

***AN ECONOMIC STUDY ON DEVELOPMENT
CONSTRAINTS OF LAKE BARDAWEEL FISHERIES,
Egypt.***

By

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INTRODUCTION

There is an evident contradiction between the availability of natural, human and capital potentials for fishery exploitation in Egypt, and the excessively increasing levels of fish import trade. Growing demand for fish in the Egyptian markets which is due mainly to : 1) increase of population; 2) increase in real incomes; 3) Fish prices increases at a decreasing rate than other animal protein food; and 4) increasing consumption patterns for fishes, reveal the need to increase catch rates from its extensive capture fisheries by effective fisheries management and development so as to achieve national goals for food security in the country in quantitative and qualitative terms and raising per capita fish consumption by the year 2000 to 10 Kg.

Problem and Purpose of Study

The extensive water Fishery resources in Egypt is estimated by about 13.2 Million Feddans (about 5.8 Million Hectare) which is twice as much as the cultivated area of land. Exclusive Economic Zones (EEZ) under the new law of seas (Los) adds greatly to these resources, in addition to availability of human and capital resources in the fishery economy. However, magnitude of fish catch and resultant Catch Per Unite of Effort (CPUE) are too low and incapable to satisfy growing fish demand.

Lake Bardaweel in the north eastern part consider as one of promising capture fisheries in Egypt. It is famous by high quality of its fishes at domestic and foreign markets. The lake is connected to the Mediterranean Sea by three bogazes and it is less polluted than other northern lakes. Regional projects for comprehensive socio-economic development in Sinai can be greatly utilized in developing lake fisheries; which is the concern of the study.

The main objectives of the study are :

- 1- To reveal relative importance of lake Bardaweel fisheries;
- 2- To identify the existing constraints for increasing fish catch from the lake.
- 3- To Forecast fish catch from the lake in the future by main fish species.

MATERIAL AND METHODS

Data and information for the study were gathered mainly from : 1) Year-Book of fish catch and effort issued by Central Agency for Public Mobilisation and Statistics (CAPMAS) 2) Extension bulletins issued by General Authority for Fish Resources Development (GAFRD); 3) Technical reports and studies on the lake fisheries as well as several papers related to the topic of study.

Descriptive economic analysis has been used to achieve the first objective of the study, several economical and statistical indices were calculated to study elements of fishery exploitation and the resultant fish catch from the lake in 1979-93 period.

Exponential smoothing technique has been adopted to forecast magnitude of total fish catch and by main fish species viz: Mullet; Grey Mullet; Gill-head Bream; Sole; Bass Bream; Meagre; Grouper and Crabs. These species constituted about 95% of total fish catch from the lake in 1979-93 period. (Table 1)

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Table (1): Evolution of fish catch from Lake Bardaweel by main fish species (1979-1993).

<i>Items</i>		<i>G.</i>	<i>G.H.</i>		<i>B.</i>	<i>Grouper</i>	<i>Others</i>	<i>Total</i>
<i>Year</i>	<i>Mullet</i>	<i>Mullet</i>	<i>Bream</i>	<i>Soles</i>	<i>Bream</i>			
1979	147	20	720	5	34	22	18	939
1980	353	82	1326	5	-	22	90	1856
1981	658	103	102	15	127	41	1019	2065
1982	667	136	1828	14	90	64	3	2801
1983	477	169	1343	10	77	41	5	2122
1984	734	247	875	12	142	96	3	2109
1985	481	198	1220	13	113	22	4	2051
1986	413	113	1302	24	113	22	6	1971
1987	323	89	787	69	85	22	23	1398
1988	359	175	781	113	85	4	25	1542
1989	195	170	801	139	143	7	145	1600
1990	1409	182	978	135	185	6	98	2761
1991	400	900	759	133	158	22	343	2715
1992	310	80	281	61	57	10	871	1670
1993	1042	249	298	158	60	22	198	2004
Avarage	531.2	182.1	888.3	60.1	97.9	22.3	27	1973.6

Source: Computer Programe TSP.

