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Population structure and catch per unit effort (CPUE) in the main stream, Damietta and Rosetta branches of the River Nile, Egypt

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Abstract

This paper presents fluctuations in the fish distributions and Catch Per Unit Effort (CPUE) in the main stream, Rosetta and Damietta Branches of the River Nile, Egypt during the period from April 2008 till May 2009. The main fishing gears and methods which were used in the Nile River are Trammel net, Gill nets, Traps and Long-lines. Average values of CPUE for gill net was lower than trammel net in the three areas of investigation. Damietta Branch is more productive for trammel net and basket traps. Totally 29 species belonging to 13 fish families along the River have been recorded .Fluctuations in the occurrence of the different species in the three studied sites were observed. Fish biodiversity of Rosetta and Damietta Branches was lower than that of the main stream of the River Nile. The Tilapias (especially *O. niloticus*) formed the mainstay of the fishery in the main stream and Rosetta Branch, whereas, *T. zillii* is the most abundant species in Damietta Branch. Recommendations for proper management of these selected sectors were recorded in the present study.

Keywords: River Nile, main stream. Rosetta Branch, Damietta Branch, species composition, CPUE

1. Introduction

The Nile extends for about 950 km from Aswan High Dam to Cairo. It is divided into two branches, the Rosetta Branch and the Damietta Branch each branch is about 200 km in length (Raslan and Abdelbary, 2001).The Nile is considered as one of the major sources of fish production in Egypt, since it constitutes 26.23 % of the total fish production of natural sources in Egypt (GAFRD, 2008). Fish are considered among the most important sources of animal protein due to rapid growth of its population in Egypt (Mohamed, 2005).

Fish biodiversity is essential for stabilization of ecosystem; protection of overall environmental quality for understanding intrinsic worth of all species on the earth (Ehrlich and Wilson, 1991).Fish biodiversity of a river essentially represents the fish faunal diversity and their abundance. River Nile conserves a rich variety of fish species which supports the commercial fisheries (Shinde *et al*., 2009). Catch Per Unit Effort (CPUE) is a useful index in the assessment of abundance of fish species (Gulland, 1975). The previous studies concerning with the fish distribution in the Nile River in Egypt were El- Sedafy and Kheir , 1990; Bishai and Khalil, 1997.

The present study attempts to update informations on the distribution of fish species of River Nile occurring in Egypt, and also calculate catch per unit effort (CPUE) of the most common gears in the River.

2. Materials and methods

The samples were collected from different localities of River Nile extended from Aswan to Shoubra El-Kheima as well as different sites in each Damietta and Rosetta Branches Figure 1.

Seasonal field trips were carried out, starting from April 2008 to May 2009. Fishing boats are non-motorized with two paddles boats, ranged from 4.5 to 6.0 meter in length. Fish specimens were obtained from fishers who used a wide range of fishing gears .The main fishing gears along the River Nile were, trammel net (Ghazle Mebattak, Shebak El-Dakka or El-Mehair or El- Dabba, gill net, basket traps (Gawabi) and hooks & line (Sennar). Trammel net is the most prominent gears in the three sampling sites, with mesh bar size of inner layer usually ranged from 2.4- 2.8 & 2.6- 3 and 1.7- 4.1 cm in Rosetta, Damietta and main Nile stream, respectively.

Fish were identified and sorted to species, according to Boulenger, 1907; Bishai and Khalil, 1997; then measured to the nearest mm and weighed to the nearest gram.

Catch per unit effort (CPUE) was calculated in the selected areas as the catch in Kg of fish per 50 m length of a net per unit of time(a day) as recommended by El-Haweet *et al*. (2008). For the catch of Gawabi, and the catch per 100 hooks were used to indicate CPUE per unit of time (a day).

