source of protein produced from an unused resource, needs to be done.

MATERIALS AND METHODS

Prepration and design of the Experiment:

Nile water filterd with plakton net, mesh size 55 μ, to separate zooplankton, left for one week in large basin to adapte with the new environmintal condetions, and 200 liter of that water poured into fiber glass basins. two items of basens were decided, the first for Silver carp fishes and the second for Grass carp. The common weight of fingerling Silver carp was fluctuated between 15-17 g/one, and Grass carp between 10:12 g/one. Each item was devided into four groups, three basens for each one (triplecate). Water in the first group basens were left as a control (untrated group), without inculation with fishes, and the others three groups were inoculated with different densities of the used fishes. One stocked with 10, the second with 20 and the third with 40 fingerling fishes.

Water analysis, physical, chemical and biological, were done at zerro time (just before fish inculation) and subsampling were reanalized periodically each 12 h. The expermints were extended to 72 h.

Physical variables; water temperature and electrical conductivity (EC) were measured by digital electrical conductivity meter (model 33 SCT meters YSI). pH and Dissolved oxygen (DO) were measured using a combined electrode connected to a pH meter.

Chemical analysis: Nutrient salts N and P contents of the sampled water were detected as discussed in APHA (1992), using the following methods; Ammonium (NH_4-N) was determined by the phenate method. Nitrite (NO_2-N) was detected by diazotization method). Cadmium reduction method was applied for reducing NO_3-N to NO_2-N. Orthophosphate (PO_4-P) was measured colorimetery as discussed by Strickland & Parsons (1965). Reactive silicate (SiO_3) was determined by the molybdosilicate method. Colorimetric measurements were done using double beam spectrophotometer (Kontron 930, UV-Vis.).

Biological investigations: Phytoplankton biomass represented as Chlorophyll *a* (Chl *a*). A defined volume of water sample was filtered on glass microfiber filter (GF/F), using filtration unit (Sartorius). Chl *a* retained in filter was extracted in 90% acetone overnight at 4 °C (Parsons *et al.*, 1984), prepared, measured spectrophotometry, and calculated according to trichromatic equation (SCOR/UNESCO 1991).

Phytoplankton composition and density: 100 ml of water sample fixed in 4% neutral formalin and preserved with Lugol's iodine solution(Margalef 1974), transferred in glass cylinder, phytoplankton cells allowed to settle for 5 days, 90% of the supernatant fluid was siphoned off, concentrated the remaining to10% and transferred to plastic bottels. Using drop method (APHA 1992) phytoplankton samples were investigated and counted through inverted microscope (ZEISS 1M 4738). Bellinger and Sigee (2010), Seckbach (2007), Compere (1991), Krammer and lang Bertalot (1991), Popovsky and Pfiester (1990), Httl. Hand (1988) and Deskachary (1959) were the references used in phytoplankton identification.

Statistical analysis: The given data were analyzed statistically with Appling ANOVA test to clear the significance of variations between the variables and to detect correlation coefficients (r) between the different studied parameter.

RESULTS

Physical variables

Water temperature in fish enclosures during the application of Silver and Grass carp in Nile water, for controlling phytoplankton bloom,was averaged within about 21.2 to 21.7 °C, as shown in table 1. pH was lied in the alkaline side, with higher pH values (7.99 and 8.0) in control enclosures for Silver and Grass carp, respectively, and gradually decreased with increasing stoking density of fishes, recording lowest pH value of 7.91 in the maximum fish population enclosures, for both types (see table 1).

DO was varied irregularly in the enclosures and limited between 7.31 and 7.4 mgO_2l^{-1}, as shown in table 1. Statistical analysis of the given data cleared that correlation of DO was highly significant (-0.479, $P \geq 0.01$) with water temperature in Grass carp, and significant (-0.461, $P \geq 0.05$) in Silver carp.

