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FISHERY ASSESSMENT SURVEY OF LAKE MANZALA, EGYPT.

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ABSTRACT

The open water fishery of Lake Manzala occupies an area of about 21,3000 feddans and employs about 17,000 fishermen using 4,000 boats. The fishery is essentially artisanal and non-mechanized. The current estimated annual yield is about 41,000 t; 87 % of this is Tilapia and 3 % is high value mullet. Open fishery yields, on a per unit area basis, are closely related to water nutrient levels. The highest annual yields of over one t/feddan are obtained in the southern area of Lake Manzala, in the vicinity of the mouth of Bahr El-Baqar Drain. Low yields of less than 50 Kg/feddan are found in the areas to the west and northwest, outside the influence of drainwater. Intermediate yields of about 150 Kg/feddan are obtained in the eastern area, where the influence of drainwater is moderate. The true significance of these yield levels may be appreciated by a comparison with other African inland water fisheries, which have the most annual yields fall in the range of 40 to 100 Kg/feddan.

INTRODUCTION

Lake Manzala is a dynamic aquatic system that has evolved from a brackish to a more freshwater state over the past 50 years. The pace of this change has greatly accelerated during the last 10 to 15 years due to a three fold increase of drain water inflows. Lake Manzala, the biggest of the Egyptian Delta Lakes, is situated in eastern of the Nile Delta between the Damietta Branch and the Suez Canal (Fig. 1). The Mediterranean Sea immediately north of the narrow coast which separates the two water bodies. The total area of the Lake is approximately 247,000 feddans and the depth of water rarely exceeds two meters.

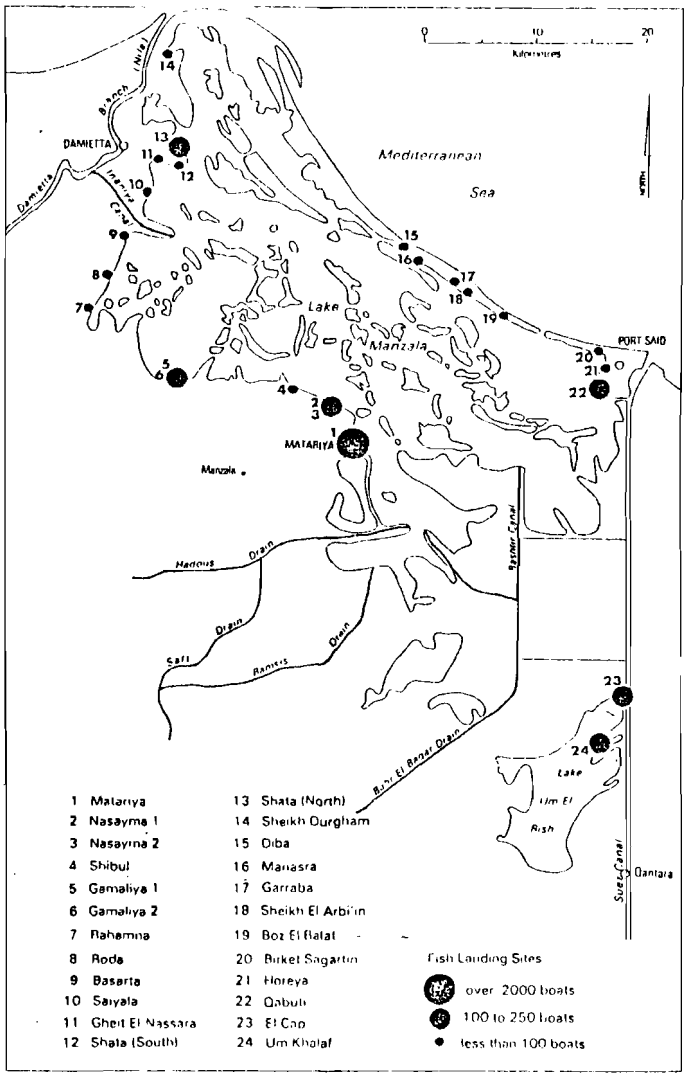

FIG. 1
Distribution of ports or fish landing sites.