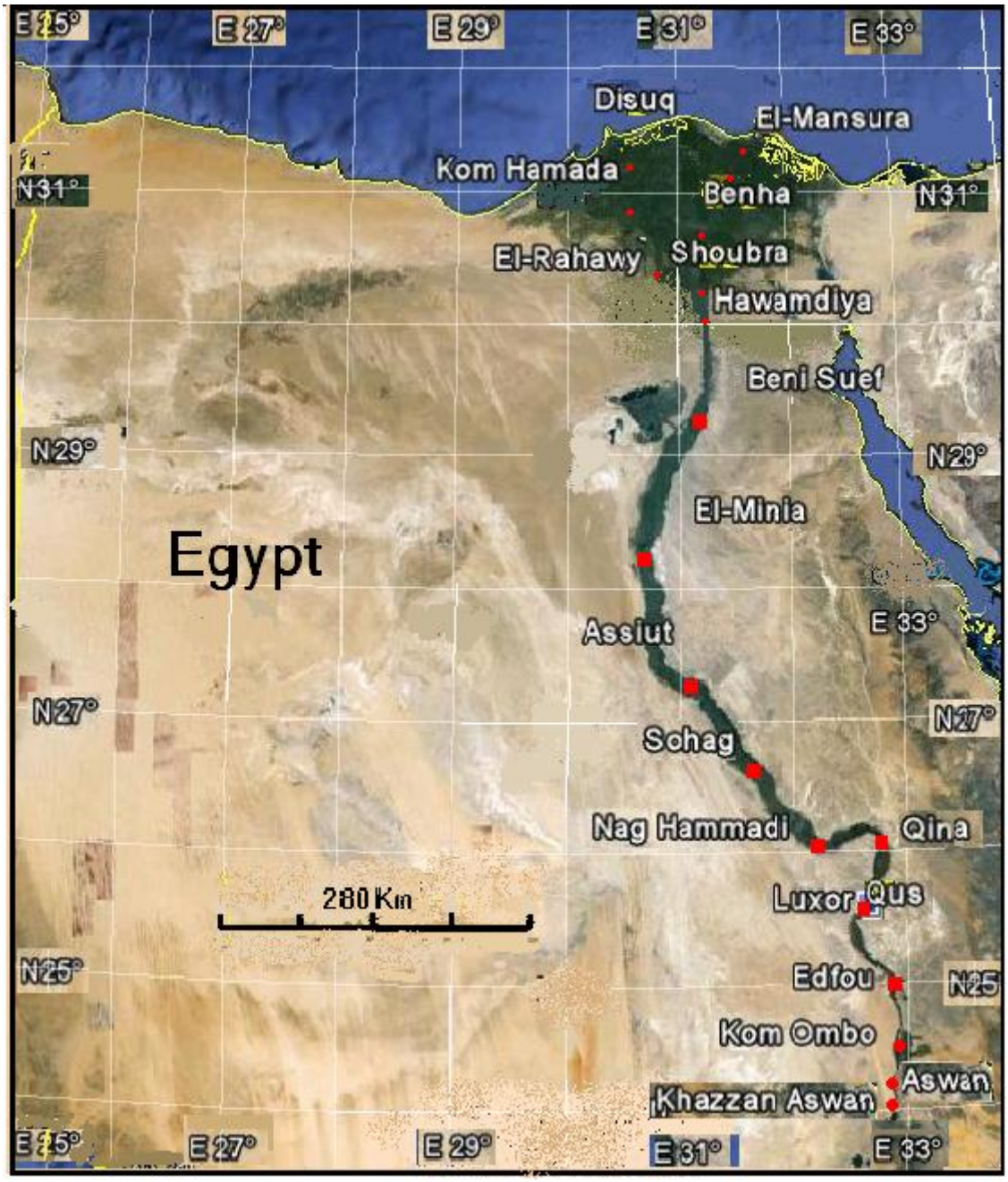

Figure 1. Egyptian River Nile, showing the samples collection sites.

3. Results

3.1. Catch Per Unit Effort (CPUE)

Mean annual values of CPUE were shown in Table 1. Generally, average values of CPUE for gill net was lower than trammel net in the three sampling areas. Damietta Branch is more productive for trammel net and basket traps, the common used methods, (CPUE= 7.24 kg/50 m net /day and 7.2 Kg/ 50 baskets, respectively) than the other two localities. Hooks and lines catch were only recorded in the main stream, with 2.19 kg/ 100 hooks.

3.2. Fish families and species in the River Nile (the two branches and the main stream)

At least 13 fish families and 29 species along the River have been detected in the present study. Fish species list and local names are mentioned in Table 2.

Table 1. Average annual CPUE [Kg / 50 m net (or 50 baskets or 100 hooks) / day] of different fishing gears in the main stream, Rosetta and Damietta branches of the River Nile (2008- 2009).

