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UNIVERSITY OF CALIFORNIA, DAVIS

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I. Introduction

Egypt has four shallow lakes (Figure 1) located along its northern Mediterranean coastline which have an estimated open water fishing area of 324,710 feddans. Table 1 shows the lake areas for 1981, calculated from landsat satellite images (Reid and Rowntree, 82). Lake Manzala, the largest and most productive lake, comprises approximately 51% of the total open lake areas. Lake Burullus, in the mid-delta, is the second largest lake with about 35% of the open lake area. Lakes Edku and Maryut together comprise the remaining 13% of the northern Nile delta lakes open areas.

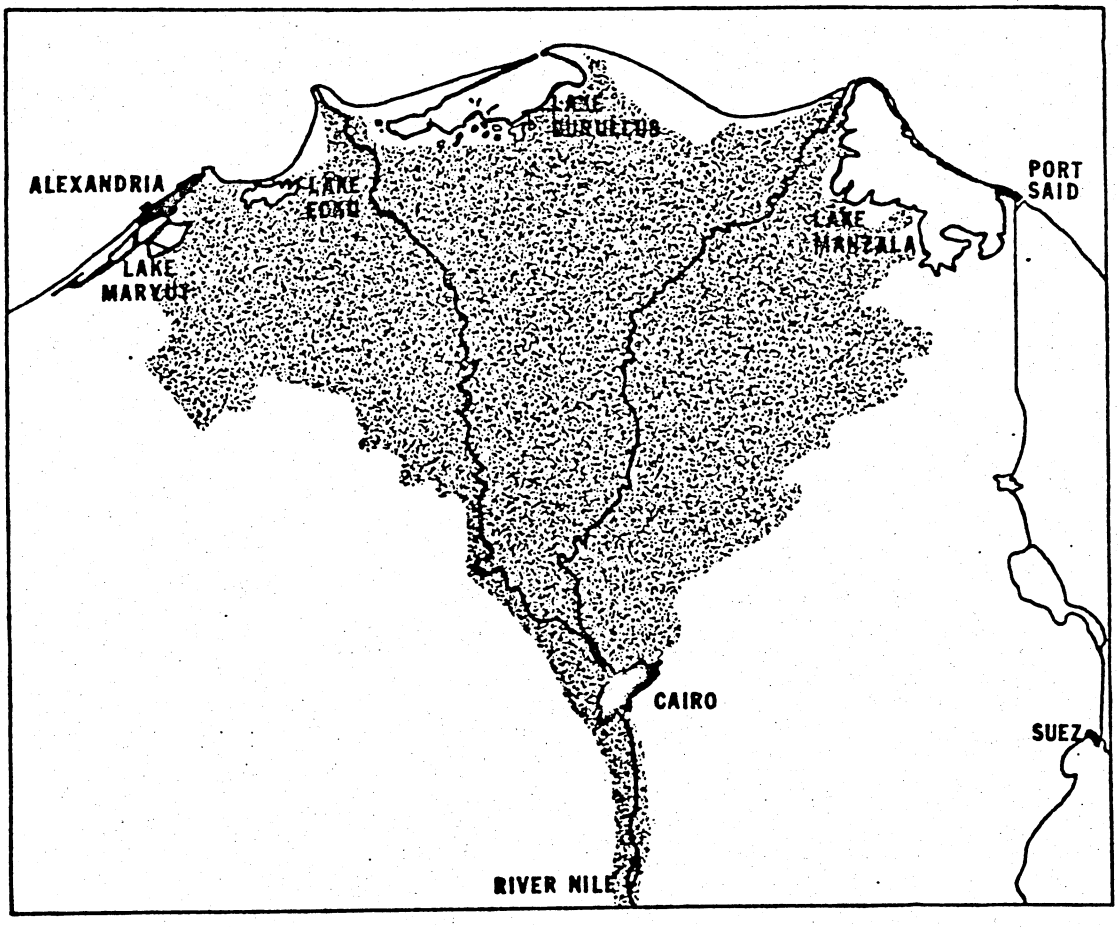
Table 1. Open Lake Areas, 1981

Lake	Area in feddans
Manzala	166,480
Burullus	114,520
Edku	27,470
Maryut	16,240
Total Lakes	324,710

Source: Reid and Rowntree, 82.