Now, Lake Manzala is characterized by low salinities in the south and west (near the outlets of the drains and canals), brackish waters over most of the rest of the area and saline waters in the extreme northwest. Nutrients from the major drains have created eutrophic conditions in the southern parts of the Lake closest to the outlets. The eutrophic conditions have changed the aquatic biota lending to a less diverse but highly productive system (Tilapia-based fishery).

The main objective of this Survey is to obtain (with measurable precision) current estimates of the total catch of the open Lake fishery in terms of live weight in tonnes. In addition, the survey design provided detailed statistical information concerning the species composition and size structure of the catch, and the amount, type and disposition of fishing effort (in space and time) involved in obtaining the catch.

METHODOLOGY

The data base describing the present state of the open fishery was systematically collected during the period May, 1979 to April, 1980, using two survey schemes; the Frame survey and the Catch Assessment Survey. These schemes have been modified from designs adopted by the F.A.O. for use in other African fisheries (Bajigoe, 1974).

Frame Survey

The Frame Survey essentially provided an inventory of a number of characteristics needed to assess the size and structure of the fishing industry. A kilometre by kilometre survey of the Lake perimter was conducted, where possible, by land vehicle. Those areas that were inaccessible by land vehicle (Southern and western shorelines) were surveyed at a later date by airboat. Based on observation and interview, details on the following were collected at each landing site: the number of fishing boats (by type and size), their pattern of operation (daily and seasonal), number of fishermen, the fishing gear used and the species composition of the catch.

The land-based boat counts were supplemented by an aerial survey carried out in September, 1979. In mid-morning, a series of transects were flown over the Lake at an altitude of 200 m and a count was made of all boats in open water.

Catch Assessment Survey

The Catch Assessment Survey is a probability sample survey which was conducted on a quarterly basis (every three months). All of the major and minor fishing ports(Fig. 1) were visited for at least one or two day period in each quarter. Prior to sampling, observations were made to determine the daily pattern of boat returns to port.

At each port, a proportion of the returning fishing vessels were sampled. Sampling was conducted in a random manner with respect to boat size and type. Boats were sampled throughout the day, in proportion to the number of boat arrival each hour. Boats were boarded as they arrived at their berths, and a detailed examination of the boat, fishing equipment and catch was made. The boat captain was interviewed and the following items of information obtained: Home port, normal fishing patter (average number of days fished per week; number of days per fishing trip), name of fishing area for the present trip, total fishing time (in hours) for the present trip, crew size (number of adults and children), fishing gear (number, type, dimensions and mesh size) and fish catch (for each species, size composition and total weight).

Estimation of the catch

From the Catch Assessment Survey data, the following two key statistics can be evaluated for each boat sampled:

- The catch weight for one fishing day (X)
- The number of fishing days for the quarter (d)

Providing the sample taken is truly random, using values for the above, and knowing the Frame Survey counts of fishing boats regularly operating from various ports, the total catch for each port per quarter can be computed as follows:

$$C \; O \; N.\bar{x}.\bar{d}.$$

Where N = the number of fishing boats
$\bar{X}$ = mean catch per boat per fishing day
$\bar{d}$ = mean number of fishing days for the quarter
C = the total catch for each port per quarter

In general, there is very little sample variation around the mean value for d. Confidence limits for the quarterly catch estimate are calculated from the sample variation around the mean value for X. Sample sizes at each port were usually sufficient to generate quarterly catch estimates with 95 % confidence limits, within 25 % of the mean value.

RESULTS AND DISCUSSION

The catch of Lake Manzala, from open fishing for the 12 month period, May 1979 to April 1980, was estimated at 40,760 t. This figure was obtained by the summation of catch estimates for all ports for the four quarterly rounds of the Catch Assessment Survey (Table 1). The upper and lower confidence limits for the annual catch, estimated at the 95 % level, are 35,665 and 45,855, respectively.

TABLE (1)

Lake Manzala Open Fishing Catch by Landing Site for the Period May 1979 to April 1980.