Methods	Main stream	Rosetta Branch	Damietta Branch
Trammel net	2.49	5.89	7.24
Gill net	1.64	4.29	5.54
Basket traps	0.62	3.2	7.2
Hooks and lines	2.19	-	-

3.3. Species composition

High fish variability was detected in the catch composition of the main stream during the investigated period, and was represented by four cichlid species namely; *Oreochromis niloticus, Oreochromis aureus, Tilapia zillii, Sarotherodon galilaeus* together with, *Lates niloticus, Clarias gariepinus, Synodontis clarias , Shelba (Eutropius) niloticus, Mormyrus kannume, Ctenopharyngodon idella (C&V),*and others (*Barbus bynni, Chrysichthys auratus, Bagarus bayad, Haplochromis bloyeti, Hydrocynus forskalii* and *Atherina boyeri*), were represented in the catch, Figure 2.

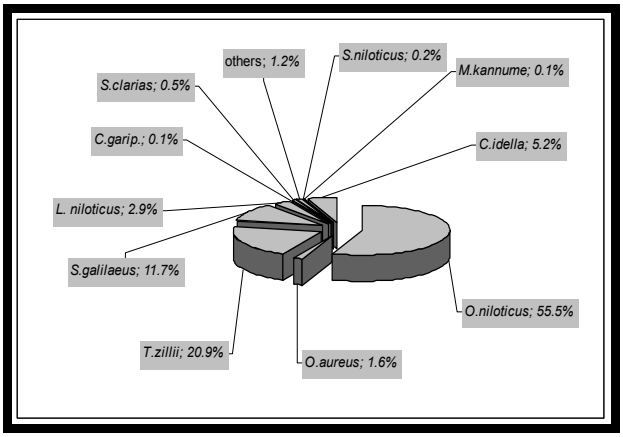

Figure 2. Species composition in the main stream of River Nile (2008- 2009).

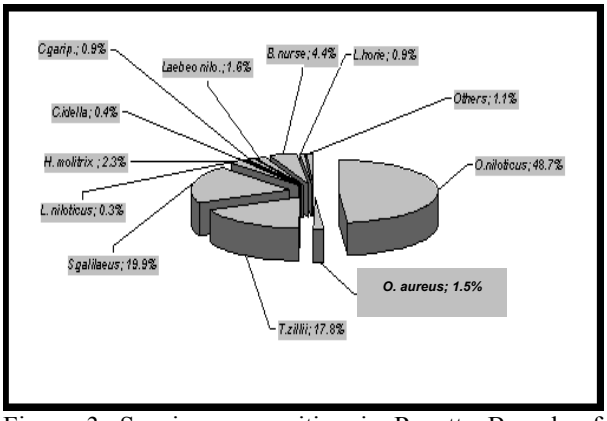

Figure 3. Species composition in Rosetta Branch of River Nile (2008- 2009)

Table 2. Chick list of identified fish species in the River Nile (main stream, Rosetta and Damietta Branches) during 2008- 2009.

* Family / Species	Local name
* Alestiidae	
Alestes baremoze	Ray Moloha
Brycinus nurse	Sardina Norase
* Atherinidae	
Atherina boyeri	Basaria
* Bagridae	
Bagrus bajad	Bayad Baqar
Bagrus docmak	Baqar Dokmak
Chrysichthys auratus	Abu-Ryalah Feddy(Zommir)
*Centropomidae	
Lates niloticus	Kesher Bayad(Shamuth)
* Characidae	
Hydrocynus forskalii	Kalb El- Bahr
*Cichlidae	
Oreochromis aureus	Bolti Hassani(Azraa)
Oreochromis niloticus	Bolti Nilii
Sarotherdon galilaeus	Bolti Galily
Tilapia zillii	Bolti Akhdar
Haplochromis bloyeti	Haplochromis kisim
Hemichromis bimaculatus	Hemichromis mekhatat
* Clariidae	
Claries gariepinus	Karmout Lazera
* Cyprinidae	
Labeo niloticus	Lebees Abyad Nilii
Labeo horie	Lebees Aswad Horii
Labeo forskallii	Lebees Hagary
Ctenopharyngodon idella	Mabrouk Hashaaesh
Hypophthaimichthys molitrix	Mabrouk feddy
Cyprinus carpio	Mabrouk Aady
Barbus bynni	Benny Aseel
* Malapteruridae	
Malapterurus electricus	El-Raade- El- Raash
* Mochokidae	
Synodontis schall	
Synodontis claries	Karkor Shall- Shelane
* Mormyridae	Karkor Karmout
Mormyrus kannume	
Mormyrus(pollimyrus) isidori	Annoma(Bowiza)
* Mugilidae	Annoma Isidori
Liza ramada	Tobara
* Schilbeidae	
Eutroplus(Shilbe) niloticus	Shilba Nilii

O. niloticus was the most frequent species in the main stream constituting more than the half of the total catch (55.5 %) followed by *T. zillii* (20.9 %), and *S. galilaeus* (11.7%). *C. idella* and *L. niloticus* followed the catch of cichlid species in the main stream constituting 5.2 and 3.0 %, of the total catch, respectively, Figure 2.

