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ECOLOGICAL AND FISHERIES MANAGEMENT OF EDKU LAKE 6. EXPERIMENTAL STUDY ON THE EFFECT OF FISHING WITH SEINE NETON FISHPOPULATION AT EDKU LAKE

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ABSTRACT

Seine net is one of the illegal fishing methods widely used at Edku Lake. Experimental fishing with seine net having stretched mesh sizes of 2.88cm, 3.65cm and 4.28cm were used at Edku Lake during the period from November 1999 to March 2001.

***Oreochromis aureus** and **Sarotherodon galilaeus** dominated the catch of seine net during summer and winter. **Clarias lazera** was the most dominant species during spring.*

It was found that the average lengths of the tilapia fish caught by seine net were around 10.0cm or even less with an average weight around 20.0gm. This means that most of the fish caught were undersized and unmarketable.

It is possible to conclude that fishing with seine net adversely affects the breeding cycle of the fish species living at the lake. Most of the fish are caught before attaining the length at first maturity. On the other hand the adults of the males and females are caught while carrying out the parental care and aeration of their eggs in the nests.

It is strongly recommended to prevent fishing with seine net at Edku Lake. This will lead to the increase of the annual fish production of the Lake.

INTRODUCTION

The northern delta lakes of Egypt contribute significantly in the annual fish production of Egypt. These lakes provide with more than 50% of such annual production.

Edku Lake which locates about 40km to the east of Alexandria has been considered to be one of the most productive lakes in the world (Salah, 1960).

The fish production of Edku Lake covers most of the needs of fish for the human populations living at Alexandria and Behira provinces.

One of the most serious factors which adversely affect the development of fish production in Edku Lake is the use of illegal fishing gears and methods.

Seine net fishing in spite of its illegality is used on a wide scale at Edku Lake for fishing various fish species specially ***Oreochromis aureus, oreochromis niloricus, Tilapia Zillii*** and ***Sarotherodon galilaeus***. These are considered as the main species at the lake.

It is attempted in the present investigation to indicate the effect of the seine net fishing on the fish populations living at Edku Lake.

The present investigation will therefore contribute in suggesting the recommendations that may be required for any further fisheries management in Edku Lake.

This study is a part of the first phase of the research plan of the fisheries division belonging to National Institute of Oceanography and fisheries which is suspected to duarte for (3) years. The aim of this plan is to develop the fisheries in the northern delta lakes of Egypt namely Manzalah, Borollus, Edku and Maruit.

Seine net:

The seine nets without bags and the seine net with bag are both used in fresh water fishing. Different types and shapes are used in the Northern delta lakes of Egypt to catch the various species of Tilapia and cat fish specially ***Clarias lazera***.

The seine net is considered as the second common fishing gear at Edku Lake next to trammel net. The head rope of the net is 15.0m long while the foot rope is only 10.0m in length. The depth of the net is 15.0m as shown in Fig. (1) (After Alsayes and Soliman, 1992). To keep the seine net in a vertical position lead weights are attached to the lower edge of the net (lead line). In some cases floats are arranged on the upper ropes otherwise bambo stalks are used to hang and keep the net in vertical position.

The seine net used in Edku Lake usually consists of two parts, the larger meshed part which is used to seine the catch while the second part which consists of narrow meshed webbing is used to retain the catch before collection. The part of the net having wider meshes is manufactured of multifilament nylon twines Td 210/9 while the other part which is used to retain the catch is manufactured from nylon twines Td 210/6.