Changing in EC of Nile water enclosure was limited. Their values were varied from 402 to 412 µS/cm, those readings were significantly correlated with nutrients (N and P) contents in Silver carp enclosures, as seen in tables 2 and 3.

Table (1): Physical variables of the treated water in the fish enclosures.

Treatment	Temperature (°C)		pH		DO (mgO_2l^{-1})		EC (µS/cm)	
Fish 200 l^{-1}	SC*	GC**	SC	GC	SC	GC	SC	GC
Control	21.4	21.7	7.99	8.00	7.33	7.32	412	407
10	21.3	21.2	7.99	7.96	7.36	7.36	411	402
20	21.2	21.2	7.96	7.93	7.34	7.40	412	404
40	21.2	21.3	7.91	7.91	7.31	7.38	411	406

SC*; silver carp GC**; grass carp.

Table (2): Correlation between the parameters of water analysis for Silver Carp enclosures.

	DO	pH	T[1]	EC	NO_3	NO_2	NH_4	PO_4	SiO_2	Chl .*a*	Phyt.[2]
DO	1										
pH	-.169	1									
T[1]	-.461-*	.130	1								
EC	-.104	.305	-.046	1							
NO_3	-.148	.133	.194	-.435-*	1						
NO_2	-.173	.154	.211	-.470-*	.983**	1					
NH_4	-.182	.189	.209	-.454-*	.982**	.990**	1				
PO_4	-.126	.105	.206	-.439-*	.979**	.976**	.965**	1			
SiO_2	-.013	-.064	.128	-.531-**	.813**	.813**	.781**	.848**	1		
Chl *a*	-.099	.042	.121	.238	-.664-**	-.586-**	-.628-**	-.678-**	-.640-**	1	
Phyt.[2]	-.112	-.079	.338	-.335	-.061	.020	.002	-.073	-.015	.236	1

Table (3): Correlation between the parameters of water analysis for grass carp enclosures.

	DO	pH	T[1]	EC	NO_3	NO_2	NH_4	PO_4	SiO_2	Chl.*a*	Phyt.[2]
DO	1										
pH	.005	1									
T1	-.479-**	-.083	1								
EC	-.328	-.367	.201	1							
NO3	.043	-.070	-.056	-.278	1						
NO2	.022	.021	.000	-.208	.927**	1					
NH4	-.107	.314	.148	-.175	.689**	.840**	1				
PO4	.035	-.013	-.017	-.244	.931**	.975**	.783**	1			
SiO2	-.080	.333	.204	-.163	.209	.250	.525**	.166	1		
Chl.a	-.045	.417*	.141	.013	-.715-**	-.521-**	-.124	-.617-**	.187	1	
Phyt.2	-.033	-.151	.341	.397*	-.261	-.120	.102	-.159	.331	.313	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
T[1] = Water temperature.
Phyt.[2] = Phytoplankton density.

Chemical analysis

Water quality in the enclosures showed that NO_3-N concentration increased with time, in the inculcated water with fishes, and that was proportioned with stocking density of fishes, in both types of the used fishes, comparing with the control. It was maximized to about 3.9 times within Silver carp enclosures, and 3.4 times in Grass carp, more than the control which steel more or less constant along the experimental time, as found in fig 1a and b.

NO_2-N variability in the used water has the same trend found in NO_3-N. It was increased with time and increasing fish density. Its values were higher in Silver carp enclosures than in Grass carp. It was maximized to about 4.2 times more than in control, in 40 fish/200 L of Silver carp, while it reached to 2.6 times in Grass carp (see figs. 2a and b).

Changing in NH_4-N in Silver carp enclosures has the same view of NO_3 and NO_2, when as its concentrations increased with time and fish density, that was recorded about 1.9 times in 40 fish/200L, than in the control. While in Grass carp enclosures, it values were still more or less similar with that obtained in control as shown in fig (3a and b). NH_4-N contents were significantly correlated with NO_3 and NO_2 in both types of the used fishes (see tables 2 and 3.).

