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FOOD AND FEEDING HABITS OF *OREOCHROMIS NILOTICUS* UNDER THE EFFECT OF INORGANIC FERTILIZER WITH DIFFERENT N:P:K RATIOS IN ABBASA FISHPONDS

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ABSTRACT

The food and feeding habits of Nile tilapia (*Oreochromis niloticus*) in ponds received inorganic fertilizer with different ratios of N:P:K were studied. The ratios were 20:20:5,20:40:5, and 20:20:0 and applied at a rate of 40 kg/feddan/month. It was found that, *O.niloticus* mainly consumed phytoplankton. The main items found in fish stomach belonged to *Cyanophyta, Chlorophyta, Bacillariophyta* and *Euglenophyta.* Detritus consisted mainly of scraps of macrophytes and mud. Zooplankton was occasionally found. The most frequently species represented in the food were *Anabaena spp., Merismopedia eleganse, Microcystis aeruginosa, Oscillatoria* spp. and *Spirulina* sp. (Cyanophyta), *Chlorella spp., Pandorina morum, Pediastrum spp. Scenedesmus spp.* and *Shereoderia setigera* (Chlorphyta), *Amphora ovalis, Gyrosigma attenuatum,* Melosira granulata, *Navicula* spp., *Nitzschia* spp., *Pinnularia* spp. and *Synedra* sp. (*Bacillariophyta*) and *Euglena* spp. and *Phacus* spp. (*Euglenophyta*). *O.niloticus* could select only *Cyanophyta* and *Euglenophyta* during the investigation period and sometimes select *Bacillariophyta.*

INTRODUCTION

Nile tilapia *(Oreochromis niloticus)* is one of the best known members of the tropical and subtropical freshwater fish and is now globally distributed because of its importance in aquaculture. Moreover, *O. niloticus* has a very diversifying diet with a dominant vegetable component (epilithic, epiphytic and filamentous algae, phytoplankton, vegetable debris and fine sediments), as well as, animal component such as insect larvae, crustaceans and mall fish (Philippart and Ruwet, 1982, Onyari, 1983). That wide dietary breadth could have made it a more adaptable species in eutrophic environment (Kaufman, 1992, Hechy 1993, Gophen *et al.*, 1993).

On the other hand, inorganic fertilizers are usually added to fishponds to stimulate and maintain the production of natural food (phytoplankton and zooplankton) (McIntire and Bond, 1962). The increase in fish production in fertilized ponds has been attributed to an increase in primary productivity (Melack, 1976;

Almazan and Boyd, 1978 Boyd, 1990).

In Abbasa fishponds, Nile tilapia is one of the most important components of polyculture system. Organic and /or inorganic fertilzers are used in pond fertilization. On the other hand, the compositional rations of fertilizer and time of addition are very critical and widely depending on local conditions (Boyd, 1990, Diana *et al.*, 1991). Phytoplankton, flourishsing and blooming, interfered with fish production and became limiting factor in fishponds causing problems with water quality (Boyd, 1990). So, this work was carried out to study the food and feeding habits of *O.niloticus* in fishponds receivd only chemical fertilizer with different N:P:K ratios to know how to use it in polyculture system and to control phytoplankton blooming.

MATERIALS AND METHODS

Eight earthen ponds (155m ^{2}) at Central Laboratory for Aquaculture Research, Abbasa, Sharkia, were used for studying the foods habit of Nile tilapia in fishponds received different ratios of N:P:K fertilize·s. The ponds had been drained, cleaned and refilled with new freshwter from El-Wadi Canal derived from Ismailia Canal. The average depth of water column was 0.8m. This experiment started on 14/5 1990) and continued for 155 days.

The fertilizers were applied to ponds every week throughout the experimental period. The ingredient sources of fertilizer were urea (46.5% N), superphosphate (15.5% P_2O_5) and potassium chloride (63.1% K_2O). These sources were used to prepare the ratios of 20:20:5, 20:40:5, 40:20:5 and 20:20:0 (N:P:K) The fertilizers were dissolved and spread on the water surface of fishponds according to Davidson and Boyd (1981) at the rate of 40 kg/feddan/month (kg/f/m). Each application was represented by two replicates. Nile tilapia was stocked at a rate of 150 fish/ pond. The average weight was 15-20 g/fish.