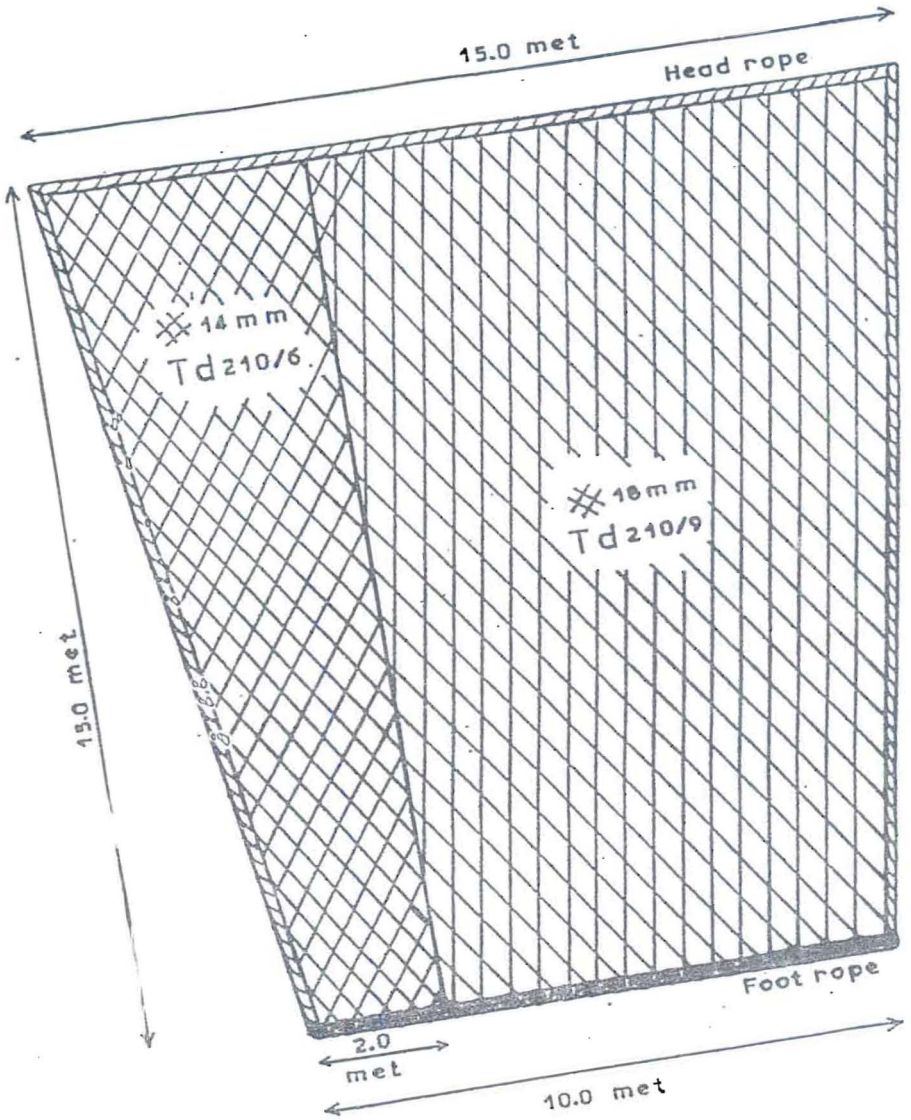

Fig.(1): Design characters of Seine net used in Lake Edku.

Fishing with seine net is carried out at Edku Lake at the shallow areas where intensive growth of aquatic plants may be occurring. Fishing operations are done according to one of the following methods.

(1) Large parts of the aquatic plants are collected, fixed in shallow area of the lake and left for a period which may extend for six months. In such a case Tilapia and cat fish are attracted for sheltering and moving between such plants. The fishing operation starts by setting the seine net around the plants while bambo stalks are used to fix the net surrounding the plants. When seining is completed a number of the fishermen ranging from 6 to 10 persons start cutting the plants and removing it outside the seined area. The ends of the net are hauled slowly for trapping the collected fish in a narrow portion of the net. The catch is then removed from the net to the boat. The duration of this operation ranges from 3 to 6 hours.

(2) The second way of operating the sine net is carried out while two well trained fishermen go around and beat the water with bambo stalk while observing the movement of fish towards the aquatic plants. Once considerable number of fish are collected in the plants, fishing such fish starts by seining the plants with the net and following the same steps as described in the above method.

Experimental fishing with seine net:

Experimental fishing operations were carried out at Edku Lake during the period from Nov. 1999 to March 2001. Three seine nets with different mesh sizes were used during the course of the present study. The mesh sizes of the pats used as bags of these nets were mesh (L) = 2.88cm, mesh (M) = 3.65cm and mesh (N) = 4.28cm stretched measure.

Six fishing localities were chosen at Edku Lake to represent the whole fishing area of the lake as shown in Fig. (2). The fishing operations were carried out two times weekly. Each operation was durating for about 12 hours starting at 3.0 a.m. and end by about 3.0 p.m. The number of fishing operations does not differ either from one locality to another or from one net to another to give equal chances for all the fish lengths of the population to be caught. Professional fishermen working at Edku Lake were hired to carry out the experimental operations.

