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An economic study on the axes and constraints for Lake Manzala development

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ABSTRACT

Manzala Lake undergoes a decline in its fish production in recent two decades. The present work aims to assess the axes and constraints for development of its fisheries. Descriptive and quantitative analyses were conducted for its production during the period from 1995 to 2016. The results revealed that Manzala Lake produced 59.6 thousand MT (14.6% total fish production in Egypt) during 1995 and declined to 42.3 thousand MT (3.4%) during 2016. Statistically, data revealed that estimated model at 10% change in tilapia production led to 78% in the lake total production, 10% change in catfish led to change in 17% of the lake total production and about 93% of annual production leads to changes in fish species. The annual increment in productivity per boat was estimated as 1.14 MT, with estimated 6% rate of change during period from 1995 to 2016 based on the linear regression of average productivity per boat. In addition, productivity per fisherman indicated that there was a progress trend estimated at 7.5 MT per year, with a rate of change estimated at 4% during the study period. And, the average productivity was slightly increased from 313.7 to 384.6 kg between 1995 and 2016, respectively. In conclusion, this study suggests some solutions for constraints which are negative affecting the lake development.

INTRODUCTION

Manzala Lake is the most important northern lake in Egypt in terms of area and multiplicity of fish species. However, it is exposed to several threatening problems as a result of hydrological and natural changes, which adversely influenced environmental balance in the lake, resulting in disappearance of some fish species, as well as changes in the composition of fish species and fish stocks (Ministry of Environmental Affairs, 2016). Quantity of water flowing into the Lake was estimated about 6.7 million m^3/year. It is a mixture of agricultural drainage water from Hados drain (49%); Bahr El-Baqar wastewater drain (25%); El-Serw drain (13%); Ramsis and Farascor drains (4% each), El-Mataria drain (2%); El-Anania Canal, El-Ratma

Canal and El-Saffara Canal branched from Dameitta in front of Ras El-Barr (GAFRD, 2012). Therefore, this work was designed to identify the constraints and development axes related to economic importance of Lake Manzala and factors affecting fish production, composition and relative importance, and geographical distribution of fish species, and main problems obstructing fish production, as well as the development axes for this Lake.

MATERIALS AND METHODS

Study location: The Manzala Lake lies within the borders of five Egyptian governorates (Dakahliya, Damietta, Port Said, Ismaillia and Sharkiya). It is bordered by the Suez Canal to the East, the Damitta Branch of the Nile to the west, the Mediterranean Sea to the north and agricultural land in the south. Nine agricultural and sewages drains are the main sources of it water; Hados, Bahr El-Baqar, El-Serw, Ramsis, Farascor, El-Mataria drains, El-Anania Canal, El-Ratma Canal and El-Saffara Canal. The catch is landed through five regions; Al-Mothalath (Triangle), Qaar El-Bahr (Sea-bottom), Booz El-Balat, El-Gohr and Mother Lake.

Collected data: Data were collected from published annual statistical bulletins from 1995 to 2016 which were issued by Ministry of Environmental Affairs (2016) and GAFRD (2012 & 2018).

Statistical analyses: The descriptive and quantitative analyses; percentages mean, linear and logarithmic models, and regression analysis were estimated using MS office (Ver., 2016) and SPSS (Ver., 20) programs as following:

1- Linear Regression Model to estimate total fish production during period of study:

$\log \hat{y_n}$= log 1.304 + 0.789 log x_1 + 0.031 log x_2

(1.320) (9.407)* (4.917)*

$\bar{R}^2 = 0.93$ F= 46.79

Where:

$\hat{y_n}$ = Estimated total fish production from Lake Manzala,

X_1 = annual production of tilapia,

$X_٢$ = annual production The catfish.

X_n = time variable in years (1, 2, 3, ……, 22)

* Significant at 0.01 level.