Twenty fish were monthly collected from each treatment for examination, using pure seines. The specimens were immediately placed in 10% formalin solution. The length of fish specimens and elementary canal were measured and the ratio of length was calculated. The degree of full was estimated according to Abdelghany (1993). Numerical count of organisms was carried out with Sedgwick Rafter counting cell (Boyd, 1984). Selectivity index for different components of the food was calculated according to Ivlev (1961).

RESULTS AND DISCUSSION

The average weight of fish samples (Fig. 1) shows that, fish growth linearly increased by time till the end of experiment in all treaments without significant differences. This growth was due to fish activity in plankton grazing since artificial feed was not used. This result is in agreement with Melack (1976), Almazan and Boyd (1978) and Boyd (1990) who found that the increase in fish production in fertilized ponds has been attributed to the primary productivity. Subsequently, the deposition of nutrients in fish tissues was achieved through fish grazing and accumulation of phytoplanton.

The analysis of stomach contents of *O.niloticus* showed great diversity in the found forms. Fig. 2 shows that, phytoplankton was the more abundant category in stomach, followed by detritus and their percentages were little varied during the investigation period in all treatments. In this concern, many authors reported that, Nile tilapia feed predominantly on phytoplankton and can utilize blue green algae (DeMaeseneer, 1984, Diana *et al.*, 1991, Abdelghany, 1993).

The main species of algae found in fish stomach belonged to *Cyanophyta, Chlorophyta, Bacillariophyta* and *Euglenophyta* (Table 1). Detritus consisted mainly of scraps of macrophytes and mud. Zooplankton was occasionally found (<1.5% of the total components in fish stomach) and consisted of parts of aniamals especially *Cladocera, Copepoda* and *Rotatoria*. This result was in concomitant with Fish (1955), Lowe-McConnell (1958) and Tudorancea *et al.* (1988) who reported that, *O.niloticus* is phytoplanktivorous and a facultative detritivore. Contrary result was obtained by Moriarty (1973) and Northcott *et al.* (1991) who stated that, insects and crustaceans can also comprise a large portion of the diet of *O.niloticus*. Moreover, it has the ability to feed on either small or bulky particles in Lake Victoria and also is the most efficient filter feeder and it could utilize a broad range of particle sizes (Batjakas *et al.*, 1997).

Considering the fluctuation of phytoplankton abundance in fish stomach, Fig 3 shows that, *Euglenophyta* followed by *Bacillariophyta* were dominant in fish stomach during the investigation period except June where *Cyanophyta* was the dominant in treatment 20: 20: 0 and May and June in the treatments 20: 20:5, 20:40:5 and 40:20:5. These results indicate that the small fish preferred *Cyanophyta* during these months. Abdel-Tawwab (1994) studied the application of inorganic fertilizer with different N:P:K ratios to fishponds. He found that, this application led to more or less changes in physicochemical parameters and phytoplankton occurrence in ponds water because of the changes in nutrients budget in each treatment. Therefore, the fluctuation in phytoplankton composition and occurrence in fish stomach resulted from the fluctuation of phytoplankton composition and occurrence in fishponds. On the other hand, phytophagous fish consume great amounts of food, and the intensity of feeding is affected by the filtration rate of food components, which depends on the density of phytoplankton in the water mass (Gajevskaja, 1958) and the condition of fish (Nikolski, 1963).

The most frequently species represented in fish stomach in all treatments (Table 1) were *Anabaena spp.*, *Mersimopedia eleganse*, *Microcystis aeruginosa*, *Oscillatoria* spp. and *Spirulina sp.* (Cyanphyta), *Chlorella spp.*, *Panmorum*, *Pediastrum* spp., *Scendesmus spp.* ans *Shereoderia* (*Chlorophyta*), *Amphora ovalis*, *Gyrosigma attenuatum*, *Melosira granulata*, *Navicula spp.*, *Nitzschia* spp., *Pinnularia*, spp. and *Synedra* sp. *(Bacillariophyta)* and *Euglena spp.* and *Phacus spp.* (*Euglenophyta*).