In Rosetta Branch, species variations were represented by *O. niloticus, O. aureus, T. zillii, S. galilaeus*, *L. niloticus, C. gariepinus, Labeo niloticus, Labeo horie* , *Hypophthaimichthys molitrix , Brycinus nurse* and others (*B. bynni, B. bayad, H. bloyeti, Hemichromis bimaculatus)*. Figure 3 showed that*, O. niloticus* was also the most frequent species in Rosetta Branch, represented by 48.7 % of the total catch, followed by *S. galilaeus* (19.9%) and *T. zillii* (17.8%).

The most abundant species in Damietta Branch was *T. zillii* (35.2%), followed by *O. niloticus* and *S.*

galilaeus which formed 28.4 and 27.2% of the total catch respectively Figure 4.

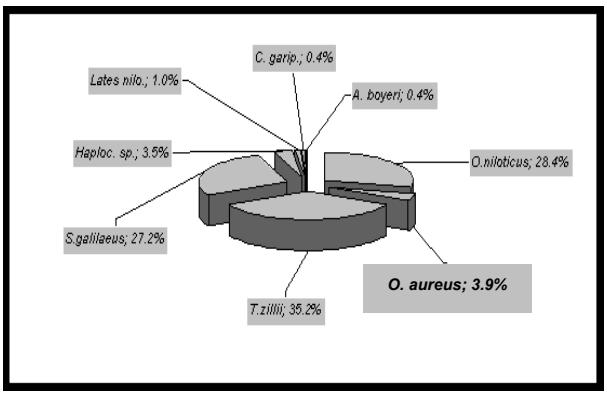

Figure 4: Species composition in Damietta Branch of River Nile (2008- 2009)

Regarding to the seasonal fluctuation of species composition in the three studied sites of the main River, it was detected that, fluctuations in the occurrence of the different species during different seasons could be detected. *O. niloticus* constituted the main frequent species in the main stream, since it is represented by 45.09 % during spring, by more than the half of the total catch during summer (60.8%), autumn(58.7 %) and winter 52.4%), as shown in Figure 5. The maximum catch of *Lates niloticus* in the main stream was observed during summer season (13.2%).

In Rosetta Branch, *O. niloticus* was the most abundant species during summer and autumn, representing 52.4 and 54.1% of the total catch, respectively whereas, *T. zillii* and *S. galilaeus* were the most frequent species during spring and winter seasons (48.1 and 44.9% respectively), Figure 6.

O. niloticus constitutes the most represented species in summer and winter seasons (39.6 and 75.9 %, respectively) in Damietta Branch, whereas, *O. aureus* dominated in spring (35.9 %) and *T. zillii* were the most common species in autumn (53.5), Figure 7.

In general, The Tilapias (especially *O. niloticus*) formed the mainstay of the fishery in the main stream of River Nile and Rosetta Branch, whereas, *T. zillii* was the most abundant species in Damietta Branch.