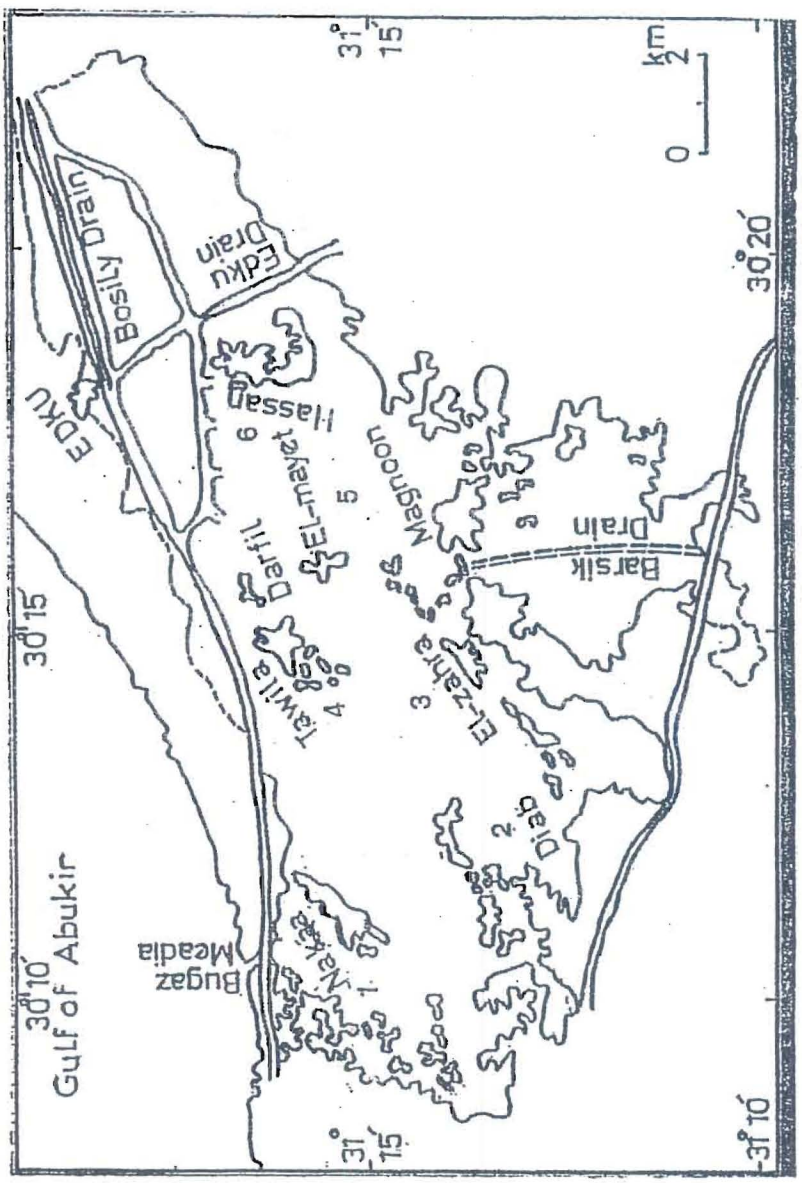

Fig.(2): The location map of sampling stations in Lake -Edku

Results and discussion

A. Species composition of the experimental catch of seine net:

The weights of each of the various fish species caught by the experimental seine nets from Edku Lake during the four seasons of the year 2000 are given in table (1) and graphically represented in Fig. (3).

Table 1: Weight of experimental catch taken by seine net from Edku Lake.

Species	Weight of catch (kg)				Total catch
	Winter	Spring	Summer	Autumn	
O.niloticus	2.390 (8.59)	12.120 (20.070)	5.050 (8.80)	3.720 (3.01)	23.280 (8.65)
O.auraus	10.980 (39.48)	18.650 (30.88)	10.00 (17.43)	35.200 (28.50)	74.830 (27.81)
T.zillii	3.625 (13.03)	9.500 (15.73)	2.200 (3.84)	16.850 (13.64)	32.175 (11.96)
S.galilaeus	7.100 (25.53)	0.450 (0.75)	21.100 (36.78)	61.500 (49.79)	90.150 (33.50)
c.lazera	3.500 (12.58)	19.250 (31.88)	2.110 (3.68)	6.250 (5.06)	31.11 (11.56)
B.bayad	0.220 (0.80)	0.420 (0.70)	10.900 (29.46)	—	17.54 (6.52)
Total	27.815	60.39	57.36	123.52	269.085