Brown's one parameter linear model for future forecasting was used as given in the following equation (Makridakis et al, 1983):

$$F_{t+m} = a_t + b_t (m) \quad \text{with smoothing parameter Alfa}$$

where : F_{t+m} is the forecasted value for each of the economic variables under study at time (t) and number of periods ahead to be forecasted (m)

a_t and b_t represent equation parameters as :

$$a_t = 2 S_t' - S_t'' \quad \text{and} \quad b_t = \frac{9}{1-9} (S_t' - S_t'')$$

where, S_t' is the single exponential smoothing value at period t and S_t'' is the double exponential smoothing value at period t.

The values of smoothing parameter alpha ranges from zero to one, the more close the value obtained to zero point, the more best fitted model.

Sum of squared residuals and root mean squared error has been taken into consideration for statistical fitness. Time-Series package (TSP) has been used in data processing (Lilien et al, 1988).

RESULTS

Relative importance of lake Bardaweel Fisheries :

Water surface area of the lake's fisheries is about 167 thousand Feddans (about 73 thousand hectares), it constitutes some 1.2% of total area under exploitation of Egyptian capture fisheries (Marine and inland), and some 31.3% of total area of northern lake fisheries.

Average annual fish catch from the lake over 1979-1993 period was about 1973.6 tons. Yearly catch in the given period was rather close around its average which may reflect stability in the lake fisheries from biological, economical and social points of view. (Table 1).

Catch per unit area of water over the given period was about 11.8Kg/Feddan/year, which is far bellow its comparable productivity in

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northern lakes of Egypt which is about 40-170 Kg/feddan/year in the same period. Over 50% of fish catch from the lake mainly Bream and Sole is exported annually to foreign markets. Barania (1983) stated that low productivity of the lake in physical unit is compensated by high selling prices of its fishes in foreign markets.

Total number of fishermen engaged in the lake's fisheries in 1993 was about 3879 men. It is about 4.5% of total Egyptian fishermen, and about 6.7% of total fishermen in northern lake fisheries (CAPMAS, 1995).

Unit productivity in 1993 was about 516.6 Kg/man which is also far below its comparable productivity in northern lake fisheries in the same year of about (2.1 ton/man.)

Average size of fishermen's family in Bardaweel lake is as high as 6.5 person/family (Anon. 7,) a general case in Egyptian lakes fisheries,. Accordingly total population in the fishing sector in the lake is estimated in 1993 by about 25.2 thousand inhabitants.

Forecasted fish catch from lake Bardaweel fisheries :

Table (2) illustrates forecasted fish catch from lake Bardaweel on annual basis for the period 1993-2000 by main fish species and by total fish catch from the lake.

Mullet :

Catch of Mullet fish is estimated to increase by time (Fig.1), the fish is tolerant to wide range of water salinity Part per thousand (up to 97 ppt). It is forecasted to reach (catch) a level of about 1018.5 tons by 2000. Fishery regulation of bamboo fishing method which is used to tackle Mullet fish is recommended.

Table (2): Forecasted Fish Catch from take Bardaweel by main Fish Species for 1994-2000.

Year	Mullet	G. Mullet	G.H. Bream	Soles	Bass Bream	Grouper	Others	Total
1994	837	365.4	454.9	146.1	113.2	12.5	293.7	2352.8
1995	867	385.6	409.9	155.9	115.4	11.1	297.8	2409.5
1996	897.5	405.8	365	165.9	117.5	9.7	301.9	2466.1
1997	927.7	425.9	320	175.8	119.7	8.3	305.9	2522.8
1998	957.9	446.2	275.1	185.7	121.8	6.9	310	2579.5
1999	988.2	466.3	230.2	195.6	123.9	5.5	314.1	2636.1
2000	1018.4	486.5	185.3	205.5	126.1	4.1	318.2	2692.8

Source: Computer Program TSP.

Gray Mullet :

Catch of Gray Mullet fish is estimated to increase as well by time (Fig.2), the fish is tolerant to wider range of water salinity (up to 123 ppt). The catch is forecasted to increase by 2000 to 486.5 tons the former fishing method is used for Gray Mullet as well.

Gill-Head Bream :

Catch of Gill-Head Bream is estimated to decrease sharply from the lake over time (Fig.3) Forecasted catch by the year 2000 is only 185.3 ton which require certain measurements, firstly to lessen water salinity down to its tolerance level of about 60-75 ppt, and secondly to control mesh-size of trammel nets which is used to tackle bream and also to limit fishing effort by the nets.