2- Linear Regression Model to estimate average productivity per boat:

$\hat{y}_t = 10.35 + 1.044\ x_t$

(3.3) (4.4)**

$R^2 = 0.46$ F = 19.1

Where,

$\hat{y}_t$ = average productivity per boat

X_t = time in years (1, 2, 3, ……, 22)

** = significant at 0.01 level.

3- Linear Regression Model to estimate average productivity per fisherman:

$\hat{y}_t = -13.8 + 5.33\ x_t$

(-0.55) (2.81)*

$R^2 = 0.28$ F = 7.9

Where,

$\hat{y}_t$ = average productivity per fisherman during the period 1995-2016:

X_t = time in years (1, 2, 3, ……, 22)

* = significant at 0.05 level.

RESULTS AND DISCUSSION

Economic Importance and quantities of the fish species in Lake Manzala

The economic importance of Manzala Lake includes fish production, fishermen, catching boats and services associated with fishing processes. Table (1) and Fig. (1) show fish production from Lake Manzala during period from 1995 to 2014 according the plans and strategies as set by GAFRD (2012). It could be observed that fish production declined from 59.6 thousand tons (14.6% of total fish production in Egypt) during 1995 to 42.3 thousand tons (3.4%) during 2016. It was also noted that fish production fluctuated to estimate as average 63.7 thousand MT during the period from 1995 to 2005 and it remained relatively stable to record 53.1 thousand MT during period from 2006 to 2016. However, total fish production obtained from this lake was estimated about 81.4 thousand MT during 2013. Such increase can be attributed to increases in the number of fishing boats, fishing effort and improved fishing nets.

Fish Species in the Lake Manzala

Changes occurred in the aquatic system led to less salinity and increasing the vegetation covered in all parts of the lake (Ministry of Environmental Affairs, (2016). Such factors led to changes in fish species composition, where marine species as a high economic value declined whereas freshwater species increased. Based on the data presented in table (1), it could be noticed that Eels production declined from 783 MT during 1995 to 9 MT during 2016, seabass and seabream species declined from 190 and 289 MT respectively during 1995 to zero production during 2016. Also, tilapia production decreased from 35.5 thousand MT to 19 thousand MT at the same period. On the other hand, mullet and catfish recorded a relative stability which could be attributed to higher quantities of fries produced by fish hatcheries of fish farms surrounded the lake while carp fish species increased as result could be attributed to get rid of the aquatic plants.

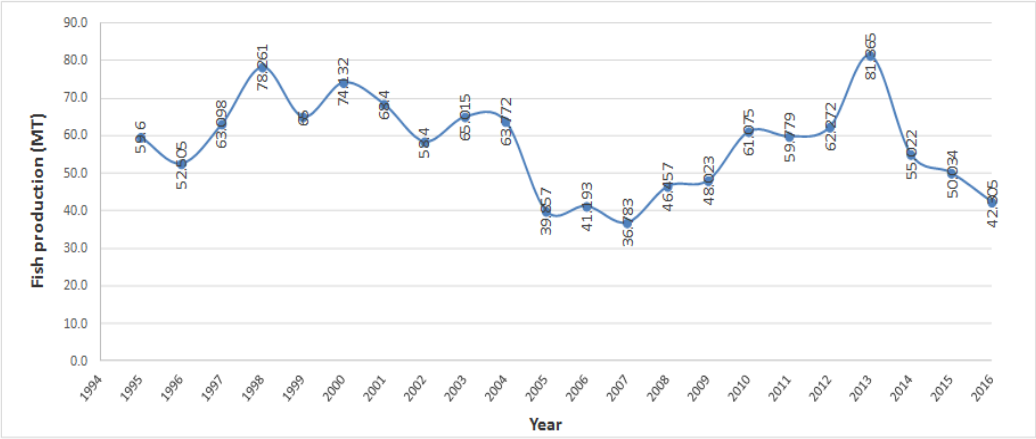

Fig. 1: Fish production from Manzala Lake during the period 1995 – 2016.

Source:

- The Central Administration for Public Mobilization and Statistics, Bulletin of Fish Production, Issues 1995-2016.
- Ministry of Agriculture and Land Reclamation, Fish Production Statistics, Issue 1995-2016.

Table 1: Species and quantity of fish production from Lake Manzala during the period 1995 – 2016.