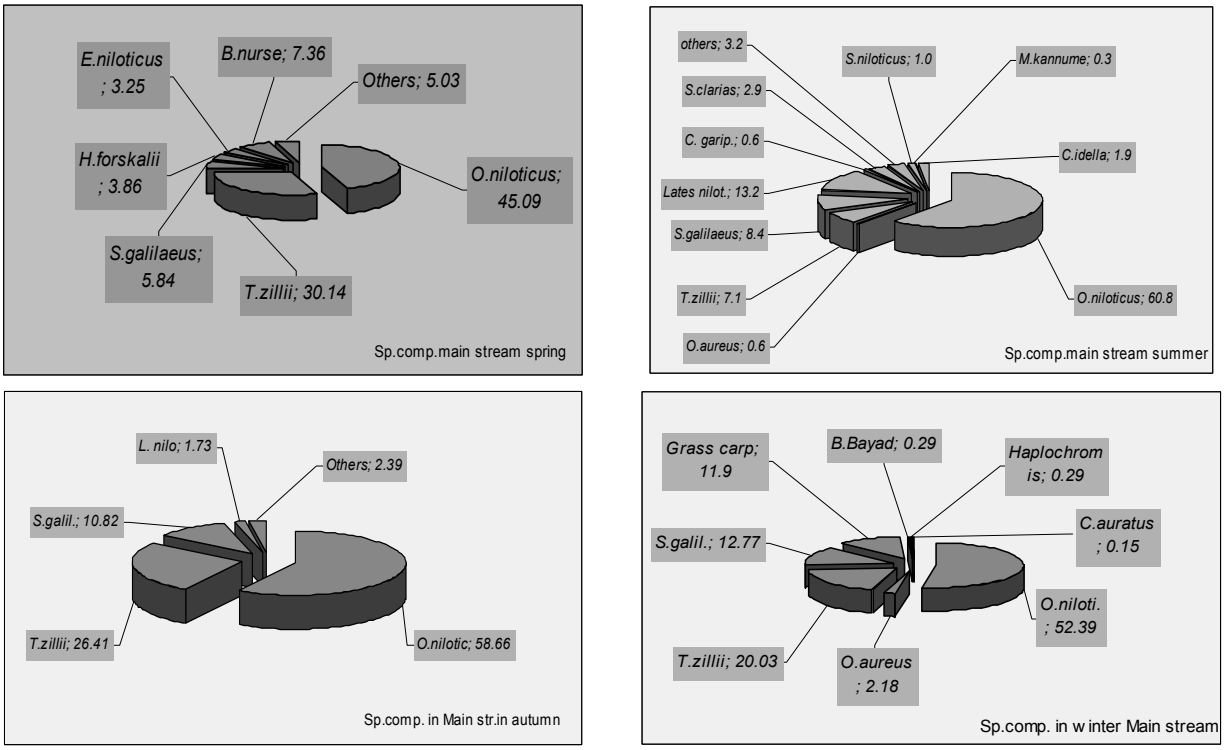

Figure 5. Seasonal variations of species composition in the main stream of River Nile (2008- 2009).

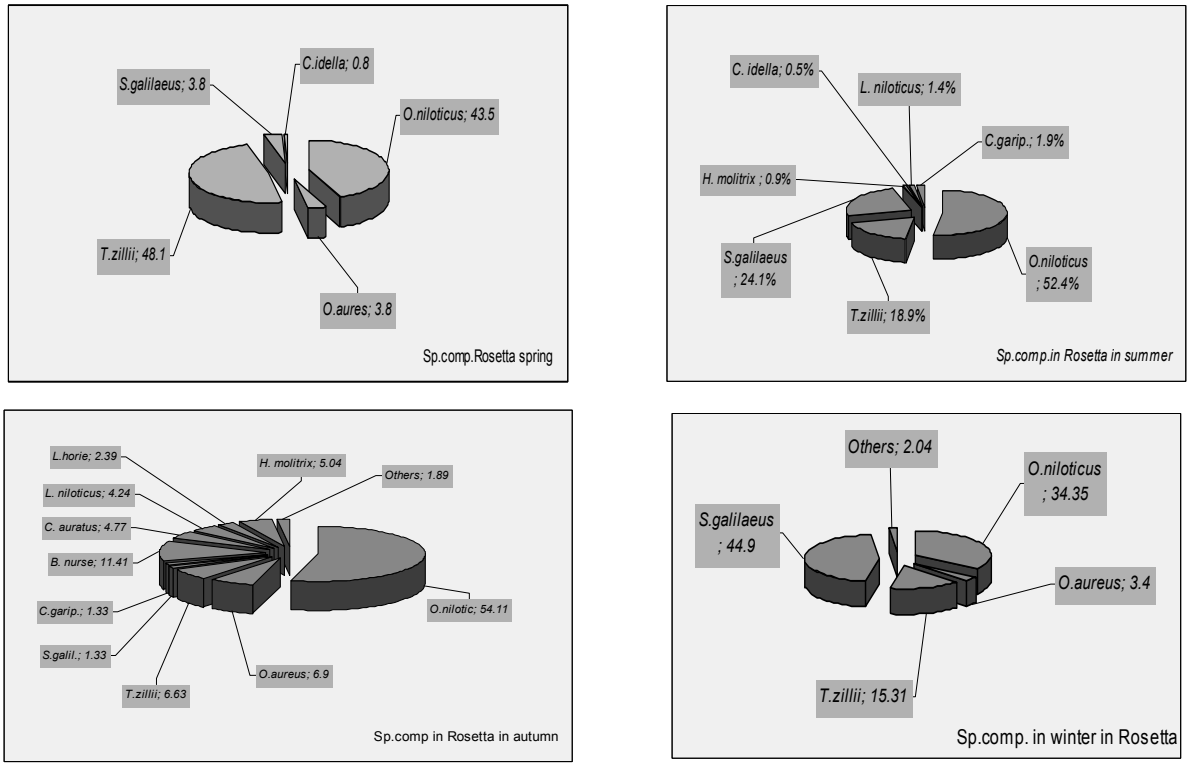

Figure 6. Seasonal variations of species composition in Rosetta Branch of River Nile (2008- 2009).