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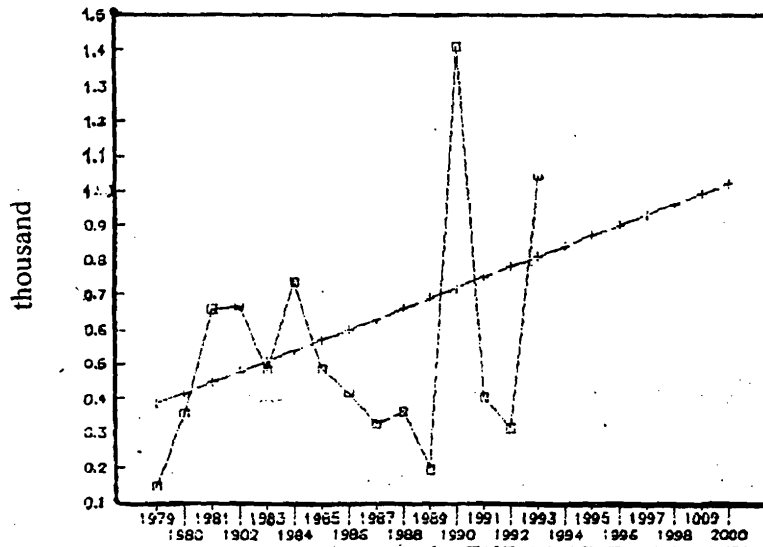


Fig. (1): Secular trend of Mullet catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

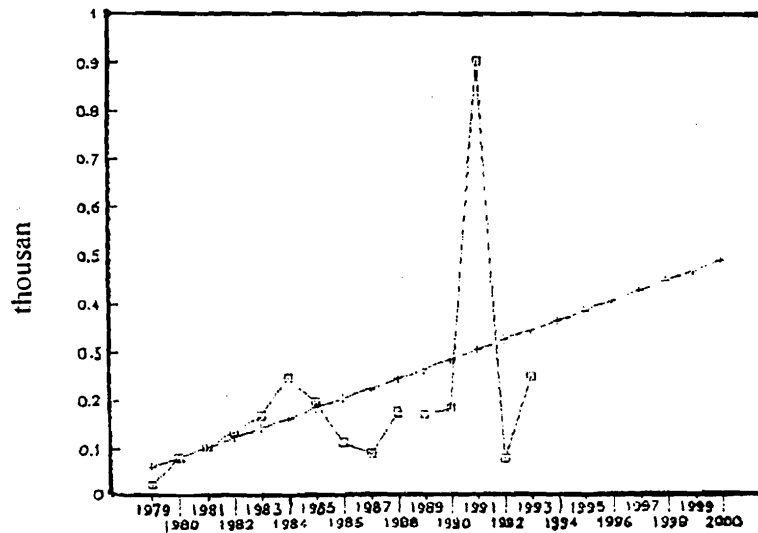


Fig. (2): Secular trend of Grey Mullet catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

Soles :

The catch is estimated to increase by 2000 to 244 tons (Fig. 4). The fish is highly tolerant to any salinity raise, it dwells in shallow muddy bottoms close the lake's margins. Over 75% of sole's catch is taken from fishing area called "Rowak Port".

The fish is tackled by trammel nets as the case with Gill-Head Bream. Hence, it is suggested to limit effort by this net in the main water body of the lake so as to conserve breams and to re-allocate this effort near the lake's margins for soles.

Bass - Bream :

Catch of Bass Bream is estimated to have declining trend over time as well (Fig. 5). Forecasted catch by the year 2000 is only 126 tons, illegal trammel nets fishing operation near bogaz harms greatly nursery grounds of Bass-Bream. So it is suggested to stop fishing operations by this gear in spawning seasons of Bass-Bream by closed area and seasons.

Grouper :

Catch of Grouper is estimated to decrease over time (Fig.6), it is forecasted to drop to 4 tons by 2000. The fish dwells in deeper depths 10-30 fathoms in rocky, muddy or sandy fishing grounds. Traps fishing is suggested in such fishing grounds.

Others :

Others fishes from the lakes fisheries which are not else where included (NEI) are estimated to increase by time (Fig. 7) .It's catch by 2000 is forecasted to raise to 31 tons.