Regarding the complex nature of the feeding habits of *O.niloticus* in Abbasa fishponds, it has been necessary to calculate the selective index which might throw some light on fish food preference. According to Ivlev's equation (Ivlev, 1961), values of selective index are between +1 and -1. The positive values indicate a positive selectiveness of a certain kind of food, while, the negative values indicate a negative selectiveness. The data obtained (Fig 4) show that, *O.niloticus* slected *Cyanophyta* and *Euglenophyta* during the investigation period except during Aug. in the ratio 20:40:5 and May in the ratio 20:20:0 for *Cyanophyta.* Sometimes it selected *Bacillariophyta* during May, July and Aug. at the ratio 20:40:5, during June at the ratio 40:20:5, and during Sep. at the ratio 20:20:0. The fish did not select Chlorophyta, but it occurred incidentally in the stomach when it was mechanically swallowed together with other foodstuff. This result indicates that, fish does not consume food at random but is able to select and choose the preferred foodstuff.

Table 1. The main taxa of phytoplankton found in stomach of *O.niloticus* under the effect of inorganic fertilizers with different N:P:K ratios.

	20:20:5						20:40:5						40:20:5						20:20:0					
	M	J	J	A	S	O	M	J	J	A	S	O	M	J	J	A	S	O	M	J	J	A	S	O
Cyanophyta																								
Anabaena spp	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	-	-	+	+	-	+	+	-
Anabaenopsis Elenkinni	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Coleospharium sp	+	-	-	-	+	+	+	+	-	-	-	+	+	+	-	-	-	+	-	-	-	+	-	+
Merismopedia eleganse	-	-	-	+	-	-	-	+	+	-	+	+	+	-	+	-	+	+	-	-	+	+	-	-
Microcystis aeruginosa	-	-	-	-	+	+	-	-	-	+	-	+	-	-	+	+	+	+	-	-	+	-	-	-
Nodularia harveyana	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Oscillatoria spp	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	-	+	-	+	-	+	+	+
Spirulina sp	-	+	-	-	-	+	+	+	-	-	+	+	+	+	-	-	-	+	+	+	-	-	+	+
Chlorophyta																								
Actinostrum sp	+	-	+	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	+
Chlorella spp	+	+	+	+	+	-	+	-	-	+	-	-	+	+	+	-	+	-	-	+	-	-	+	-
Closterium Eherebergil	+	-	+	-	-	-	-	-	+	+	+	-	+	-	+	+	-	+	+	-	+	+	-	+
Coelastrum reticulatum	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	+	-	-
Eudrina ekorkowiensis	-	-	+	-	-	+	+	-	-	+	-	-	-	-	+	-	+	-	-	-	+	-	+	-
Pandorina morum	-	+	+	+	+	-	-	+	+	+	+	-	+	+	+	-	+	-	-	+	+	+	-	-
Pediastrum spp	+	+	+	+	+	-	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Scenedesmus spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Shereoderia setigera	+	+	+	+	+	+	+	-	+	-	+	-	-	-	+	+	+	+	+	+	-	+	+	+
Staurastrum sp	-	-	-	-	-	+	+	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	-	+
Bacillariophyta																								
Amphora ovalis	+	-	-	+	-	+	-	+	-	+	-	+	-	+	+	+	+	+	+	+	+	+	+	-
Cocconeis placentula	+	-	+	+	+	+	+	-	+	+	+	+	-	-	-	-	-	-	-	-	-	+	+	+
Cymatopleura solsa	+	-	+	+	+	-	+	-	-	-	-	-	-	-	+	+	+	+	+	-	+	-	+	-
Cymbella cistula	-	+	+	-	+	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	-	+	-
Gyrosigma attenuatum	+	+	+	-	+	+	-	+	+	+	+	+	+	-	+	+	+	+	+	-	-	+	+	-
Melosira granulata	+	+	+	-	+	+	+	-	+	-	+	+	-	+	+	+	+	-	+	+	+	+	+	+
Navicula spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Nitzschia spp	+	+	+	+	+	+	+	-	+	-	+	-	+	-	+	-	+	-	+	+	+	+	+	+
Pinnularia sp	+	+	+	+	-	-	-	+	+	+	+	+	-	-	+	+	+	+	+	-	+	+	+	-
Synedra sp	+	+	+	+	+	-	+	+	+	-	+	-	+	-	+	+	+	+	+	+	-	+	+	-
Euglenophyta																								
Euglena spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Phacus spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