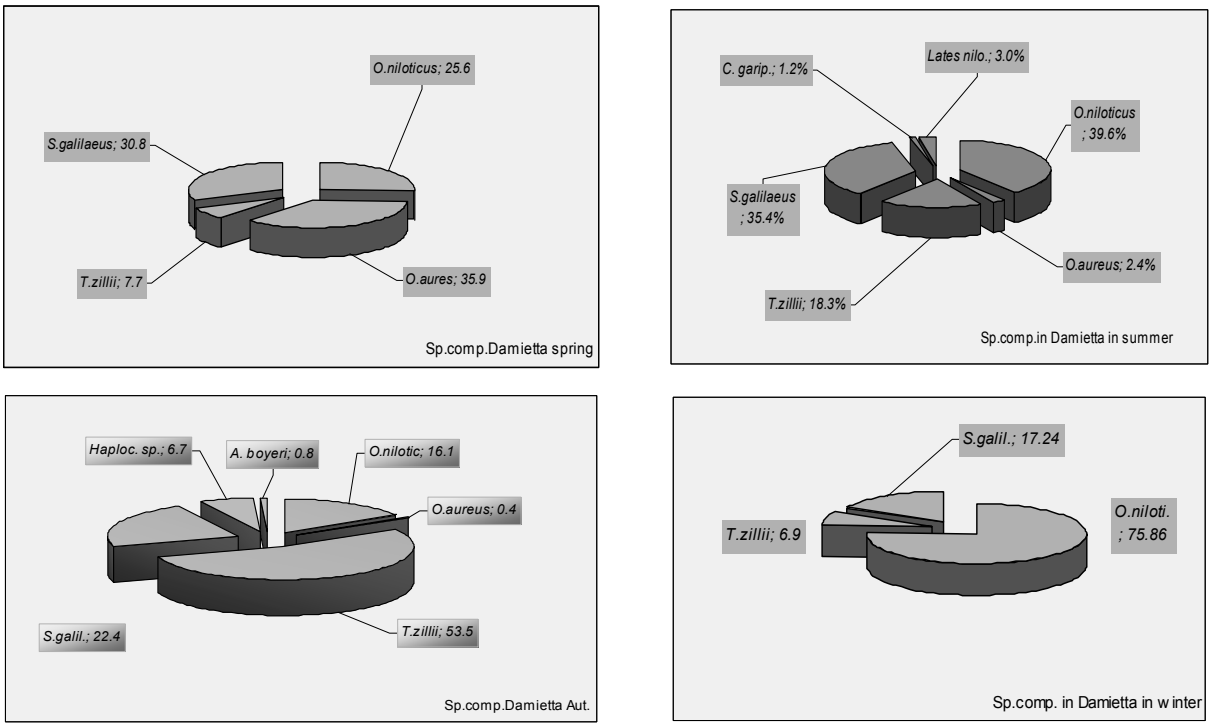

Figure 7. Seasonal variations of species composition in Damietta Branch of River Nile (2008- 2009).

4. Discussion

A Reverian fishery of Egypt comprises the three major River Nile system and their tributaries, canals and irrigation channels. These three major river system namely; main stream, Rosetta and Damietta Branches.