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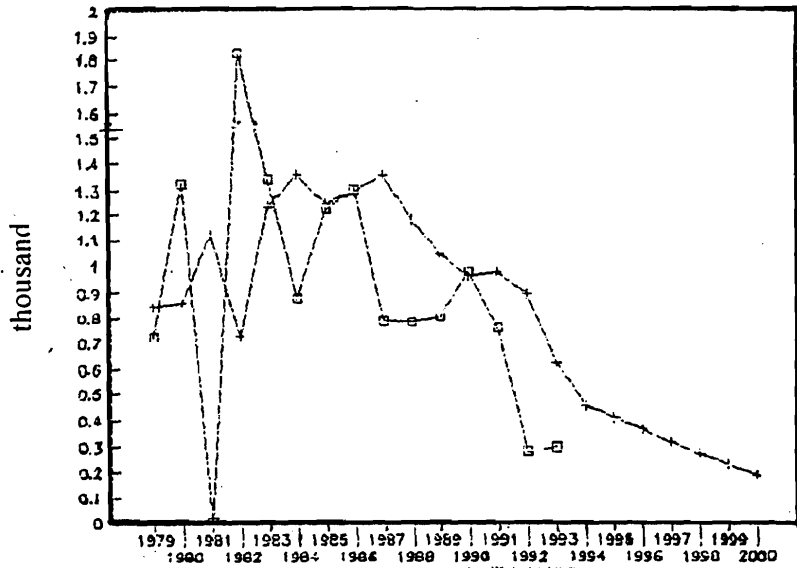


Fig. (3): Secular trend of Gill-Head Bream catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

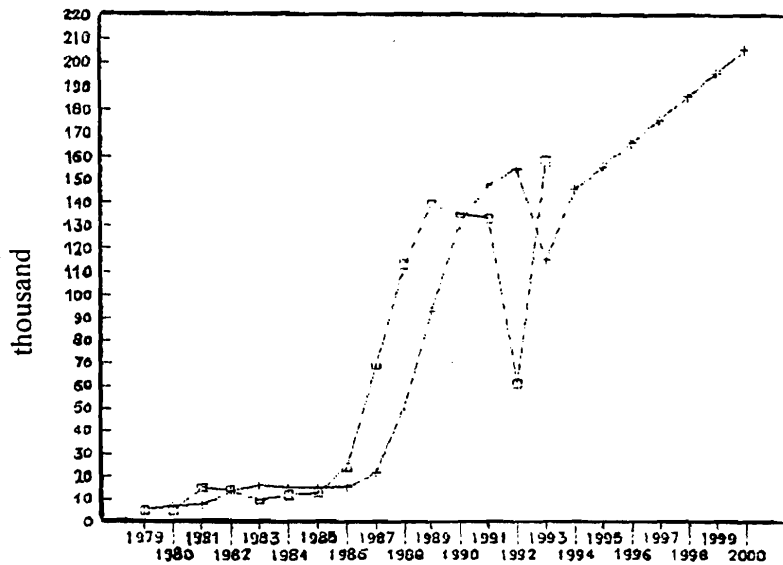


Fig. (4): Secular trend of Soles catch from Lake Baraweel in 1979-93 and smoothing forecasting by the year 2000.

Total fish catch from the lake :

Total fish catch from lake Bardaweel have rather fluctuating trend from year to year over 1962-93 period, an upper level of the catch of about 2.9 thousand tons was recorded in 1962, while lower level of about 0.9 thousand tons was recorded in each of 1971 and 1979. Total fish catch from the lake is estimated to increase over time (Fig. 8), it is forecasted to raise to 2693 tons by 2000.

Existing constraints for increasing fish catch from lake Bardaweel :

Magnitude of fish catch from the lake and productivity of fishing effort was found to be low with respect to other delta lakes of Egypt, the annual fish catch slightly dropped from about 2.9 thousand tons in 1962 to 2.0 thousand tons in 1993, the catch is estimated to increase by time. Apart from fish stock potentials of the lake which is suggested to be investigated for future fishery development and management, it is subjected to the effects of several other non-biological factors which are a bottle neck for its development, in the following part these factors will be reviewed.

- 1- Salinity of the lake's water is rising rapidly for several physical factors affecting the lake ecosystem as evaporation, winds, water temperature, rain fall, and ebb and tide.
- 2- Frequent blockage of the lake's connections to the sea's water.
- 3- Shallowness of the lake, the average water depth in the lake is about 0.5-1.5 meters which speeds up evaporation rates.
- 4- Due to salinity in the lake's water several water plants as *Robia* rotten on lake's bottom and cover ground snails which is a source of feeding for fishes as breams.