Year	Silver-sides	Tilapia	Bugrus	Shrimp	Eels	Daffas	Sea-bream	Mullets	Seabass	Catfish	Nile Perch	Crabes	Meagre	Grass Carp	Gilthead Seabream	Spotted Seabass	Other	Total
1995	725	35503	363	176	783	0	289	465	190	3844	497	4855	24	2206	100	238	9341	59600
1996	297	32881	205	277	494	0	254	301	238	2114	219	4191	54	1940	106	411	8523	52505
1997	249	39826	621	2252	178	0	372	2745	596	5206	242	0	45	296	0	280	9941	63098
1998	393	40050	171	252	631	0	169	308	301	2814	633	0	49	2258	0	263	24655	78261
1999	122	33929	535	411	202	0	328	3083	248	5893	219	0	40	330	0	146	19382	65000
2000	1421	39573	1677	1085	1502	0	1225	3693	1301	11585	0	0	13	198	0	1473	7121	74132
2001	1356	34767	1706	969	1564	0	1358	4125	1363	10759	17	0	4	600	0	1349	6251	68400
2002	1098	29703	998	925	1180	0	1124	4170	1233	8943	2	743	11	731	1117	1193	5229	58400
2003	19	30054	2124	1041	81	0	44	15193	50	13548	5	42	32	806	19	22	1935	65015
2004	114	26882	3192	3926	249	0	273	15012	277	9646	33	235	0	1308	129	166	2330	63772
2005	196	17364	2907	3053	150	0	166	5084	194	7272	19	164	9	1232	75	147	1825	39857
Mean	544.5	32775.6	1318.1	1306.1	637.6	0.0	509.3	4925.4	544.6	7420.4	171.5	930.0	25.5	1082.3	140.5	517.1	8775.7	62549.1
2006	77	17547	1631	2349	257	0	202	1838	116	9597	20	366	75	4249	101	172	2596	41193
2007	100	20539	1029	1671	283	0	251	2130	159	5445	10	215	25	2270	126	296	2234	36783
2008	127	25557	1891	2560	12	122	265	3175	242	5689	0	268	0	1946	216	248	4139	46457
2009	147	18818	4016	2761	21	157	158	4709	160	8643	0	282	0	3373	206	307	4265	48023
2010	126	33545	515	501	66	77	276	10062	242	11202	0	266	0	489	222	242	2884	61075
2011	110	32076	396	512	30	61	177	10282	155	12347	0	220	0	486	116	170	2641	59779
2012	41	26805	198	195	20	63	85	15476	16	16513	0	266	9	305	68	99	2140	62272
2013	0	31380	77	195	44	22	16	25317	0	21926	0	136	2	222	4	65	1959	81365
2014	0	23347	50	145	15	55	5	15237	0	13544	0	135	0	360	0	85	2044	55022
2015	0	22438	70	160	60	10	5	14867	0	9671	0	189	0	705	0	90	19767	50034
2016	0	19096	54	126	9	51	0	11353	0	8790	0	224	140	494	0	135	1833	42305
Mean	66.2	24649.8	902.5	1015.9	74.3	56.2	130.9	10404.2	99.1	11215.2	2.7	233.4	22.8	1354.5	96.3	173.5	4227.5	53118.9
General mean	315.8	28889.4	1119.3	1167	368	26.9	328.3	7545.7	331.5	9235.3	90.8	596.8	24.2	1212.4	119.4	352.8	6600.5	58039
%	0.5	49.8	1.9	2.0	0.6	0.05	0.6	13.0	0.6	15.9	0.2	1.0	0.0	2.1	0.2	0.6	11.4	100

Source:

- The Central Administration for Public Mobilization and Statistics, Bulletin of Fish Production, Issues 1995-2016.

Ministry of Agriculture and Land Reclamation, Fish Production Statistics, Issue 1995-2016.