+ present - absent

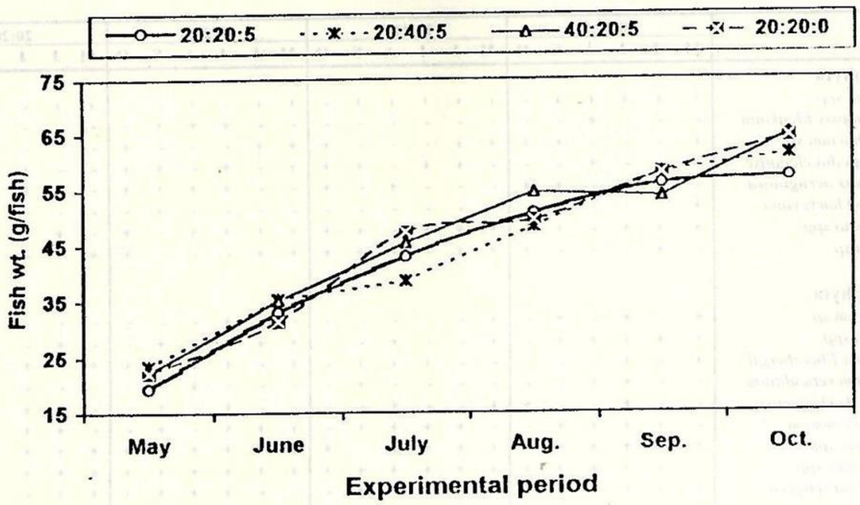

Fig. 1. Average weight of *O.niloticus* under the effect of inorganic fertilizers with different N:P:K ratios in fishponds.

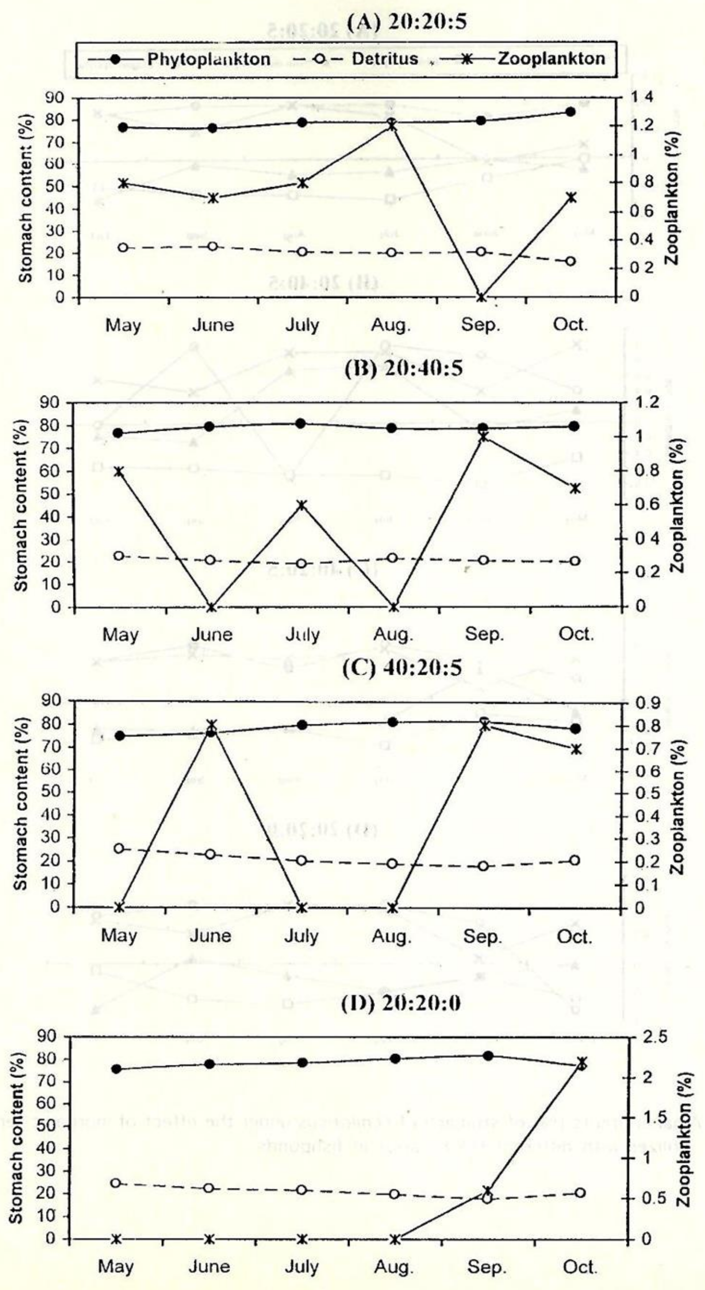

Fig. 2. Stomach contents of *O.niloticus* under the effect of inorganic fertilizer with different N:P:K ratios in fishponds.