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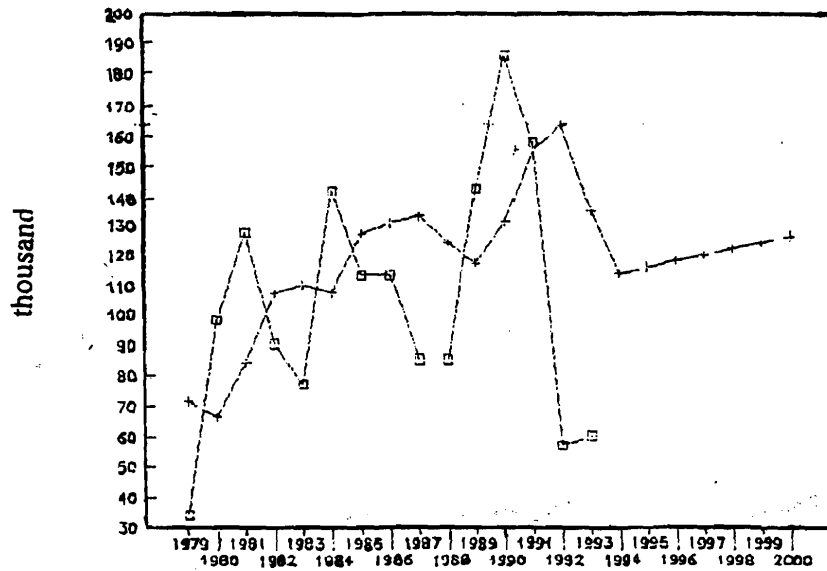


Fig. (5): Secular trend of Bass Bream catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

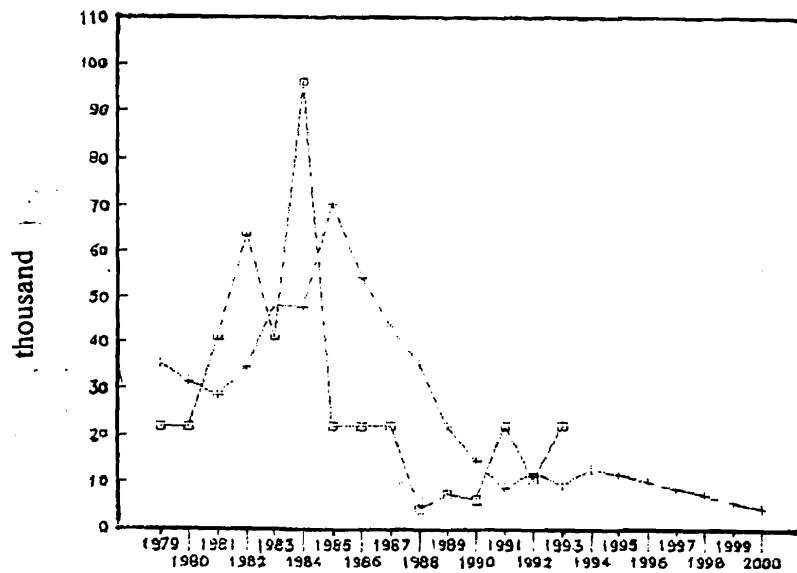


Fig. (6): Secular trend of Grouper catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