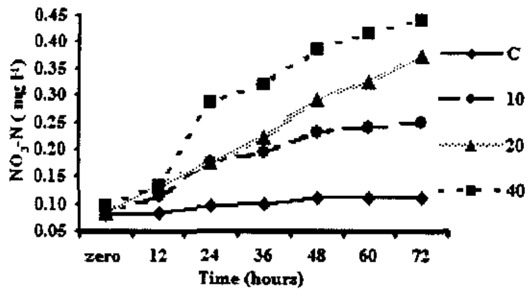


Fig (1a): NO_3-N in Silver Carp enclosures.

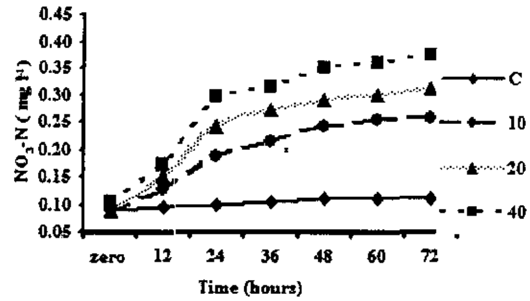


Fig (1b): NO_3-N in Grass Carp enclosures.

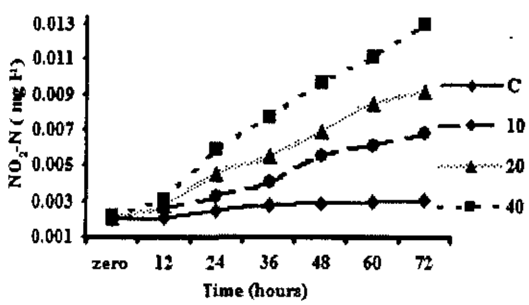


Fig (2a): NO_2-N in Silver Carp enclosures.

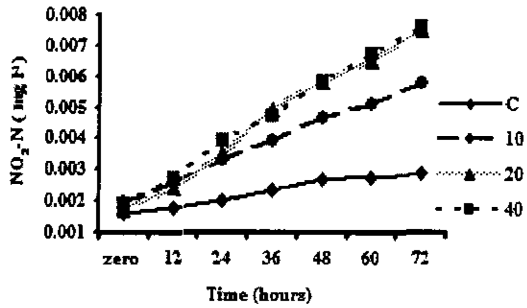


Fig (2b): NO_2-N in Grass Carp enclosures.

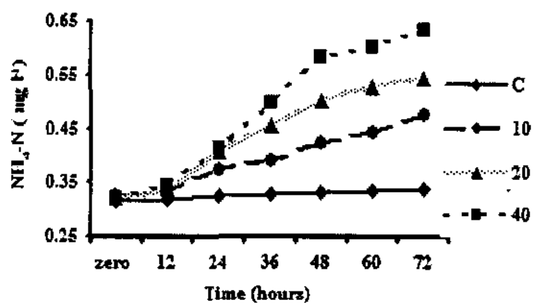


Fig (3a): NH_4-N in Silver Carp enclosures.

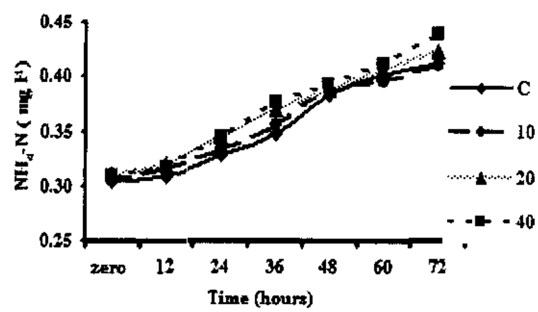


Fig (3b): NH_4-N in Grass Carp enclosures.

PO_4-P increased to abut 2 times in the highest density of Silver carp enclosures and to about 2.6 times in Grass carp. Increasing in PO_4-P was graduated with time and fish population in both cases, in comparison with control, as showed in figs (4a and b). Statistical analysis cleared that correlation between PO_4-P and N salts were highly significant, as shown in tables 2 and 3.