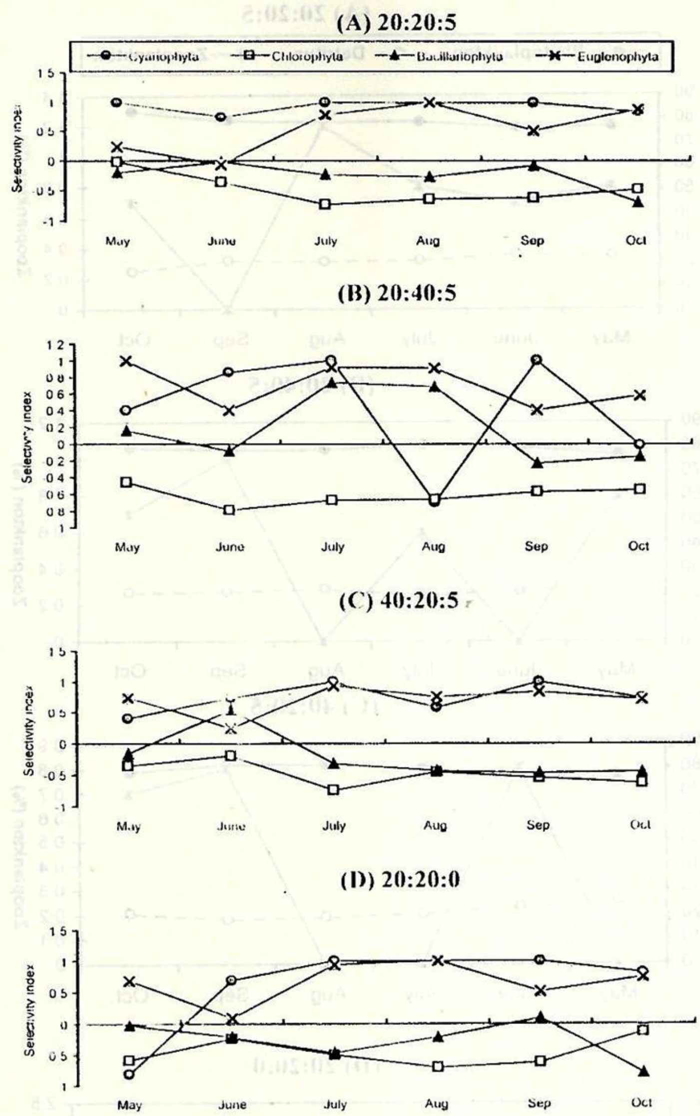

Fig. 3. Algal contents (%) of stomach of *O.niloticus* under the effect of inorganic fertilizer with different N:P:K ratios in fishponds.