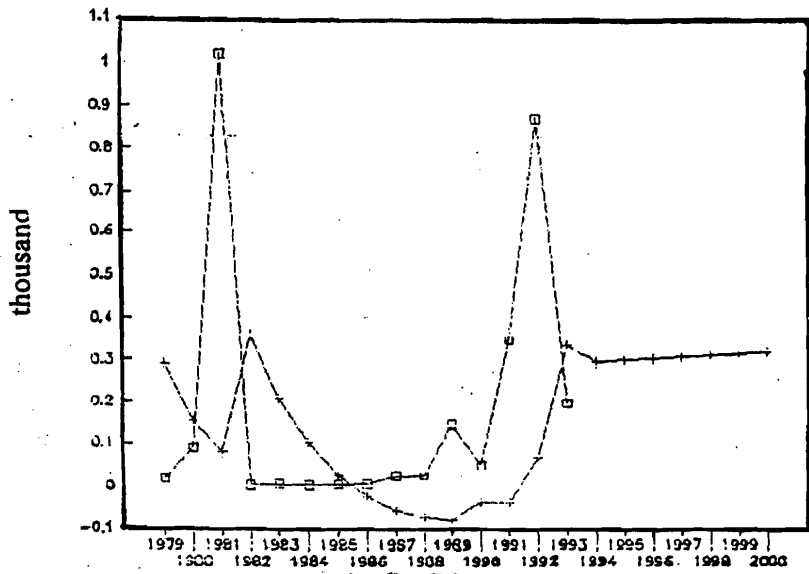


Fig. (7): Secular trend of Other Fish catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

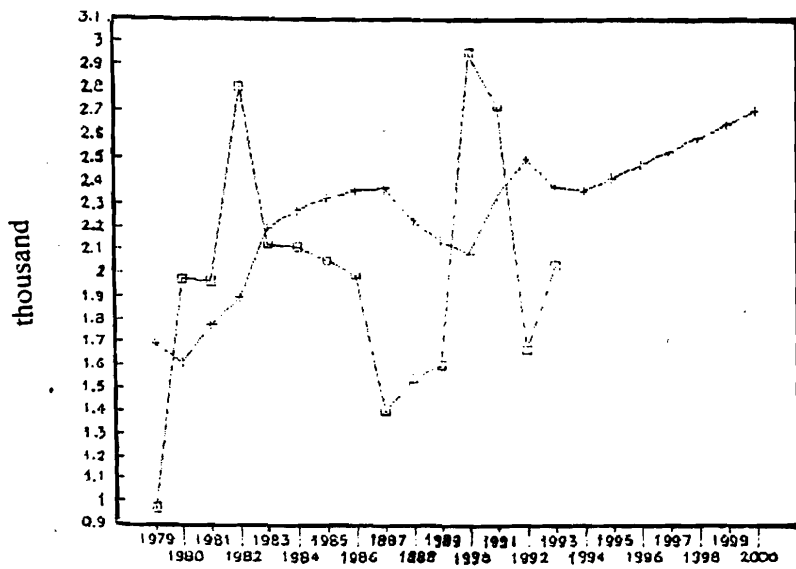


Fig. (8): Secular trend of Total Fish catch from Lake Bardaweel in 1979-93 and smoothing forecasting by the year 2000.

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- 5- Salinity levels are higher in the other secondary lake's connected to the main lake as Rowak and Mallahet EL-Markeb. Salinity rates is generally higher at southern parts of the lake. Perceptive rocks adds greatly to the lake's salinity.
- 6- The lake suffers from shortage of minerals for its primary production of plankton.
- 7- Transportation difficulties at fishermen's settlements.
- 8- Lack of port and auxiliary services facilities at fish landing centers as cold storing, ice factories and work shops for gear and boat repairs.
- 9- Coast guard regulation impose some limitations to fishing operation at the lake.
- 10- Insufficient loan and credit facilities for fishermen.

SUMMARY

Natural, human and Capital economic resources are available at lake Bardaweel fisheries. Likewise It's Fishes are of wide reputation and can be a source for foreign exchange and to promote fishery export trade in the country, especially the lake is less polluted as the case in Delta lakes. Comprehensive Socio-economic plans for developing Sainii can be greatly utilized in developing lake's fisheries.

Results of this study revealed low productivity of unit effort from the lake's fisheries as compared to Delta lake's productivity. Unless the prevailing conditions in the lake's fisheries would be improved, the estimated increase of fish catch from the lakes to the year 2000 will be too modest about 57 tons annually. High quality fish species which is exported to foreign markets is estimated to decrease over the period of study.

From the results of the study it is necessary to regulate fishing method of bamboo which is used to catch mullet for its conservation. For Gill-head Bream it is necessary to control mesh size of trammel nets and to limit fishing effort by this gear in the main water body of the lake and to reallocate the excess effort to catch Soles near the lake's margin. It is also important to apply closed fishing season and closed area for trammel net at spawning season of Bass bream near bogaz

connection with the sea. It is suggested to apply deep fishing by traps for catching grouper.

In addition to recommendations reached by results of the study, it is also important to deal with constraints for fishery development which is mentioned in the study.

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