Landing Site	Round 1 May-July 1979			Round 2 (Aug.-October 1979)			Round 3 Nov.1979-Jan.1980)			Round 4 Feb.-April 1980)	
		(t)	(%)		(t)	(%)		(t)	(%)	(t)	(%)
1- Matariya	11	33.9.5	82.9	8	818.9	74.3		4939.3	68.3	5264.1	64.8
2- Nasayma 1		452.4	3.3		131.5	1.1		141.7	2.0	114.5	2.1
3- Nasayma 2		85.1	0.6		76.9	0.6		65.1	0.9	37.1	0.5
4- Shibul		70.0	0.5		63.2	0.5		53.6	0.7	30.6	0.4
5- Gamalyia 1		292.6	2.1		211.1	1.8		214.0	3.0	377.6	4.9
6- Gamalyia 2		284.2	2.1		256.8	2.2		217.4	3.0	123.8	2.3
7- 11 West Shore		203.0	1.5		234.4	2.0		232.0	3.2	113.5	2.0
12 Shata (South)		69.8	0.5		54.9	0.5		76.0	1.1	42.3	0.5
13 Shata (Sorth)		201.9	1.5		316.5	2.7		157.8	2.2	329.0	4.2
14 Sheikh Durgham		14.1	0.1		22.2	0.2		11.0	0.2	24.7	0.3
15-19 North Shore		182.4	1.3		220.2	1.8		120.4	1.7	124.5	1.6
20 Birket Sagartin		19.1	0.1		22.0	0.2		15.7	0.2	56.3	0.7
21 Horeya		82.9	0.6		124.8	1.0		111.1	1.5	198.6	2.5
22 Qabuti		326.3	0.4		279.7	2.3		177.8	2.5	277.5	3.5
23 El Cap		198.9	1.4		413.2	3.5		278.1	3.8	288.3	3.7
24 Um Khalaf					625.0	5.3		420.6	5.8	434.0	5.5
Total	13	822.2	100	11	871.3	100	7	231.6	100	7836.4	100

The total catch of the four rounds: 40,760t

Fishing Effort

Fishermen

Based on the Catch Assessment Survey Sample data, there are an estimated 16000 to 17000 fishermen (of which approximately 3000 to 3500 are pre-adolescent boys) operating on the Lake. These figures represent the regular fishermen operating from fishing vessels at lakeside ports. They do not include casual fishermen, of those operating from hand. However, casual and land-based fishermen contribute only an insignificant portion to the total open fishery catch.

Estimates of the number of fishermen (by port and fishing region), for each quarter of the Catch Assessment Survey year, are given in Tables 2 and 3. Approximately, 65 % or a total of 11000 fishermen are based at Matariya site (Fig. 1). In general, seasonal changes in the number of fishermen, by region and port, closely follow changes in the number of fishing vessels. The overall mean crew size remains relatively constant throughout the year, decreasing only very slightly in winter. The increase in number of fishermen at Materiya during the summer months is due to the influx of temporary fishermen participating in hand-catching and surroundnet fishing methods.

Fishing Vessels

There are approximately 4000 fishing boats on the Lake, comprise two main types. 37 % are the canoe-like faloukas (usually without sail), which range between 2 and 9 metre in length. They have crew sizes in the range of one to three individuals, with a mean number of two, wh[illegible] 63 % of the fishing vessels comprise the larger, wide-beam sailing markebs. They are from 7 to 10 metre in length and their crews range in size from two to eighteen people, with a mean number of about five.

From the Catch Assessment Survey data, the number of fishing boats operating in each fishing region can be derived. These results are presented by port (Table 1), and by region (Table 2). The estimated number of operational boats remained fairly constant throughout the sampled period, with a peak of about 3950 boats in August to October and a low of about 3400 in February to April (Table 1).

The seasonal distribution of boats of fishing region (Table 2) illustrates that regions 2, 3 and 4 show a gradual increase in the number of fishing vessels as the season progresses. While the fishing effort in region 7 decreased markedly from about 1400 boats in May to July to less than 500 in November to January. This is primarily due to a shift of Matariyabased boats from region 7 to those more northerly regions. Regions 5 and 6 show a peak in the number of boats during August to October, due to the influx of boats from Matariya. This peak in fishing effort coincides with the period of peak marine fish production of these regions.