Relative importance of main fish species

Data in table (1) and figure (2) indicate that the average tilapia production estimated as 29 thousand MT (49% of total fish production of the lake), followed by 11.2 thousand MT of catfish (15.9%), 7.5 thousand MT of mullets (12.1%) during the period from 1995 to 2016 (Ministry of Agriculture and Land Reclamation, 1995 - 2016). Therefore, it was found that the double log model (equation 1) was the best fit. The model estimated the relationship between fish production from Lake Manzala as the dependent variable (y) and production from different fish species as the independent variables; including tilapia (x_1), catfish (x_2), mullets (x_3), grass carp (x_4), shrimp (x_5), bagrus (x_6), eels (x_7), Seabass (x_8), crabs (x_9), silversides (x_{10}), seabream (x_{11}), meagre (x_{12}), and daffas (x_{13}). It is clear from the estimated model that10% change in tilapia production (x_2) led to 78% in total production of lake, 10% change in catfish led to change in total production estimate by 17% of total lake and about 93% of annual production led to changes in fish species according to R^2, the model proved significant at a level higher than 0.005.

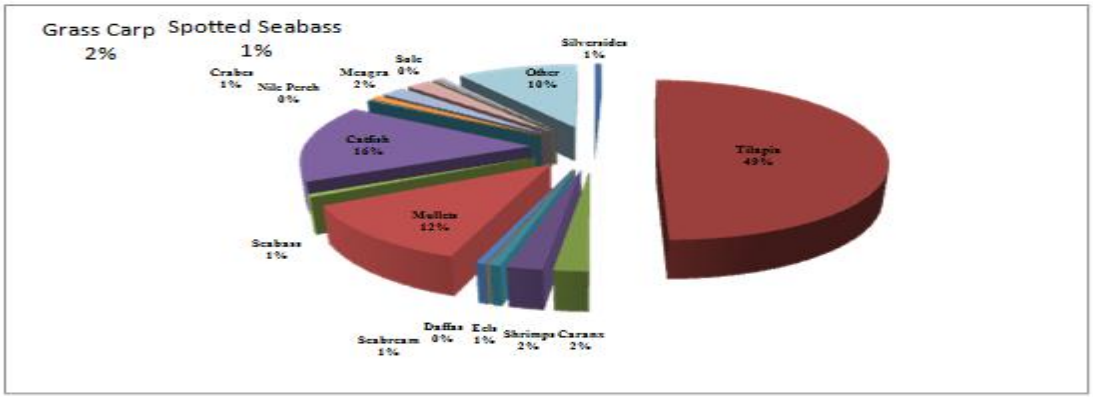

Fig. 2: Relative importance of main fish species produced from Lake Manzala over the Period 1995-2016.

Source:

- The Central Administration for Public Mobilization and Statistics, Bulletin of Fish Production, Issues 1995-2016.
- Ministry of Agriculture and Land Reclamation, Fish Production Statistics, Issue 1995-2016.

Relative importance of production regions in Lake Manzala

Ministry of Agriculture and Land Reclamation (2014) divided the fish production regions into three regions;

Dakahlia Governorate **(**Nasaymah, Shoboul, Mataria, Gamalia and Azezia; with Mataria region as the source of data recorded by GAFRD, (2016), Damietta Governorate **(**comprises Shata, Ghait Al-Nasara, Ezbet El Borg, El Sayala, Raswet El Basarta and Raswet El Rawda; with Ghait El-Nasara and Port Said Governorate (El-Gaboty, which is a production assembly region). Table (2) presents the relative importance of fish production regions for Lake Manzala during the period 1995-2016.

Data also revealed that Mataria recorded 76.6 thousand tons of total fish production for Manzala with average estimated by 44.3 thousand tons during the period 1995 – 2016, followed by 10.3% of total fish with average 5.9 thousand tons, 7.4% Ghait Al-Nasara with average 4.2 thousand tons and 5.7% Gamalia with average 10.8 thousand tons. It is worth mention that fish production is mainly concentrated in Mataria (56%) and Gamalia (30%). Percent of fishermen represents

91% of total fishermen. This indicates the effect of production policies in Dakahlia Governorate to improve and increase fish production from the Lake.

Table 2: Relative importance of fish production regions in Lake Manzala during the period 1995-2016.