Changing in SiO_2 contents were irregular in the different treatments for both types of fishes. It was slightly increased (1.09 time), than control, with increasing Silver carp density, while as it decreased (0.98 time) in Grass carp enclosures (see figs 5a and b). Its values were significantly correlated with N and P nutrients in Silver carp enclosures, while that was found only with NH_4-N in Grass carp (tables 2 and 3).

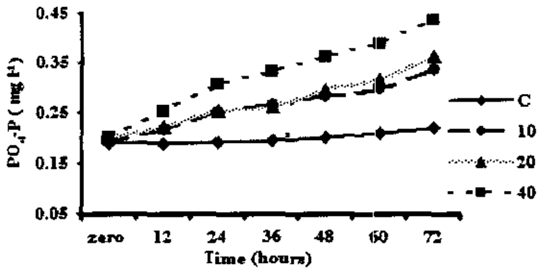


Fig (4a): PO_4-P in Silver Carp enclosures.

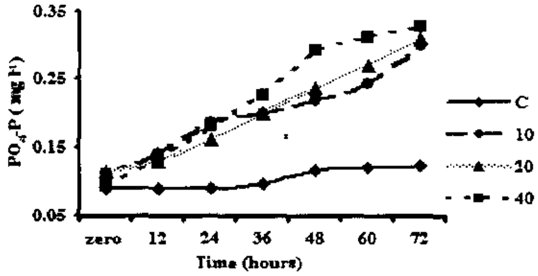


Fig (4b): PO_4-P in Grass Carp enclosures.

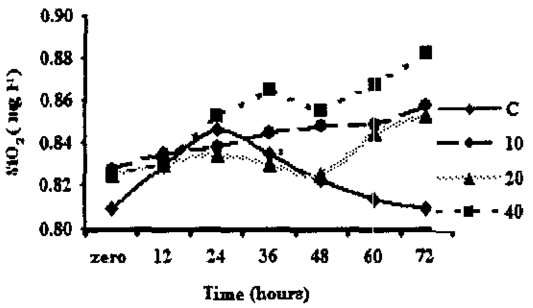


Fig (5a): SiO_2 in Silver Carp enclosures.

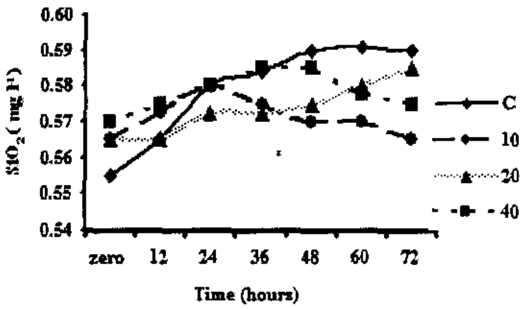


Fig (5b): SiO_2 in Grass Carp enclosures.

Phytoplankton biomass

Results of phytoplankton biomass, as represented by Chl *a*, cleared that grazing pressure of Silver carp on phytoplankton reduced Chl *a* to about 53.9% from that found with the control, in 10 fish/200L enclosures. Fig (6a) indicate that grazing of that fishes on phytoplankton was comparatively similar with all of the used densities of Silver carp. The rate of grazing was stressed during the first 24h, and relatively become stable. In contrary, the higher density of Grass carp fishes (40 fish/200L) was more effective than the other densities on grazing phytoplankton (Fig 6b), when as it decreased Chl *a* to about 52.5% comparing with the control. Statistically, variations of Chl a in Silver carp enclosures were highly significant reversely correlated with all N, P and SiO_2 contents, where as in Grass carp, the same relation was reported only with NO_2, NO_3 and PO_4, as shown in tables 2 and 3.