TABLE (2)

Fishing Effort by Port

	Landing Site	Round 1 May to July			Round 2 August to October			Round 3 November to January			Round 4 February to April		
		N	$\bar{c}$	F	N	$\bar{c}$	F	N	$\bar{c}$	F	N	$\bar{c}$	F
1	Matariya	2165	5.1	11 030	2180	5.6	12 210	1955	15.0	9 755	1700	15.7	9690
2	Nasayma[1]	125	2.9	365	110	2.7	295	100	3.1	310	100[1]	2.9	290
3	Nasayma[2]	60	2.4	145	60	2.4	145	60	2.4	145	62[1]	2.4	149
4	Shibul	50	2.4	120	50	2.4	120	50	2.4	120	51[1]	2.4	122
5	Gamaliya[1]	170	3.3	560	175	3.3	580	190	3.1	590	180	3.3	594
6	Gamaliya[2]	205	2.4	490	205	2.4	490	205	2.4	490	207[1]	2.4	497
7-11	West Shore Sites	190	2.4	455	190	2.3	435	190	2.2	420	190[1]	2.3	437
12	Shata (South)	40	1.7	70	40	1.6	65	40	2.3	90	40	3.0	120
13	Shata (North)	200	1.7	340	200	2.1	420	200	1.8	360	200	1.9	380
14	Sheikh Durgham	15	1.7	25	15	2.1	30	15	1.8	25	15	1.9	285
15-19	North Shore Sites	210	1.7	355	205	1.4	285	205	1.5	310	207[1]	1.5	311
20	Birket Sagartin	20	2.4	50	20	2.4	50	20	2	40	20[1]	2.7	54
21	Horeya	60	4.0	240	60	3.4	205	50	5.4	270	50[1]	4.3	215
22	Qabuti	195	4.0	780	135	3.4	460	80	5.4	430	70[1]	7.0	490
23	El Cap	105	1.8	190	120	1.8	215	120	2.1	250	121	2.0	242
24	Um Khalaf	-	-	-	185	1.8	335	195	2.1	390	183	2.0	366
	Total	3810	4.0	15 225	3950	4.1	16 340	3665	3.8	13 955	3396	4.2	14 242

NOTES :

N = Number of boats

$\bar{C}$ = Mean crew size

F = Number of fishermen

TABLE (3)

FISHING EFFORT BY LAKE REGION

Region	Round 1 May to July			Round 2 August to October			Round 3 November to January			Round 4 February to April		
	N	$\bar{c}$	F	N	$\bar{c}$	F	N	$\bar{c}$	F	N	$\bar{c}$	F
1	215	1.7	365	215	2.1	450	205	1.8	370	164	2.1	344
2	365	2.4	875	400	2.6	1 040	490	2.6	1 275	536	2.8	1 500
3	215	3.6	775	265	2.5	660	410	4.0	1 660	124	3.3	409
4	910	2.9	2 640	930	5.8	5 405	1150	5.1	5 865	866	5.6	4 850
5	545	3.7	2 015	740	2.8	2 070	590	3.1	1 830	494	3.2	1 581
6	55	2.6	145	120	5.0	600	55	2.6	145	55	2.6	143
7	1400	6.2	8 680	975	5.8	5 665	460	5.0	2 300	907	5.7	5 170
8	105	1.8	190	305	1.8	545	305	2.1	640	304	2.0	608
Total	3810		15 685	3950		16 435	3665		14 085	3396		14 604
		4.1			4.2			3.8			4.3	

NOTES :

N = Number of boats
$\bar{c}$ = Mean crew size
F = Number of fishermen

Catch by Landing Site

The detailed data of annual catch by landing site is presented in Table 4. An estimated 30,000t (75 % of the catch of the open fishery) is landed at Matariya (Port 1). El-Cap (Port 23) and Um Khalef (Port 24), on Lake Um El Rish (Fig. 1), rank next to Matariya in terms of fish landings, each accounting for about 3% of the catch 1200 and 1500 t, respectively).

On a seasonal basis, the most significant pattern is the steady decline in the portion of the total catch landed at Matariya from 82 % of the total catch during May to July, 1979, to 65 % in February to April 1980 (Table 6). For the most part, this reflects a decline in the Tilapia catch during Round 4.