Year	**Gaboty (Port Said)**	%	**Ghait El-Nasara (Damietta)**	%	**Mataria (Dakahlia)**	%	Gammalia **Dakahlia)**		**Gross Total**
1995	984	1.7	10825	88.6	47790	80.2	--	-	59600
1996	1053	2.0	3956	7.5	47499	90.5	-	-	52505
1997	1140	1.8	4971	7.9	56987	90.3	-	-	93098
1998	1197	1.5	5700	7.3	71364	91.2	-	-	78261
1999	1200	1.8	3800	5.8	60000	92.3	-	-	65000
2000	1271	1.7	4337	5.9	68424	92.3	-	-	74132
2001	2145	3.1	6239	9.1	60016	87.7	-	-	68400
2002	1100	1.9	5800	9.9	51500	88.2	-	-	58400
2003	1114	1.7	2901	4.5	61100	94.0	-	-	65015
2004	2118	3.3	4747	7.4	56907	89.2	-	-	63772
2005	2379	6.0	3037	7.6	34441	86.4	-	-	39857
Average	1427.4	2.3	5119.4	8.2	56002.5	89.5	-	-	62549.1
2006	5625	13.7	2896	7.0	32672	79.3	-	-	41193
2007	8783	23.9	3000	8.2	25000	68.0	-	-	36783
2008	8787	18.9	4140	8.9	33530	72.2	-	-	46457
2009	9939	20.7	3984	8.3	34100	71.0	-	-	48023
2010	13554	22.2	4271	7.0	43250	70.8	16449	26.9	61075
2011	11090	18.6	3879	6.5	26801	44.8	14373	24.0	59779
2012	10088	16.2	4307	6.9	25617	41.1	13160	21.1	62272
2013	10654	13.1	2845	3.5	55115	67.7	12751	15.7	81365
2014	11880	21.6	2460	4.5	33593	61.1	7089	12.9	55022
2015	12305	24.6	3011	6.0	27756	55.5	9692	13.9	50034
2016	12880	30.4	2725	6.4	21700	51.3	5000	11.8	4230
Average	1.5.7.7	18.4	3410.7	6	32648.5	57.1	10826.3	8.7	57181.5
Gross Period's Average	5967.5	11.4	4265.0	7.5	44325.5	75.7	10826.3	18.1	57834.0
%	10.3		7.4		76.6		5.7		100

Source:

- The Central Administration for Public Mobilization and Statistics, Bulletin of Fish Production, Issues 1995-2014.
- Ministry of Agriculture and Land Reclamation, Fish Production Statistics, Issue 1995-2014.

Impact of fishing effort, labor and unit area on fish production from Lake Manzala

Fishing gears and methods used in Lake Manzala include trammel net, hook, bamboo, wire-basket trap (Gobia) and surrounding nets, in addition to illegal methods. The average productivity per fishing boats and fisherman working in Lake Manzala during the period 1995-2016 are presented in Table (3).

It was found there are variations and fluctuation in production efficiency and productivity of fishing unit (CAPMAS, 1995 – 2016). Average productivity ranged between a minimum level of 7.3 tons per boat in 1996 and a maximum level of 51.5 tons per boat (the annual mean was estimated by 22.4 tons/boat during 2013. On the other hand, average production efficiency fluctuated from 17.1 tons during the period 1995 – 2005 and increased to record 27.6 as a mean during the period 2006 – 2016.

Statistically, data revealed that an annual increase in productivity per boat estimated by 1.14 tons, with a rate of change estimated by 6% during the study period of 1995-2016 based on applying linear regression analysis (equation 2) to average productivity per boat.

Table 3: Average productivity per fishing boats and fisherman working in Lake Manzala during the period 1995-2016.
(Production in tons; number of boats and fishermen)