Phytoplankton structure and density

Phytoplankton composition in the untreated water (control) was dominated by Cyanophyceae forming about 52% of the total count, followed by Chlorophyceae (22.9%), Bacillariophyceae (14.7%) and Dinophyceae (6.9%). While abundance of the other three classes, Euglinophyceae, Cryptophyceae and Chrisophyceae were rare, forming about 1.2, 1.3 and 0.7%, respectively. Detailed composition of phytoplankton and percent are shown in fig (7).

Grazing of Silver and Grass carp was effected on both phytoplankton density and class composition. But the class composition was more affected than the population density, for both types of fishes. Within Grass carp, phytoplankton density was minimized to about 77.0% from that found in the control, with the higher density of Grass cap (40 fish/200L). While in Silver carp, it was decreased to about 77.8% with the lower density (10fish/200L). Impact of the both types of fishes and their densities on phytoplankton counts are shown in fig (8).

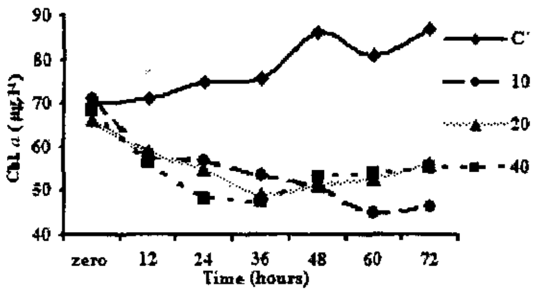


Fig (6a): Chl. *a* in Silver Carp enclosures.

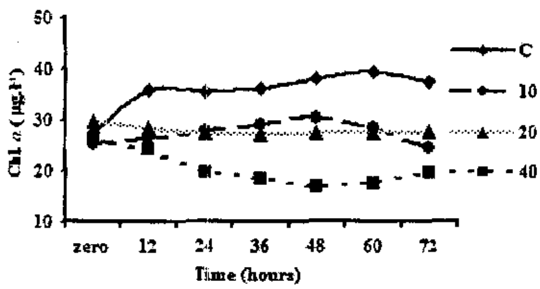
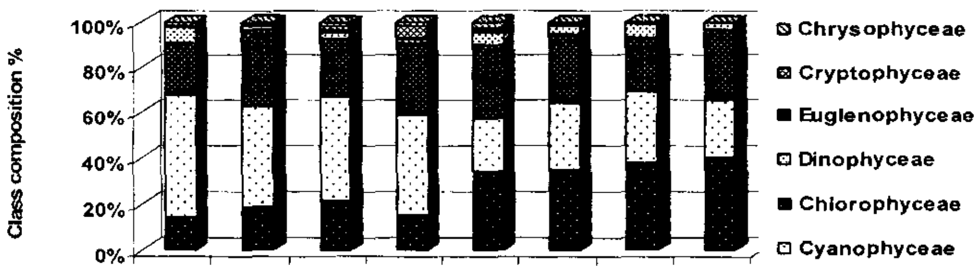
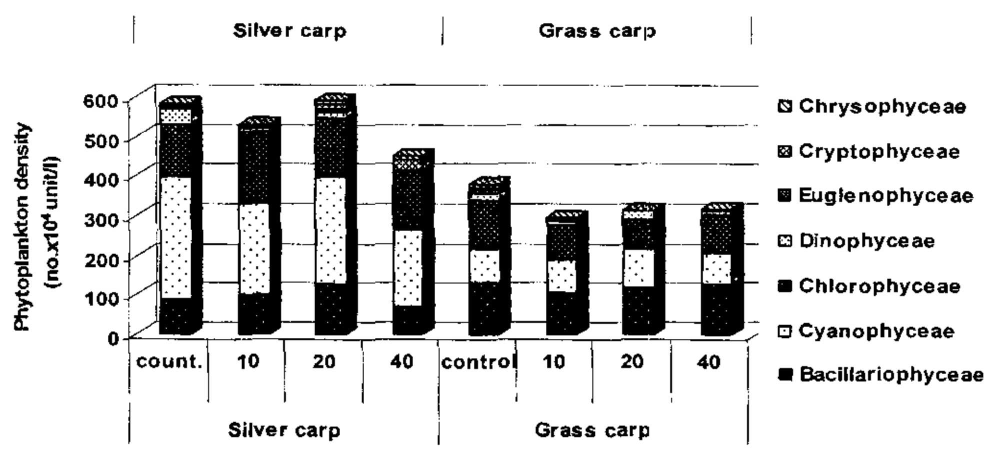


Fig (6b): Chll. a in Grass Carp enclosures.