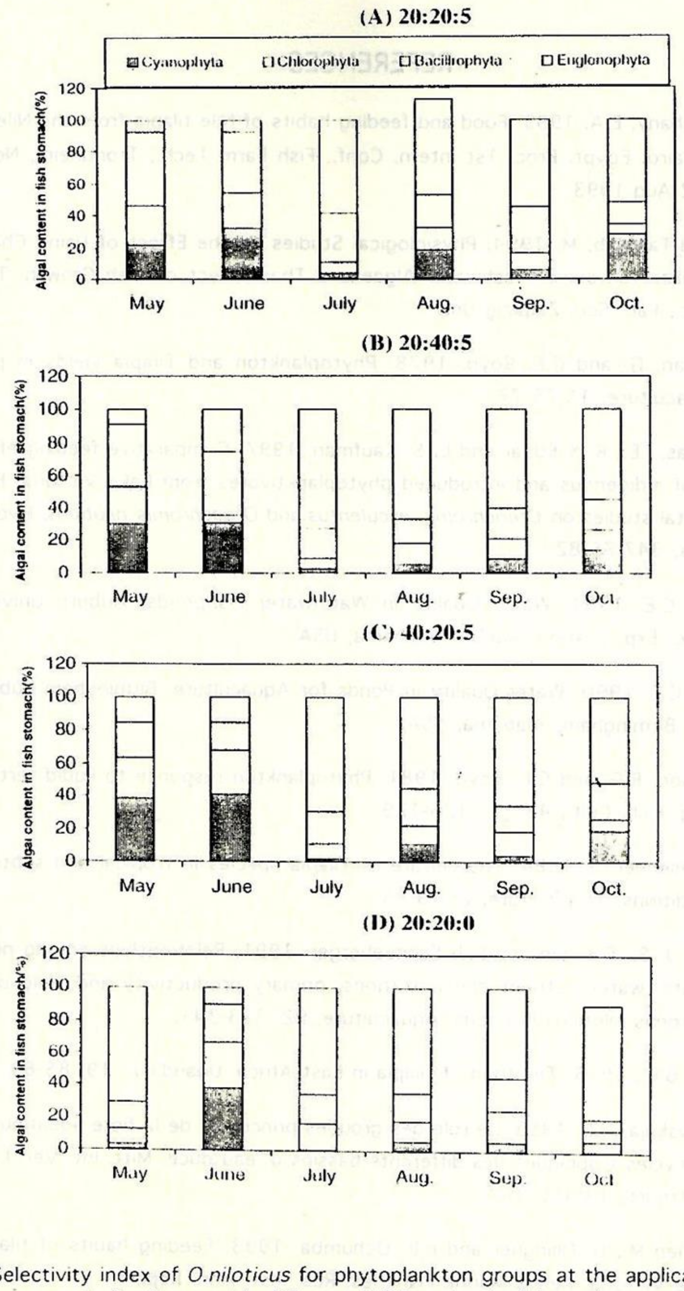

Fig. 4. Selectivity index of *O.niloticus* for phytoplankton groups at the application of inorganic fertilizers with different N:P:K ratios in fishponds.

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العادات الغذائية للبلطي النيلي *Oreochromis niloticus* تحت تأثير التسميد الغير العضوي بنسب مختلفة من N:P:K في الأحواض السمكية

محسن عبد التواب

المعمل المركزي لبحوث الثروة السمكية بالعباسة - مركز البحوث الزراعية - وزارة الزراعة - الجيزة - مصر.

أجرى هذا البحث بغرض دراسة العادات الغذائية للبلطي النيلي *O.niloticus* تحت تأثير التسميد الغير العضوي بنسب مختلفة من النيتروجين والفوسفور والبوتاسيوم (٢٠ / ٢٠ / ٥ ، ٢٠ / ٤٠ / ٥ ، ٤٠ / ٢٠ / ٥ ، ٢٠ / ٢٠ / ٠) في الأحواض السمكية الترابية.

أظهرت نتائج فحص المحتوي الغذائي لمعدات سمك البلطي النيلي أنه يتغذي بشكل رئيسي علي الهائمات النباتية (الفيتوبلانكتون) ثم المواد العضوية المتحللة (detritus) بينما كانت الهائمات الحيوانية (الزووبلانكتون) قليلة ولاتزيد عن ١,٥٪ من المحتوي الكلي لمعدات السمك التي فحصت طوال فترة التجربة.

كانت أهم الأجناس الطحلبية المتواجدة في معدات السمك هي *Anabaena, Merismopedia Microcystis, Oscillatoria, Spirulina* وهي تتبع الطحالب الخضراء المزرقة والأجناس *Pandorina, Pediastrum, Scenedesmus, Chlorella, Amphora, Gyrosigma, Melosira,* وهي تتبع الطحالب الخضراء والأجناس *Amphora, Gyrosigma, Melosira, Navicula, Nitzschia, Pinnularia, Synedra* وهي تتبع الدياتومات والأجناس *Euglena Phacus,* وهي تتبع الطحالب اليوجلينية.

أظهرت النتائج أيضا أن سمك البلطي النيلي له القدرة علي اختيار غذائه حيث أنه اختار الطحالب الخضراء المزرقة والطحالب اليوجلينية طوال فترة التجربة بينما اختار الدياتومات أحيانا ولم يختر الطحالب الخضراء مطلقا.