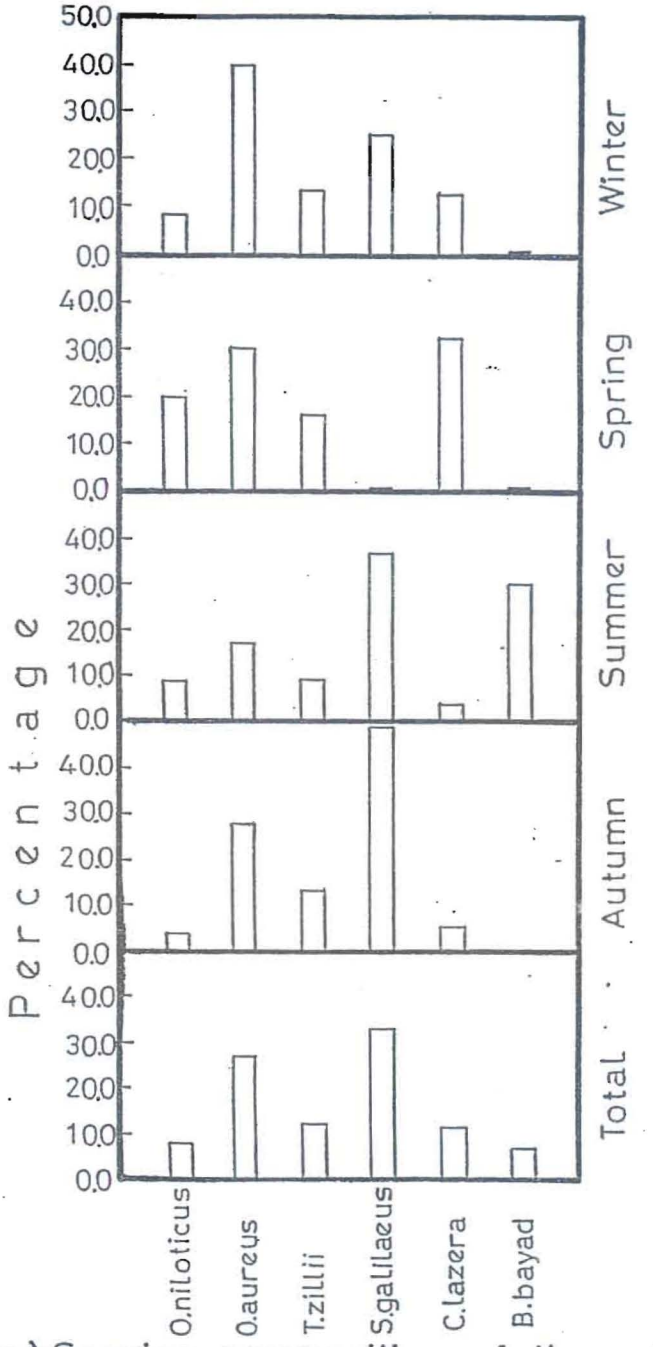

Fig.(3): Species composition of the catch of seine net.

It can be indicated from the data given in table (1) that:

(1) ***Oreochromis aureus*** comprised the highest percentage of the catch during winter while ***Sarotherodon galilaeus*** constituted the highest percentages during summer and autumn and ***Clarias lazera*** attained such highest percentage during spring.

(2) ***Bagrus bayad*** dominated the catch of seine net during summer comprising 29.46% of the catch next to ***S. galilaeus*** which comprised 36.72% of such catch.

(3) ***S. galilaeus*** comprised the maximum percentage of the catch during the whole season constituting 33.10% of the whole catch followed by ***O. aureus and T. zillii*** comprising 27.81% and 11.91% of the total catch respectively.

(4) The four Tilapia fish species namely ***O. aureus, O. nioticus, T. zillii*** and ***S. galilaeus*** totally comprised 81.92% of the total catch taken by seine nets during the whole period of the year.

It can be pointed out therefore that the cichlid fish species were dominating the catch of seine net where the fishing operations were carried out at the shallow areas around the aquatic plants. This can be attributed to the movement of these fish species towards the aquatic plants during their spawning activity to shelter between these plants.

In this concern Shaheen and Youssef (1979) pointed out that ***Tilapia*** fish move to the shallow water areas of the lakes near their shores where the aquatic plants grow intensively.

Imam and Hashem (1960) indicated that the feeding and spawning habits of *Tilapia zillii* directed this fish species to move to the shallow areas which are characterised by condensed growth of the aquatic plants.

It can be pointed also that the movement of Tilapia fish to the areas of the lake rich with these plants can be attributed to its feeding preference near the plant.

The obvious contribution of *clarias lozera* with high percentage comprising 31.88% by weight of the catch of seine net during spring can be attributed to the breeding behavior of this fish species which move to the very shallow areas to spawn between or even over the plants in the areas where the water depth does not exceed 30cm.

Alsayes (1976) pointed out that ***Clarias lazera*** comprised more than 25% of the experimental catch taken by trammel nets having different mesh sizes at Borollus Lake during the spring season. He attributed the high contribution of ***C. lazera*** in the catch to the obvious activity and frequent movement of this fish species around the aquatic plants during its breeding months.

On the other hand ***Bagrus bayad*** was caught with high percentage (29.46%) of the weight of the total catch taken by seine net during summer. The appearance of this

species with such high percentage during summer may be due to its movement towards the lake through the discharge of high rates of agricultural waste water to the lake.

B. Size composition and 50% retention length of fish caught by different meshes of seine net:

The length distributions of ***Orechromis aureus, Tilaapia zillii*** and ***Sarotherodon galilaeus*** caught by various meshes of seine net from Edku Lake are indicated in table (2), (3) and (4) respectively. The average lengths and standard deviations of these distributions are calculated and given in these tables.