Tilapia species comprises 75 to 100 % of the annual catch at all landing sites, with the exception of the north-shore sits, where the portion is only 35 %. On Lake Um El Rish, tilapia account for 99 % of the annual catch for the landing sites for El Cap and Um Khalef. Gamaliya lands the highest portion of the mullet species (17 % of the annual catch). The bulk of the catch landed at north shore sites (landing sites 15-19) consists of marine species : 31 % of the annual catch is shrimp, 12 % is mullet, and other marine species account for 9% of fish caught (Table 4).

Catch By Lake Region

The open water of Lake Manzala was subdivided into 8 regions (Fig 2). Wherever possible, regions conform to natural geographical boundaries, and define areas homogeneous in terms of yields and fishery characteristics.

Annual Catch statistics by Lake region are presented in Table 5. The catch figures by Lake region vary slightly, but insignificantly from statistics for catch by landing site because of the different system of data collection. Quarterly catch statistics are given in Table 6.

More than half (51.2 %) of the open fishing harvest is taken from Region 7 (southern sector). On a seasonal basis, peak catches in this region declined from 10,067 t (71 %) during the early summer (May to July 1979) to a low of 1765 t (25 %) during the winter (November 1979 to January 1980).

Catches in Region 4, near the Gamil Outlet, exhibit the reverse seasonal trend. They increase from a low of 1661 t (12 % of the annual catch) during Round 1 to 2675 t (22 %) and 2377 t (33 %) during Round 2 and 3 respectively. These trends reflect a general decline in fishing effort in the fall and early winter. Some of the effort is restricted to other areas during this period; mainly to Region 4, but also to Regions 3 and 5, where fishermen focus on migrating mullet and other marine species.

On an annual basis, Tilapia represent 80 to 100 % of the catch, with the exception of Region 5 (Table 5) where shrimp amounts to 1285 t (31 %). Of this, 1146 t was the shrimp **Palaemon elegans,** caught during March to April.

TABLE (4)

Lake Manzala Open Fishing Catch by Landing Site for the Period May 1979 to April 1980.

	Species Group																	
	Tilapia[1]		Mullet		Catfish Bagrus		Catfish Clarias		Eels Anguilla		Other[2] Freshwater		Other[3] Marine		Shrimp[4]		Total	
	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)
1. Matariya	25 904.1	85.3	309.1	1.0	918.2	3.0	721.5	2.4	181.0	0.6	66.8	0.2	218.6	0.7	2042.5	6.7	30 361.8	74.5
2. Nasayma 1	751.3	89.4	62.6	7.5	18.6	2.2	0.4	<0.1	5.3	0.6	0	-	1.6	0.2	-	-	840.1	2.1
3. Nasayma 2	235.4	89.1	12.0	4.5	9.0	3.4	3.2	1.2	3.0	1.1	0.5	0.2	1.1	0.4	-	-	264.2	0.6
4. Shibul	193.5	89.0	9.8	4.5	7.4	3.4	2.7	1.2	2.6	1.2	0.5	0.2	0.9	0.4	-	-	217.4	0.5
5. Gamaliya 1	844.9	77.1	183.8	16.8	51.2	4.7	4.0	0.4	5.6	0.5	3.6	0.3	2.5	0.2	-	-	1 095.3	2.7
6. Gamaliya 2	785.7	89.1	39.9	4.5	30.2	3.4	10.8	1.2	10.3	1.2	1.8	0.2	3.5	0.4	-	-	882.2	2.2
7-11 West Shore	705.3	90.0	29.2	3.6	10.6	1.4	35.6	4.4	2.1	0.3	0.1	0.3	0	-	-	-	782.9	1.9
12. Shata (South)	218.3	89.8	9.4	3.9	7.2	3.0	2.4	1.0	5.4	2.2	0.2	0.1	0.1	<0.1	-	-	243.0	0.6
13. Shata (North)	940.7	93.5	57.8	5.8	1.0	0.1	-	-	3.9	0.4	-	-	1.8	0.2	-	-	1 005.2	2.5
14. Sheikh Durgham	67.4	93.6	4.1	5.7	0.1	0.1	-	-	-	-	-	-	0.2	0.3	-	-	72.0	0.2
15-19 North Shore	226.5	35.1	76.8	11.9	28.8	4.4	1.5	0.2	54.6	8.4	-	-	59.8	9.2	199.5	30.8	647.5	1.6
20. Birket Sagartin	86.3	76.3	11.7	10.3	0.1	0.1	-	-	3.7	3.3	1.0	0.9	1.1	1.0	9.2	8.1	113.1	0.3
21. Horeya	392.9	75.9	28.5	5.5	6.5	1.3	0.5	0.1	11.8	2.3		2.6	0.5	3.7	0.7	70.8	517.4	1.3
22. Qabuti	843.7	79.5	65.3	6.2	12.6	1.2	1.4	0.1	20.0	1.9	3.6	0.3	6.3	0.6	108.3	10.2	1 061.4	2.6
23. El Cap	1 165.5	98.9	0.9	0.1	0.7	0.1	11.4	1.0	-	-	-	-	0.2	<0.1	-	-	1 178.5	2.9
24. Um Khalaf	1 460.3	98.7	1.4	0.1	1.1	0.1	16.8	0.1	-	-	-	-	-	-	-	-	1 479.5	3.6
Total	34 821.8	85.4	902.3	^2.2	1 103.3	^2.7	812.2	2.0	309.8	^0.8	80.7	0.2	301.4	0.7	2 430.3	6.0	40 761.5	