Fig, (7): Phytoplankton class composition percents in Silver and Grass carp enclosures.



Fig, (8): Phytoplankton densities in Silver and Grass carp enclosures.

Changing in phytoplankton structure in the treated enclosures was varied according to the type of inoculated fishes. Class composition cleared that Silver carp reduced Cyanophyceae ratio form about 52.0 %, in control, to about 43.9 % in the lowest density of fishes. Where as Bacillariophyceae increased from 14.7 % to 21.7 %, and Chlorophyceae from 22.9 to 36.7% (see fig.7). Other wise the reverse was reported with Grass carp, Cyanophyceae increased from 23.2 to 30.9 %, and Bacillariophyceae from 34.7 to 40.2 %, while Chlorophyceae reduced from 32.9 to 23.0 %.

DISCUSSION

Productivity of inland waters in Egypt has been increased causing harmful algal bloom in Nile aquatic ecosystem in Lake Nasser and in some Nile river canals (Abdel Monem *et al.*, 2008) as a result of human activities. That caused damages of water resources, alters the functioning of natural ecosystems and may lead to significant economic losses, and releasing toxins in the surrounded ecosystems (Gomaa *et al.*, 2000).

Biomanipulation of algal bloom in the natural aquatic ecosystem of Nile water was applied using filter feeding fishes, Silver and Grass carp, to improvement water quality instead of nutrient management or use of chemicals, which have some residual effects in the aquatic food chain (Jhingran 1995) and increase potential health risks in drinking water supplies (Lam *et al.*, 1995)

In the present work, application of Silver and Grass carp in Nile water revealed that DO is not affected with the type or density of fishes, but its fluctuation was reversely associated with water temperature during the day. The presence of fishes can produce a controlled plankton growth in fertile bodies of water and decrease the biochemical oxygen demand by increasing oxygen production (Joseph *et al.*, 2005).

Inoculation of fishes reduced pH and that declining enlarged with the condensed fishes. That can be realized to the impact of fish faces on the chemical components and DO of water. As the grazing pressure of the fishes effect on the primary productivity which use carbonate and bicarbonate as a source of CO_2. It was reported that fish excrete two principal toxic metabolites to the water; NH_3 and CO_2. However, allowing the accumulation of metabolic CO_2 results in pH reduction (Micha *et.al*, 2006).

Chemically; stocking of Grass and Silver carp can influence both directly and indirectly water body. The General trend of dissolved nutrient salts (N and P) in the examined water was gradually increased with the time and fish densities. The same finding was obtained by Lieberman (1996). NH_4-N was the most dominant form of N and slight enhancing with the stoking Grass carp, followed with NO_3-N and then NO_2-N. NO_3-N increased to about three times, comparing with the control. It has to maintain that increasing rate of NO_3-N was high during the first day and slow down after. NO_2-N contents were very low comparing with NO_3-N and the both has the same trends in their fluctuations. Primary consequences of Grass carp feeding include a selective decrease or elimination of aquatic plant biomass and the release of nutrient – rich excrements into the water (Pine and Anderson 1991). Pipalova (2003) reported that Grass carp speeds nutrient recycling in a fishpond and transfers the nutrients from plants to other compartments of the ecosystem.