Table 2 : Length distribution of *Oreochromis aureus* caught by various meshes of seine net.

Laugh (cm)	Number of fish caught		
	L = 2.88 cm	M = 3.65cm	N = 4.28cm
6.5	2	1	
7.5	32	26	134
8.5	201	189	220
9.5	233	265	302
10.5	105	386	448
11.5	41	275	352
12.5	19	176	259
13.5	9	80	122
14.5	1	45	22
15.5		14	9
16.5	1		
17.5		1	
18.5		1	
Total number of fish caught	644	1459	1868
Average length (cm)	9.53	10.78	10.62
Standard deviation	1.249	1.664	1.704

Table 3 : Length distribution of *Tilapia zillii* caught by various meshes of seine net.

Laugh (cm)	Number of fish caught		
	L = 2.88 cm	M = 3.65 cm	N = 4.28 cm
6.5	3	1	
7.5	34	25	59
8.5	94	64	153
9.5	68	196	289
10.5	43	235	278
11.5	29	146	120
12.5	3	54	82
13.5	3	25	38
14.5		7	13
15.5		6	5
16.5			1
17.5		1	
Total number of fish caught	277	760	1038
Average length (cm)	9.32	10.48	10.22
Standard deviation	1.322	1.448	1.556

Table 4 : Length distribution of *Sarotherodon galilaeus* caught by various meshes of seine net.

Laugh (cm)	Number of fish caught		
	L = 2.88 cm	M = 3.65 cm	N = 4.28 cm
5.5		1	
6.5	8	9	5
7.5	68	54	100
8.5	88	134	153
9.5	61	189	256
10.5	19	116	227
11.5	15	82	148
12.5	32	43	69
13.5	38	20	44
14.5	20	26	49
15.5	17	32	62
16.5	3	20	71
17.5		17	54
18.5		19	29
19.5		9	7
20.5		2	2
21.5		1	
Total number of fish caught	369	774	1276
Average length (cm)	10.24	10.93	11.41
Standard deviation	2.588	2.945	3.038