NOTES :

1. Includes less than 0.1 percent other cichlid species, Haplochromis desfontainesii and Hemichromis bimaculatus.
2. Labeo niloticus
3. Dicentrarchus labrax, D. punctata, Sparus auratus, Hemiramphus sp.
4. Palaemon elegans, Metapenaeus stebbingi.

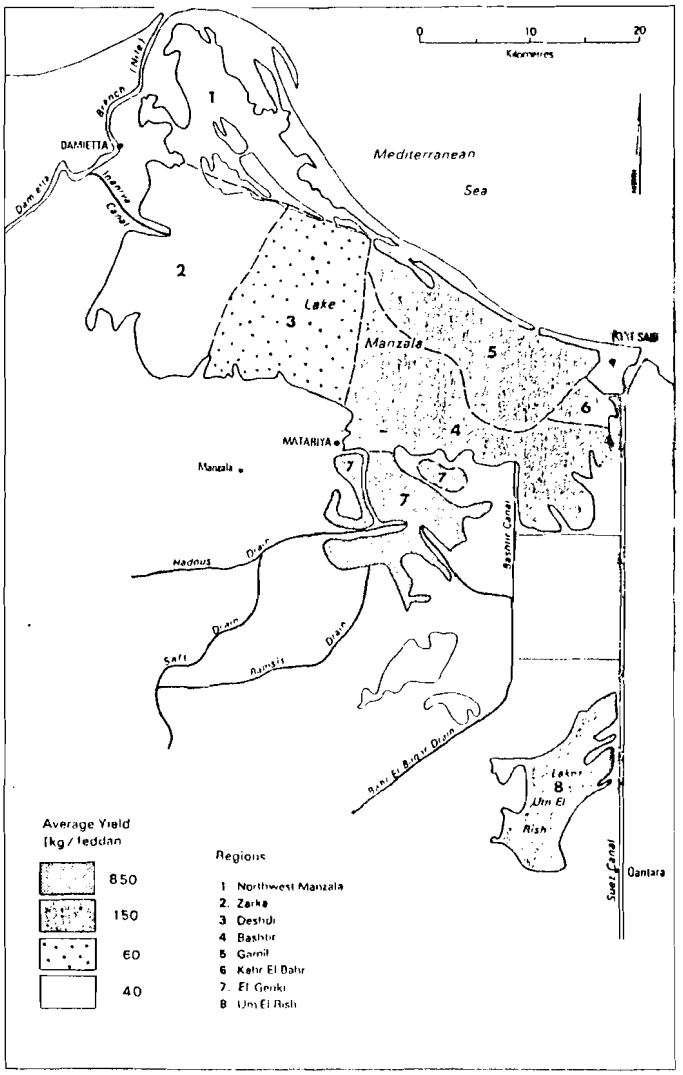

FIG. 2
Open fishing regions and yields.

TABLE (5)

Lake Manzala open fishing Catch by Lake Region for the Period May 1979 to April 1980.