Year	No. Boats	Productivity (ton/boat)	No. Fishermen	Productivity (ton/fisherman)	Production (tons)
1995	3838	15.5	1154	51.7	59600
1996	7171	7.3	28684	1.8	52505
1997	2783	22.7	8349	7.6	63098
1998	5999	13.1	9742	8.0	78261
1999	3109	20.9	5304	12.3	65000
2000	5477	13.5	4163	17.8	74132
2001	3260	21.0	6815	10.0	68400
2002	2377	24.6	3367	17.3	58400
2003	4376	14.9	3155	20.6	65015
2004	3033	21.0	2657	24.0	63772
2005	3013	13.2	2292	17.4	39857
Period's Average	4039.6	17.1	6880.2	17.1	62549.1
2006	2469	16.7	1551	26.6	41193
2007	2288	16.1	1671	22.0	36783
2008	2509	18.5	2143	21.7	46457
2009	2600	18.5	1557	30.8	48023
2010	2370	25.8	1076	56.8	61075
2011	1969	30.4	1346	44.4	59779
2012	1877	33.2	388	160.5	62272
2013	1581	51.5	300	271.2	81365
2014	1642	33.5	356	154.6	55022
2015	1686	29.7	1868	26.8	50034
2016	1395	30.3	1035	40.9	42305
Period's Average	2035.1	27.6	1208.3	77.8	53118.9
Gross Period's Average	3037.4	22.4	4044.2	47.5	57834.0

Source:
- The Central Administration for Public Mobilization and Statistics, Bulletin of Fish Production, Issues 1995-2014.
- Ministry of Agriculture and Land Reclamation, Fish Production Statistics, Issue 1995-2016.

Also, the production efficiency of fishermen varied, where the fish produced by fisherman ranged between a minimum of 1.8 ton in 1996 and a maximum of 271.2 tons in 2013 and then progressed to 77.8 tons as a mean during the period 2006 – 2016. Such increases did not reflect an increase in fishing effort; rather, it is a reflection of several production policies, where the number of fishing boats is not proportionate to fishermen and productivity inside and outside the lake. Accordingly, the number of licensed boats reflects an unrealistic situation, where mechanical boats usually need two or more persons to accomplish various operations, indicating increased number of unlicensed fishermen in such fishing areas.

Results of applying linear regression to productivity per fisherman (equation 3) revealed that there was an increasing trend estimated at 7.5 tons per\year, with a rate of change estimated at 54% during the study period. And despite using relatively modern methods in fishing operations, as well as directing more investments to improve fish production, the average productivity was slightly increased from 313.7 to 384.6 kilograms between the period 1995 and 2016.

Main constraints affecting fish production from Lake Manzala

Table (4) demonstrates the change of Lake Manzala's area over the Period 1800-2014. Drying, security keeping issues, encroachments on the Lake's surface and overfishing are considered the main problems affecting fish production from Lake Manzala. The policy of drying for plant production and urban expansion purposes led to lack of water flow into the Lake. Total area of the lake declined to a low of 110 thousand acres, which is less than 25% of its original area, leading to reduced fish stock and higher fishing effort per unit area. Drying for plant production occurred in parts of Ismayliya, Sharkia, Port Said, and Damietta. Drying for urban expansion occurred in Port Said by Dameitta-Port Said road and the new ring road. Drying due to lack of water flow into the lake (El-Mezayn, 2018), whereas drying due to sedimentation of straits, growing weeds and aquatic plants to grow and isolation from the Lake in the western and south east regions of the Lake. In addition to drying due to encroachments on the water surface of the lake by deducting parts for fish farming activities as occurred in some parts of Dameitta, Port Said, Sahrkia and Dakahlia(Ministry of Water Resources and Irrigation, 2014). Therefore, total areas targeted for drying in the five-year plan 1992-1997 include: 4500 acres in South Port Said; 21200 acres in Om El-Rish; 30000 acres in Sahl El-Huseinia; 8000 acres in Mataria-El-Salam; 3500 acres in El-Adawi; in addition to 200 thousand acres on El-Salam Canalfor the purpose of expansion in agricultural land, and 1000 acres outside Port Said city for establishing drainage stations.

Table 4: Change of Lake Manzala's Area over the Period 1800-2014
(In 1000 Acres)

Year	1800	1889	1912	1956	1982	1987	1994	2000*	2004*	2011**	2014
Area	750	490	410	326.8	280	190	191	190	130	116	110

Source:
* The General Authority for Fish Resources Development, Fish Farms Administration, Cairo, 2004.
** Ministry of Water Resources, Main Information Center, Administration of Digital Maps and Remote Sensing, Estimation of Fish Farms' Area using Remote Sensing Technology.