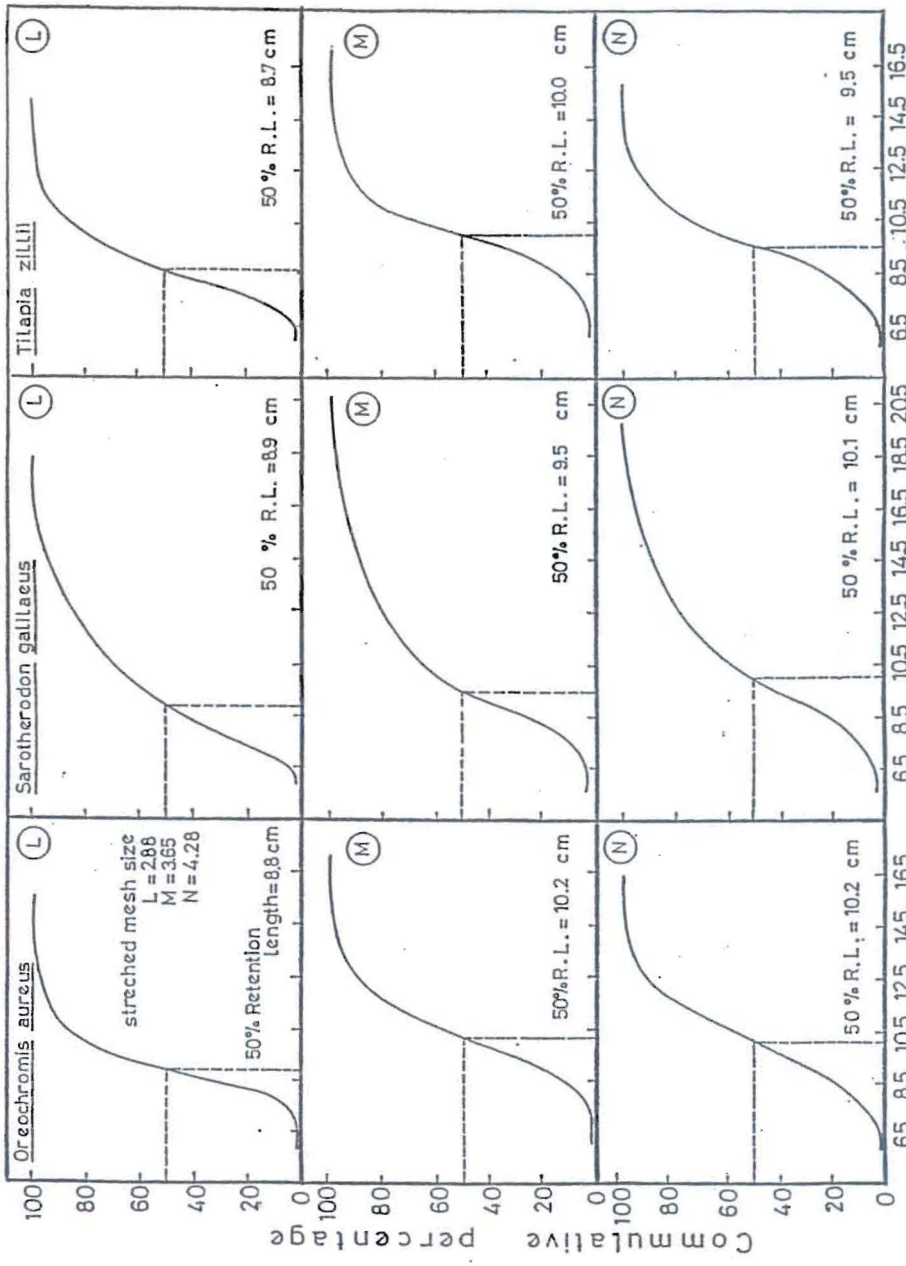

Fig.(4): Percentages retention lengths of fish species caught by different meshes of seine nets.

The length range of fish caught by seine net through out the present investigation was in general a wide range. In case of ***S. galilaeus*** the length range lied between 5.5cm and 21.5cm for those fish caught by mesh (M). As for ***O. aureus*** the same net unit (M) was able to catch fish within a length range laying between 6.5cm and 18.5cm. This may indicate the fact that seine net is not selective by length for fish and was able to collect all the sizes of fish moving around or sheltering among the surrounded hydrophytes. It can be observed also from the data given in tables 2, 3 and 4 that the average lengths of fish caught by the various meshes of seine net did not differ very much from one mesh to another. The levels of significance of the differences between the average lengths of fish caught by the three meshes of seine net used were calculated by applying the test of significance (t) test. The values of (t) as well as the levels of significance are given in table (5). It can be believed from the data given in this table that the differences between the average lengths of fish caught by the three meshes of seine net (L, M and N) were not significant at high levels. This means that the seine net is not sharply selective in catching Tilapia fish. Such non selection behavior of the meshes used may be attributed to their narrowness, therefore it does not allow any of the seined fish to escape.On the other hand the 50% retention lengths of ***O. aureus, T. zollii, S. galilaeus and O. niloticus***. caught by the three meshes L,M and N are calculated as shown in Fig. (4) and (5) and tabulated in table (6). These calculated lengths indicate that in all cases the smallest fish were caught by mesh (L) as the narrowest meshes of such not did not allow these smallest fish to escape. It can be pointed out also that the differences between the 50% lengths of fish caught by the meshes (M) and (N) did not vary signifantly.

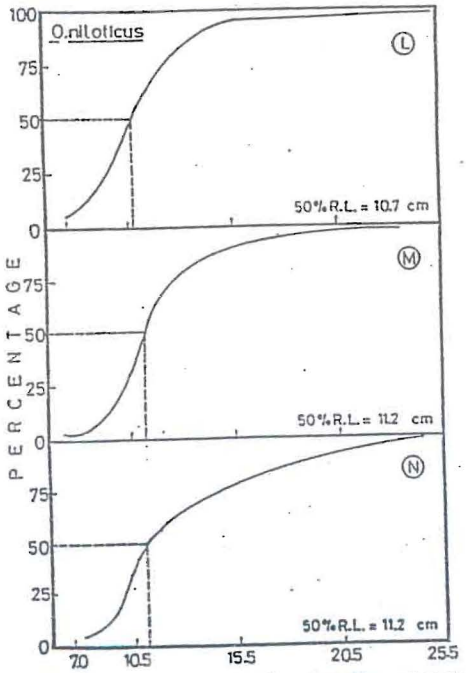

Fig.(5):Percentages retention lengths of O.niloticus caught by various meshes.

Table 5 : Length distribution of *Oreochromis niloticus* caught by various meshes of seine net.