In the present study, catch per unit effort (CPUE) was calculated as the catch in Kg of fish per 50 m length of a net per unit of time (a day) as recommended by El- Haweet *et al*. (2008). Also, effort calculated as the catch per 50 baskets for Gawabi method and the catch per 100 hooks too. Unit time of CPUE in the present study was estimated as a day, because fishing periods in the selected areas were different from day to another rather than from boat to boat in the same fishing method. Abowei (2009) calculated this effort by dividing the total monthly catch by the effort (number of fishers per boat) and finally dividing by the number of hours of fishing giving: CPUE = Total catch ⁄ No. of fishers ⁄ fishing hours & CPUE = Kg ⁄ man ⁄h. (King, 1991).Variations in the mean estimate values of catch per unit effort for the different gears used in the Nile River were observed in the present study, Hence the average values of CPUE for gill net was lower than trammel net in the three areas of investigation. Damietta Branch is more productive for trammel net and basket traps (CPUE= 7.24 kg /50 m net /day and 7.2 Kg/ 50 baskets, respectively) than the other two localities. This may be attributed to the difference in fishing activities along the river, and using illegal meshed sized nets in this branch. El Haweet *et al*. (2008) estimated that, the CPUE for trammel net in the north and south parts of Lake Nasser was 7.08 and 3.99, respectively. Abowei (2009) attributed the reason of the low estimates in the Nkoro River as a result of high mortality of both juveniles and brood stock of various fish species as a result of predatory activities. High species abundance has been indicated along the three selected regions during the present study. Fish variability in Rosetta and Damietta Branches was lower than that of the main stream of the River Nile, even during different seasons. This may be attributed to the differences in depths, current speed and width of these branches. Fish diversity in reservoirs, derived from riverine fishes, is not usually as extensive as in natural lakes. Natural lakes have more stable conditions under which the fishes evolve. This is particularly the case in the evolution of cichlid flocks in the African Great lakes. Riverine species have to live under harsher and more variable conditions. When a reservoir is formed, several of the riverine species do not adapt and either die or move out of the area (Craig, 2005).In the present study, at least 13 fish families and 29 species occurred along the River. We should mention here the disappearance of some species (as *Mugil cephalus, Liza aurata, Anguilla anguilla, Barbus prince*, etc…) that were previously recorded by Bishai and Khalil (1997). Boulenger (1907) recorded 85 species inhabiting the Egyptian Nile waters. Bishai and Khalil (1997) recorded 71 fish species, out of them 22 species were ranked to be common in the commercial catch while 49 were rare and 14 species which were previously recorded by Boulenger (1907) but did not record during their study, and probably disappeared. El- Sedafy and Kheir (1990) recorded that; Egyptian region of the River Nile comprised 31 fish species including only 17 commercial species. The total number of fish species in the Nile drainage Basin including the River Nile, is estimated as more than 800 species. Of these, 128 species belonging to 27 families, occur in the River Nile (Witte *et al.*, 2009) Decline of the recorded fish species in the present study than that previously recorded may be due to increase of pollutants in the river. Several studies revealed that, untreated industrial wastes of more than 350 factories were discharged directly into the Nile, most of them release explicitly known toxic and hazardous chemicals such as detergents, heavy metals and pesticides (RNPD, 1989).The River Nile exposed to many kinds of chemical and biological pollutants in addition to the remains of agricultural wastes and dead animals that are discarded in it. Along its course, the River Nile receives about 37 main drains discharging municipal agricultural and industrial wastewater (Aboul- Ela *et al.,* 1990). According to National Water Research Center (2000) and El- Naggar *et al.* (2009), the River Nile from Aswan to El- Kanater Barrage receives wastewater discharge from 124- point sources, of which 67 are agricultural drains and the remainders are industrial sources. Bishai and Khalil (1997) stated that, many of Nile fish species disappeared, others began to show a marked decline, especially in the downstream areas where water is almost lentic. However, when spawning takes place; the absence of natural nurseries during flood reduced greatly the survival and growth of offsprings. This may be probably one of the most important factors that affected the distribution of riverine fish species that had not been yet adapted to the new ecological conditions of the Nile. Many schools of fish that lived in the waters of the Nile in Egypt during the flood season have been reduced or disappeared since the construction of the Aswan High Dam. Most of the fish species of the Nile were migrants, and the dam has prevented many from migrating to Lake Nasser. The diminution in the number of anchovies in the eastern Mediterranean has also been attributed to the serious reduction in the outflow of waterborne nutrients due to the dam. Lake Nasser, however, has been developed into a commercial fishery, where the Nile perch and other species thrive (Karyabwite, 2000).

The Tilapias (especially *O. niloticus*) formed the mainstay of the fishery in the main stream and Rosetta Branch, whereas, *T. zillii* is the most abundant species in Damietta Branch. This may be due to food availability in the Nile and successful reproduction.

The maximum catch of *Lates niloticus* in the main stream was observed in summer season (13.2

%).George (1971) recorded that, the highest occurrence of *L. niloticus* was in July and August.