Lake Region		Species Group: Tilapia (t)	Tilapia (%)	Mullet (t)	Mullet (%)	catfish Bargrus (t)	catfish Bargrus (%)	catfish Clarias (t)	catfish Clarias (%)	Eels Anguilla (t)	Eels Anguilla (%)	Other[2] Freshwater (t)	Other[2] Freshwater (%)	Other[3] Marine (t)	Other[3] Marine (%)	Shrimp[4] (t)	Shrimp[4] (%)		Total (t)	Total (%)
1		752.6	91.6	61.2	7.4	1.2	0.1	0	0	5.0	0.6	0	0	1.9	0.2	0	0		821.9	2.0
2	1	456.3	86.8	114.8	6.8	46.1	2.7	43.4	2.6	10.0	0.6	5.9	0.4	0.5	<0.1	0	0	1	677.5	4.1
3	1	718.4	80.3	331.4	15.5	54.8	2.6	7.6	0.4	22.1	1.0	1.3	0.1	5.1	0.2	0	0	2	140.7	5.2
4	6	882.3	80.1	157.0	1.8	482.0	5.6	82.4	1.0	106.2	1.2	53.2	0.6	62.4	0 7	674.2	8.9	8	589.7	20.8
5	2	184.5	52.8	252.8	6.1	91.4	2.2	1.9	<0.1	138.9	3.4	7.1	0.2	179.4	4.3	1284.7	31.0	4	410.7	10.0
6		422.5	82.1	25.6	5.0	0:6	0.1	0.1	<0.1	3.9	0.8	0	0	61.7	12.0	0	0		514.4	1.2
7	19	590.4	92.6	14.4	0.1	464.3	2.2	685.6	3.2	5.2	<0.1	18.1	0.1	0	0	382.1	1.8	21	160.1	51.2
8	2	266.9	98.2	2.3	0.1	2.1	0.1	35.3	1.6	0	0	0	0	0	0	0	0	2	266.6	5.5
Total	35	233.9	85.3	959.5	2.3	1142.5	2.8	856.3	2.1	291.8	0.7	85.6	0.2	311.0	0.8	2431.0	5.9	41	311.6	100

NOTES:

1 Includes less than 0.1 percent other cichlid, **Haplochromis desfontainesii** and **Hemichromis bimaculatus.**

2 **Labeo niloticus.**

3 **Dicentrarchus labrax, D. punctata, Sparus auratus, Hemiramph s sp.**

4 **Palaemon elegans, Metapenaeus stebbingi.**

TABLE (6)

Lake Manzala Open Fishing Catch by Lake Region for the Period May 1970 to April 1980.

Lake region	Round 1 May-July 1979		Round 2 Aug.-October 1979		Round 3 No.1979-Jan. 1980		Round 4 Feb.-April 1980	
	(t)	(%)	(t)	(%)	(t)	(%)	(t)	(%)
1	216.0	1.5	338.6	2.8	157.8	2.3	109.9	1.4
2	377.7	2.7	492.4	4.1	577.0	8.1	230.4	2.9
3	775.6	5.4	354.6	2.9	739.9	10.4	270.6	3.5
4	1661.3	11.6	2675.2	22.1	2377.2	33.4	1876.0	23.9
5	938.6	6.6	942.4	7.8	750.1	10.5	1509.6	19.3
6	48.4	0.3	356.5	3.0	46.2	0.6	63.4	0.8
7	10067.4	70.5	5881.9	48.7	1765.4	24.8	3445.4	44.0
8	198.9	1.4	1038.2	8.6	698.7	9.8	330.9	4.2
Total	14 283.9	100	12 079.8	100	7112.3	100	7836.2	100

REgions 3 appears to be the most important mullet rearing area in the Lake. Mullet (mainly juveniles) accounts for 23 % (174 t) and 41 % (145 t) of the catch during Rounds 1 and 2 respectively. Of greater significance from a fishery viewpoint is the very low occurrence (0.1 %) or sometimes absence of Mullet in Regions 7 and 8, which contribute about 57 % of the total catch. This is mainly due to the low oxygen concentrations and high nutrient loading resulting from Bahr El-Baqar drainage inflow which carries sewage of Cairo to these Lake regions. These unnormal environmental conditions are marginal for mullet and other less tolerant species (Khalil and Salib, 1986).