Laugh (cm)	Number of fish caught		
	L = 2.88 cm	M = 3.65 cm	N = 4.28 cm
7.5		4	
8.5		5	2
9.5	8	26	48
10.5	47	51	97
11.5	21	76	69
12.5	17	47	29
13.5	11	20	16
14.5	9	10	28
15.5	2	14	12
16.5		5	12
17.5	1	4	15
18.5	1	4	23
19.5		4	18
20.5	1	3	7
21.5		2	4
22.5			3
23.5	1	1	4
24.5		1	2
25.5	1		1
26.5			
27.5			
28.5			1
29.5		1	
30.5			
31.5	1		
Total number of fish caught	121	278	391
Average length (cm)	12.15	12.36	13.26
Standard deviation	3.038	2.883	3.747

Table 6 : (t) values and levels of significance of the differences between average lengths of the fish caught by various meshes of seine net

Species	Averages compared	Value of (t)	Level of significance
O. aureus	L and M	2.009	≥ 0.90
	L and M	1.652	≥ 0.90
	L and M	0.054	≤ 0.50
T. zillii	L and M	1.815	≥ 0.90
	L and M	1.289	≥ 0.50
	L and M	0.288	≤ 0.50
S. galilaeus	L and M	0.652	≥ 0.50
	L and M	1.074	≥ 0.50
	L and M	0.460	≥ 0.50

Table 7 : 50% retention lengths of fish caught by various meshes of seine net

Species	50% retention length (cm) of net:		
	L (2.88)	M (3.65)	N (4.28)
O. aureus	8.8	8.9	8.7
T. zillii	10.5	9.5	10.0
S. galilaeus	10.2	10.1	9.5
O. niloticus	10.7	11.2	11.2

C. Effects of seine net fishing on fish populations at Edku Lake

(1) Effect on annual fish production:

It is indicated from the data given in table (6) that the 50% retention lengths of *O. auteus, T. zillii and S. galilaeus* caught by various meshes of seine net are in most of the cases about 10.0cm or less with the exception of *O. niloticus* which is caught at about 12.0cm Talaat and Abdulla (2001) described the relationship between length and weight of the various species of Tilapia as follows:

$W = 0.01702.$	$L^{3.03264}$	for	*O. niloticus*
$W = 0.03260.$	$L^{2.75284}$	for	*O. aureus*
$W = 0.04005.$	$L^{2.687754}$	for	*T. zillii*
$W = 0.01727.$	$L^{3.04138}$	for	*S. galilaeus*

This means that the average weights of fish at a length of 10.0cm are:
18.5gm for *O. aureus*
19.5gm for *T. zillii*
19.0gm for *S. galilaeus*
31.8gm for *O. niloticus* at 12.0cm average length

It appears therefore that seine net catch the four fish species before passing their stage of rapid growth. In this concern El-Zarka *et al* (1970) and Alsayes (1976) recommended that the management of Tilapia fishery must be based on the criterion of gaining extra weight and that the fish must be caught with an average length of 15.0cm. The average weights of fish in such a case will be

62.76gm	for	*O. niloticus*
56.35gm	for	*O. aureus*
57.99gm	for	*T. zillii*
65.20gm	for	*S. galilaeus*

On the other hand, Talaat and Abdulla (2001) used the yield estimates to determine the minimum appropriate age and subsequently the size which might be retained by the fishing gears to gain the optimum exploitation of fish stock. They indicated that the harvest should start at age of 3.2 years for *O. niloticus*, 3.3 years for *S. galilaeus* and 3.4 years for both *O. aureus* and *T. Zillii*. These ages correspond to the size of 15.0cm, 14.0cm, 17.5cm and 18.0cm for *O. aureus*, *T. zillii*, *S. galilaeus* and *O. niloticus* respectively.If this is approached the annual fish production of Edku Lake is expected to increase or even may be doubled if fishing with seine net is stopped.

(2) Effect of seine net fishing on the spawning process of fish in the lake:

The length at first maturity of the various species of Tilpia living in inland Egyptian water has been studied by various authors.

Elester and Jensen (1960) pointed out that the smallest ripening for the female of *O. niloticus* at the Nazha Hydrodrome was observed at 15.0cm length while the smallest ripe male was found at 17.0cm. The same authors indicated also that both sexes of *T. zillii* attained their first maturity at a length of 7.0cm and perhaps below this length at Nozha Hydrodrome. El-Zarka (1962) carried out a study on the breeding process of *T. zillii* at lake Qarum indicated that the minimum length for mature males was 4.0cm while for females it was 5.0cm. Fish as young as zero group were found to be sexually mature. But the first spawning actually took place during the second year of life (scales having one annulus). It is obvious therefore that *O. niloticus* is caught with seine net having average lengths below the length at first maturity which means that before carrying out the spawning process.

This with no doubt drastically affects the breeding cycle of *O. niloticus* at the lake. Although *T. zillii* is caught by seine net having average size larger than the size at first maturity, it spawning activity is believed to be affected as a result of seine net fishing in the lake if the spawning behavior is taken in consideration . El-Zarka (1958) in his study on the breeding behavior of *T. zillii* pointed out that this fish species is nest builder. Building of the nests is only a stimulus for the spawning activity. The male and female of *T. zillii* stay to guard over their eggs and at the same time the female fans the eggs with its fins.Imam and Shaheen (1960) described the spawning process of *T. zillii* as substratum process. They emphasized that the aeration of the eggs prevents their fungal infection. Such eggs aeration as well as protection of the larvae until they become able to live free are carried out by the adults and are considered as parental care.