Application of both types of fishes in Nile water increased PO_4-P contents, about three times more than in the control, and increasing value was proportioned with fish density. That was parallel with Lieberman (1996), when introduced Silver carp in small shallow pond in Arvada (Colorado) and found that total phosphorus and total inorganic nitrogen were increased. Increase in nutrient salts in the treated water can be realized to filter feeding fish take up large amounts of planktonic algae and bacteria from the water column and accelerate nutrient cycling, due to decomposing the released undigested foods into the water column (Lu *et al.*, 2002).

In reverse with N and P variability, SiO_2 concentrations slightly decreased in the treated enclosures with Grass carp. SiO_2 contents in Silver carp treatments were higher that found in Grass carp.

Biologically; phytoplankton biomass, as detected by Chl *a*, gradually increased in the untreated sample (control), while it was still more or less steady with the starting time in low density of Grass carp enclosures. Where as it was reduced to about 57% in the high density treated enclosures. Grass carp are not dependant to microalge (phytoplankton) on there feeding because it able to consume large quantities of aquatic macrophytes (Van der zweerde, 1990).

Statistically, variation in Chl *a* between the different groups of Grass carp was highly significant ($P \leq 0.01$). On the other side, it was highly negative correlated ($P \leq 0.01$) with the dissolved nutrients, NO3 ($r=-0.715$), NO_2 ($r=-0.521$) and PO_4 ($r=-0.617$).

While it was positively correlated ($P \leq 0.05$) with pH and in significant with the other variables.

In contrary with Grass carp, Chl *a* in Silver carp enclosures were decreased directly with the starting time and most of phytoplankton consumed by Silver carp during the first day, and after it became stable at low level up to the end of the experiment. Decline rates in Chl *a* were more or less similar in all treatments. It was reduced to about 70% in the treated enclosures. This finding indicated that Silver carp is an obligate filter-feeding planktivore (Itawa, 1977) with a highly developed filtering apparatus (Hampl *et al.*, 1983). Our results agree with that done in Paranoá Reservoir (Brasília, Brazil) and found that total phytoplankton biomass (expressed as chl *a*) and net primary productivity were significantly reduced by Silver carp (Fernando 1993).

Chl *a* in Silver carp enclosures was high negative correlated ($P \leq 0.01$) with all dissolved nutrients, NO_3 (r=-0.664), NO_2 (r=-0.586), NH_4 (r=-0.628), PO_4 (r=-0.678) and SiO_2 (r=-0.64). Its variability between the groups was highly significant ($P \leq 0.01$), where as phytoplankton densities were insignificant.

Examination of phytoplankton composition inhabiting Nile water during the present biomanipulation experiments, as investigated in the control sample of Silver carp, recorded 69 spp related to 7 classes. Blue-greens (Cyanophyceae) was the most dominant spp that formed about 52% from the standing crop, flowed by Chlorophyceae (22.9%), Bacillariophyceae (14.7%) and Dinophyceae (6.9%). Where as, other three classes were rare, Euglenophyceae (1.2%), Cryptophyceae (1.3%) and Chrysophyceae (0.7%).

Microcystis aeruginosa (Kutz.) was the most abundant species among 20 spp of Cyanophyceae, forming about 24% from its total count, followed by the filamentous form Lyngbya limnetica (Lemmer.) constituting about 17.9% and Aphanocapsa elachista W. West & G.S. West (6.9%). Chlorophyceae included the highest species diversity (24 spp) among the other classes, leaded with Monoraphidium contortum (Thuret) (26.3%).Where as Bacillariophyceae represented by 13 spp, that was dominated by Cyclotella meneghiniana (Kutzing) (49%) and Cyclotella ocellata (Pant.) (10.4%). Dinophyceae was mainly represented by Peridinium and Gymnodinium spp.

Phytoplankton composition and densities in this study indicated that blue greens (cyanophyceae) which mainly represented by Microcystis aeruginosa (Kutz.) were the most effected and grazed by Silver carp. So, biomanipulation with Silver Carp is suitable for ceasing cyanoalgal blooms and reduction of the amount of planktivorous fishes seems to be a more adequate method for increasing water transparency, than introduction of phytoplankton feeding fish.