Species Composition

Twenty seven species have been identified in Lake Manzala Open fishery catch. A detailed species breakdown of the annual catch is presented in Table 7.

The four Tilapia species account for about 35,000 t, or 85 % of the total annual catch. The species **Saortherodon nilotica** represents 63 % of the Tilapia catch; declining from 73 % during summer to 41 % during winter. Yields of the other Tilapia species remain relatively constant throughout the season. Seasonal patterns of total catch on the Lake are largely determined by the abundance of **S. nilotica**

A total of 900 t of mullet are caught, amounting to 2 % of the total catch. Of this, 86 % are the species **Liza ramada.** Mullet yields peak during August to September, declining to negligible levels in February to April.

The estimated shrimp catch of 2400 t is somewhat misleading, as 98 % of this total is the low value species **Palaeomon elegans.** The bulk of this is caught during a six week period in March and April. It includes an estimated 1 % of 3 to 6 cm mullet fry. In terms of biomass this is insignificant, but numerically this translates into an enormous kill of 20 to 25 million juvenile mullet.

Species composition patterns of this study differ greatly from those shown by historical catch records of 1960's. (Youssef, 1973; Bishai and Youssef, 1977; Shaheen and Youssef, 1978). Mullet and marine species declined from 31.4 % of the total annual catch in 1960's to 8.9 % in 1980. Tilapia and other fresh water species increased from 68.5 % in 1960's to 91.1 % in 1980. The fish yield has increased from 70 Kg/feddan in 1960's to 263 Kg/feddan in 1980. These changes are mainly attributed to the increase of drainage water of the southern drains which are introduced into the Lake, containing organisms and rich in nutrient salts necessary for the flowering and flourishing of the phytoplankton.

On the other hand, the predominance of Tilapia in Lake Manzala is due to their highly tolerance of these marginal environmental conditions in terms of oxygen concentrations, high nutrient loading and salinities (Balarin, 1979). And because of their herbivorous feeding habits, they were able to respond quickly and directly to the increased production of phytoplankton.

TABLE (7)

Species Composition of the Open Water Fish Catch On Lake Manzala
During May 1979 to April 1980.

			Volume (t)	% of Total	% of Species
Tilapia[1]	S. nilotica	21	926.5	53.8	(63.0)
	S. aurea	7	259.0	17.8	(20.8)
	S. galilaea	2	311.6	5.7	(6.6)
	T. zillii	3	324.7	8.1	(9.6)
	Total	34	821.8	85.4	(100.0)
Mullett[2]	L. remada		775.7	1.9	(86.0)
	M. cephalus		126.6	126.6	0.3
	Total		902.3	2.2	(100.0)
Catfish	B. bayad	1	103.3	2.7	(57.6)
	C. lazera		812.2	2.0	(42.4)
	Total	1	915.5	4.7	(100.0)
Eels	Anguilla		309.3	0.8	
Other marine	D. labrax		226.6	0.6	(89.5)
	D. punctata		9.4	-	(3.7)
	S. auratus		0.7	-	(0.3)
	Hemiramphus sp.		16.6	-	(6.5)
	Miscellaneous[2]		48.1	0.1	
	Total		301.4	0.7	(100.0)
Other Fresh water	Lates niloticus		4.3	-	(5.4)
	Labeo niloticus		21.5	0.1	(26.6)
	Cyprinus carpio		5.9	-	(7.3)
	"Green eels"		49.0	0.1	(60.7)
	Total		80.7	0.2	(100.0)
Shrimp	Palaemon elegans	2	312.0	5.7	(95.1)
	Metapenaeus stebbingi		118.3	118.3	(4.9)
	Total	2	430.3	6.0	(100.0)
Total		40	761.3	100.0	

NOTES :

1 Includes less than one percent Haplochromis desfontainesii and Hemichromis bimaculatus.
2 Includes less than one percent mullet fry.
3 A mixture of small D. labax, D. punctata, S. auratus, Hemiramphus sp. and Solea solea.
5 Includes less than one percent mullet fry.

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