Regarding to the seasonal fluctuations of species composition in the three branches of River Nile, it was noted that, fluctuations in the occurrence of the different species during different seasons have been indicated. This may be attributed to the water level changes due to the degree of annual flood (Bishai *et al*., 2000) , changes in environmental conditions, and different methods of catching. More extensive fishing experiments during a prolonged period would be necessary to establish the pattern of occurrence of the commercial species and plan their proper management of their fisheries. Many varieties of fish are found in the Nile system. Notable among those found in the lower Nile system are the Nile perch, cichlid spp., the barbel, several species of catfish, the elephant-snout fish, and the tiger fish, or water leopard. Most of these species and the sardine like *Haplochromis*, the lungfish, and mud-fish are found as far upstream as Lake Victoria. The common eel penetrates as far south as Khartoum and the spiny eel is found in Lake Victoria (Karyabwite, 2000). Factors affecting fish distribution and abundance have already been reported by different workers. Availability of food, spawning rates, breeding grounds, presence of current, vegetation, depth of water and low predation have been suggested as a major factors affecting the distribution and abundance of various fish(Ita, 1987; Abowei, 2009).

In conclusion, to manage of River Nile fishery, the present study recommends more extensive fishing experiments during a prolonged period would be necessary to establish the pattern of occurrence of the commercial species and plan proper management. The protection of water against pollution can be achieved better through control of pollution. Treatment of sewage water before entrance the River Nile to protect fish and human from the deleterious effects of pollution, since the present study recorded the disappearance of some species that were previously recorded. This may be attributed to the increase of pollutant in the River. Also, more ecological and chemical studies must be carried out to detect the reason of species diversity that recorded along the River, even for the same species during different seasons. Traditional fishing gears are replaced by modern methods, and use of research scientific boats for following and detecting species diversity and site of stock periodically along the river. A well co-ordinate information (integrated planning) system is needed to help the planner and decision makers to make proper fisheries management and water quality assessment.

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التـركيب النوعي للأسماك وجهـد الصيد فى المجرى الرئيسي وفرعي رشيد ودمياط ـ نـهر النيل ـ مصر

كريمان أحمد شوقى شلوف ـ علاء محمود الفار

المعهد القومى لعلوم البحار والمصايد

يستعرض هذا البحث التغيرات التى تحدث فى التركيب النوعى لمصيد المجرى الرئيسى وفرعى رشيد ودمياط- نهر النيل- مصر تم جمع العينات موسميا فى الفترة من ابريل2008 وحتى مايو 2009 وذلك بواسطة شباك التلعبك و الشباك الخيشومية والجوابى(الفخاخ) والسنار، حيث تم حساب جهد الصيد لهذه الطرق المستخدمة فى تلك المناطق على أساس وزن المصيد من هذه الاسماك بالكجم / 50 مترا من الشباك / يوم ، وتم حسابه على أنه وزن المصيد بالكجم / 50 سلة من الجوابى . دلت النتائج على أن هذا الجهد للشباك الخيشومية والتلعبك يحقق أعلى إنتاجية فى فرع دمياط عنه فى المجرى الرئيسى وفرع رشيد.وقد سجلت الدراسة وجود 29 نوعا من الأسماك تنتمي إلى 13 عائلة. سجل المجرى الرئيسى تنوعا فى الأسماك أكثر من الفرعين. وجد أن البلطى النيلى هو الدعامة الأساسية لمصيد الأسماك فى المجرى الرئيسى وفرع رشيد، بينما كان البلطى الأخضر يشكل أعلى نسبة فى كم مصيد فرع دمياط . وقد أوصت الدراسة بضرورة معالجة مياه الصرف الصحي قبل صبها فى نهر النيل لحماية الأسماك والإنسان من تأثير تدهور التلوث ، حيث سجلت هذه الدراسة اختفاء بعض الأنواع التي سجلت من قبل ،والتى قد يكون من أهم أسبابها زيادة الملوثات في نهر النيل. أيضا ، لا بد من إجراء المزيد من الدراسات البيئية والكيميائية إلى الكشف عن سبب تنوع الأنواع التي سجلت على طول نهر النيل ، حتى بالنسبة لنفس النوع خلال المواسم المختلفة ، كذا نوصى بإستبدال معدات الصيد التقليدية بالطرق الحديثة ووجود تنسيق متكامل بين صانعى القرار للتخطيط المتكامل من أجل إدارة وتنمية مصائد الأسماك فى نهر النيل.