Grass carp possess comb-like pharyngeal teeth that are used to grind vegetation. Adult Grass carp prefer a diet of submerged plants with soft leaves (Pine and Anderson 1991) and will consume filamentous algae and firmer macrophytes when preferred forage has been exhausted (Opuszynski and Shireman 1995). In the absence of aquatic vegetation, Grass Carp have been reported to consume organic detritus, insects, small fish, earthworms, and other invertebrates (Froese and Pauly 2001).

Contradictory, Silver carp feed both zooplankton and large algae, leading to enhance micro algal growth. Because growth rates for micro algae are higher than large algae, stocking filter-feeding may not reduce but rather increase algal biomass (Li *et al.*, 1993).

The present study indicated that Silver carp was mainly feed on phytoplankton and more effective in controlling algal bloom than Grass Carp, in parallel with Kolar *et al.* (2007). Silver carp very efficiently strain suspended material from the water with highly specialized gill rakers that are fused into sponge-like porous plates (Robison and Buchanan 1988). Otherwise, Silver carp lack a true stomach which requires them to feed almost continuously (Henderson 1983).

Generally, use of Silver carp as a

potential way to control excess blue-green algae remains controversial, as biomass related effects of Silver carp on plankton communities are still poorly understood (Starling and Rocha 1990).

Conclusion

- Silver carp is one of the successful fish species can be applied to control algae blooms in Nile waters, canals, aquaculture ponds, lakes and drains and it was more effective than Grass carp.
- Biomanipulation of Nile water resources using Silver carp is more environmentally saved than the chemical treatments.
- The use of Planktivorous fishes as a tool to control algal growth creates undesirable results of nutrient input, so that it is need more studies.

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تأثير الأسماك الناخلة على أنواع وكثافة المجتمعات الطحلبية في مياه نهر النيل

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الملخص العربى

إن من أحد العوامل البيولوجية المستخدمة في الحد من ظاهرة الازدهار الطحلبي هي استخدام الأسماك التي تتغذي على الهائمات النباتية مثل مبروك الحشائش والمبروك الفضي. تم إضافة كثافات مختلفة من مبروك الحشائش والمبروك الفضي إلي أحواض بها كميات معلومة من مياه نهر النيل بعد حدوث الثبات البيولوجي وتأقلم الكائنات الموجودة بالبيئة المائية علي الظروف البيئية الجديدة. استمرار الكشف عن جودة المياه وتقدير حالتها عن طريق رصد بعض القياسات الفيزيقية والكيميائية كل ١٢ ساعة مثل قياس درجة الحرارة، الأس الهيدروجيني، وتقدير كمية الأكسجين الذائب في المياه وتقدير التوصيل الكهربي وكذلك تقدير الأملاح المغذية الذائبة في المياه مثل النيتريت، النيترات، الامونيا، الفوسفات، السيليكات وكذلك تقدير تركيز الكلورفيل أ وتعريف المجتمعات الطحلبية وتقدير كثافتها وكان من الملاحظ أن هذه الأسماك أكثر تأثيرا علي الأنواع الطحلبية وأقل تأثيرا علي كثافة الهائمات النباتية وإضافة هذه الأسماك أدي إلي حدوث اختزال للكتلة الحيوية (كلورفيل أ) في حين أن الأملاح المغذية كانت تزيد بزيادة الوقت. لوحظ أن أكثر الأنواع شيوعا بين الطحالب الخضراء المزرقة هو الميكروسست اريجينوزا وتم اختزال هذه المجموعة بإضافة المبروك الفضي وتم تطبيق هذه الأنواع كوسيلة بيولوجية للحد من ظاهرة الإزهار الطحلبي في مياه نهر النيل حيث أن هذه الطريقة كانت أكثر أمانا بيئيا من المعالجات الكيميائية.