Therefore it is very important for the breeding grounds of *T. zillii* to be protected during the spawning season. El-Zarka (1962) found that the maximum spawning activity of *T. zillii* was during July and August where nearly all fish living at lake Qarun were in ripe conditions. In October ripe fish of both males and females were nearly absent. Therefore *T. zillii* can be considered as prolonged spawning fish. El-Bolock and Koura (1960) in their study on the spawning activities of *T. zillii* at the experimental ponds of a fish farm, found that the ripe females and males of *T. zillii* appeared for the first time in April while all males and 61% of the females were ripe in September. As for the spawning season of *O. niloticus* Elester and Jeusen (1960) showed that this fish species started to spawn from the second half of May until the first half of July at the Nozha Hydrodrome.

They also found that the gonads of *T. zillii* were highly developed during the period from the first of June to 18th of August. It can be indicated therefore that fishing with seine net in Edku Lake adversely affects the spawning process of the various species of cichlid fish either by catching the females before carrying out their spawning activity as it is the case in *O. niloticus* or through the destruction of their nests and preventing them from carrying out the parental care and aerating their eggs as it is the case of *T.zillii*. It is to be indicated also that the noise that may result from the random

movements of the fishermen while shooting and beating the water while carrying out the fishing operation with seine net disturb and frighten the adult fish and move them away from their laid eggs. On the other hand many of the fishermen fined it a chance to dive under the collected aquatic plants to catch the males and females of fish by their hands preventing them from aerating their eggs or carrying out the parental care.
It appears therefore that the breeding cycle of *Tilapia* fish is drastically affected as a result of using the seine net for commercial fishing on a wide scale at Edku Lake.

(3) Effects of seine net fishing on the transport of fishing boats and sailin in the lake

As mentioned before one of the steps of the fishing operation with seine net is that the fishermen have been used to collect large amounts of the aquatic plants and keep them fixed in the shallow areas of the lake for long periods which may extend for six months. These plants are used for sheltering and collection of fish for breeding during their spawning season. Fishermen working with seine net have been used to utilize extended areas in the open water of the lake for keeping such plants. No others are allowed to carry out fishing operations near these fixed plants.

Therefore large areas of the lake are occupied by those fishermen and allocated for carrying out seine net fishing. This with no doubt creates problems between the fishermen using other methods rather than seine nets such as trammel nets and those fishing with seine net as a result of preventing them from fishing near the occupied area where the plants are fixed.

On the other hand in case the fishing operation with seine net starts and the collected plants are surrounded by setting the net around it, the fishermen remove these plants out of the net circle. The removed plants usually shift away under the action of the winds and spread through wide areas of the lake. This with no doubt prevents the free transport of the fishing boats as well as makes it difficult to use gill or trammel net for fishing in these parts of the lake.

Summary and Conclusion

The present study is carried out with the aim of evaluating the use of seine nets for fishing at Edku Lake as well as investigating to what extent may the fish populations at this lake are affected as a result of the use of this net on wide scale.
The following points can be concluded from the present investigation:

1) ***Oreochromis aureus*** comprised the highest percentage in the catch (39.48%) during winter while ***Sarotherodon galilaeus*** was more dominant comprising 36.78% of the catch during summer and winter. ***Clarias lazera*** constited the highest part 31.88% of the seine net catch during the spring season. However the highest percentage during the whole year was

attained by *S. galilaeus* which contributed with 33.50% of the total catch of seine net.

2) *Bagrus bayad* was caught with high percentage during summer comprising 29.46% of the catch. It is believed that this fish species is transported to the lake with the drainage water during summer season.

3) It can be indicated that seine net is not sharply selective by length for the various fish species caught from the lake.

4) It was found that the average lengths of the *Tilapia* fish caught by seine net were about 10.0cm or less with an average weight of 20gm in most of the cases. This means that before attaining a marketable weight. On the other hand some species such as *O. niloticus* is caught with an average size less than the size at first sexual maturity.

5) Fishing with seine net affects the spawning process of most of the fish species living at the lake as a result of disturbing the parents or even catching them while they carry out the parental car and aerating or guarding the eggs in their nests.

6) The use of seine net for fishing in the lake on a wide scale creates lot of problems between the fishermen as well as preventing the free transport of the fishing boats through the lake.

7) For proper fisheries management in lake Edku and to increase the annual fish yield of the lake it is strongly recommended to stop fishing with seine net in this lake.

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