Concerning pollution, Lake Manzala was subjected to pollution from several sources, including untreated wastewater. Bahr El-Baqar is pouring around 1.5 million cubic meters per day in Lake Manzala, as well as Moheb and Sayala drains in Damietta, and sanitary drainage in El-Hisha and Khiyata region at Damietta. Besides, untreated industrial wastewater comes from factories in the industrial zone; south Port Said, in addition to oil and gas companies located at north the lake. Pollution caused by agricultural drainage loaded with pesticides comes from several drains, including El-Serw, Hados, Ramses and Bahr El-Baqar. Total quantities drained were estimated about 7500 million cubic meters per year (EEAA, 2017). Several studies have been revealed that accumulation of heavy metals in the water, tissues and muscles of catfish and mullet, caused histological changes in fishes' liver and kidney tissues, in addition to algae, with different concentrations of iron, manganese, zinc, copper and cadmium (GAFRD Strategy, 2012). Security keeping problems; criminal zones are concentrated in fish fries catching and smuggling. Some fishermen depend on such illegal practices by using high-speed motors and semi-transport vehicles equipped with appropriate tools. Such illegal trade is spread as a result of the wide spread of fish farms inside Governorates overlooking at the Lake which it comprises around more than 40 islands, more than six hundred places inside the lake surrounded with a fence and a lot of random houses scattered along the lake. Illegal fishing practices include illegal fishing gears, pesticides, electricity and gas and enclosures,

Tara (surrounding nets), Qerba and Laffa nets. Surrounding net is considered a destructive method, where it requires huge amounts of aquatic plants in different parts of the Lake, causing the Lake to become almost covered with plants that obstruct water movement, fishing and sailing. On the other hand, the Nasha (a type of trammel net) is the best fishing gear, where it allows small fish to escape back to water. Migration birds; sea crow, Heron, seagulls, swans, etc., are another problem, where they start migration to Egypt at the end of November (fries season for some fishes) and risk increased as they feed on fish fries. Automatic and river transport boats are widely spread and transport passengers and animals between Port Said and Mataria. Random planning led to lack of coordination with the concerned authorities resulted in negative impacts; preventing fish fries from entering the Lake. Such practices resulted in increased freshness of water in the southern part, led to the spread of bamboo and water hyacinth, and consequently deducting parts of the lake, water corruption, and fish migration.

Available means for Lake Manzala devolopment

Fifth plans for economic development aim to increase fish production from Lake Manzala (El-Mallah, 2001). Such objective cannot be achieved without coordination between concerned Agencies and Organizations and activate the fish guidelines sector to overcome the previous mentioned constraints. Generally, some suggested solutions to avoid these constraints can be summarized in the following items based on this study:

- **Drying** problem can be resolved by defining contour points of some of the canals around and inside the lake with different level and gates to allow controlling the level of water flow beside straits or drains to grow and reproduce of fish and protection during its incubation.
- The problem of pollution can be resolved by establishing large filtration basins at the terminals of Bahr El-Baqar and Hados drains to cleaning the discharge and remove solid matter which can be used as fertilizers for sandy soils.
- The problem of overfishing and illegal fishing can be resolved by managing enclosures and dams inside the lake, activating the laws regarding illegal fishing and raising fishermen's awareness.
- **Aquatic plants** problem can be resolved by breading some animals that fed on aquatic plants and processing such plants for feedstuffs, despite they are places for fish breeding and incubation of fries and small fishes and also they help in improving the water quality especially during the winter.
- **Sedimentation of straits** can be resolved by establishing bumpers and cleaning using the drills.
- **Shortage in funds for fishing** activities can be resolved by supply of fish catch to cooperative societies. Fishermen who do not abide to such rule can be punished by confiscation of license and also help in accurate and monitoring of catching.
- **Migration of fishermen** can be resolved by establishing a support fund for fishermen and their families.
- **Inaccuracy of fish statistics** can be resolved by revisiting the concepts and methods used in data collecting of fisheries and fishing effort, with special focus on the socio-economic characteristics of fishermen.
- **Random planning,** it is important to review the laws, legislations and procedures related to water bodies in order to identify deficiencies to avoid them, in addition to providing protection and encouragement for fishing activities.
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