These lakes are today about 26% smaller than they were in the period 1953-55, primarily due to large scale public land reclamation projects which have drained parts of the lakes for conversion to agricultural uses. Small scale private land

FIGURE 1 MAP OF EGYPT SHOWING NORTHERN NILE DELTA LAKES, 1983



reclamation efforts, silt build-up, and growth of reeds and vegetation also have been contributory factors in reducing the size of the lakes. Further reclamation plans for the northern lakes by the Egyptian government would reduce the remaining areas by more than half (El-Kholei, 80).

It has been suggested that draining the lakes and reclaiming the land for agricultural uses is the most socially profitable development of these lakes. However, one of the most important costs of developing the lake areas for agricultural production is the value of the fishing that is sacrificed. While there is considerable historical fish yield data, it notoriously underestimates the actual fish yields. The Lake Manzala Study (MacLaren, 82) concluded that the official fish yield statistics underestimated the actual Manzala yields by about 40%. The Lake Burullus Area Development Study (IFAGRARIA, 83) shows that the official Institute of Oceanography and Fisheries (IOF) Burullus yield data accounts for only one-half of the actual catch. In view of the large discrepancies between the officially reported fish catch statistics and those estimated by independent surveys and studies, there is clearly a strong case for improving the fish catch statistics in order that policy makers may make the correct decisions regarding the optimal development of the northern lakes. To the extent that the official yield statistics underestimate actual yields, the benefits of converting lake areas to agricultural uses are exaggerated.

This paper reviews the trends in the official historical northern lakes fish yields and then draws on a survey to estimate the 1982 actual fish catch. This survey was conducted by the

Ministry of Agriculture-University of California Agricultural Development Systems Project research team studying the optimal development of the northern lakes. The 1982 survey highlights several features of the fishing industry which contribute to the fishing intensity in and the yields from the nothern Egyptian lakes. Suggestions for improved data collection and reporting follow the analysis.

II. An Historical Analysis of Fish Yields

II.1. Historical Trends

The only historical data on fish yields, numbers of licensed fishermen and numbers of boats for the four northern delta lakes are supplied from the Central Agency for Public Mobilization and Statistics (CAPMAS) for the period 1962 onwards. CAPMAS data used to be derived from data collected by the IOF survey teams, but from 1977, Ministry of Agriculture figures based on monthly interviews with fishermen form the basis of official fish yield data. Table 2 presents the official CAPMAS fish yield statistics for 1962-80. This data is graphically presented in Figures 2, 3, and 4. These data reveal considerable annual fluctuations in the yields within each lake as well as in each lake's contribution to the total yields. Changes in yields over time are also readily apparent.

Figure 2 shows the 1962-80 fish yields for the total of all four lakes, for Lake Manzala, and for Lake Maryut. A look at Figure 2 shows that the total fish yields for all four lakes reached a peak in 1966 of 43,229 tons, after which the yields

TABLE 2.

NORTHERN NILE DELTA LAKES FISH YIELDS, TONS, 1962-80

YEAR	MANZALA	BURULLUS	EDKU	MARYUT	TOTAL
1962	18951	7549	4416	7844	38760
1963	20112	7796	4343	9526	41777
1964	21870	7242	5059	7059	41230
1965	19321	6769	4074	6622	36786
1966	28370	9149	2841	2869	43229
1967	25029	6002	1807	1685	34523
1968	24407	8598	1208	1138	35351
1969	20591	9257	1295	1900	33043
1970	21977	6916	927	2356	32176
1971	20629	8226	639	2769	32263
1972	21000	7497	763	3846	33106
1973	22131	4556	938	10668	38293
1974	27851	4875	1078	17379	51183
1975	29176	5469	1060	17058	52763
1976	22960	6573	876	10788	41197
1977	23410	6587	1280	13216	44493
1978	23645	6514	632	13985	44776
1979	25223	7018	781	13586	46608
1980	23280	10755	807	14059	48901

SOURCE: CAPMAS

FIG.2. FISH YIELDS, 62-80

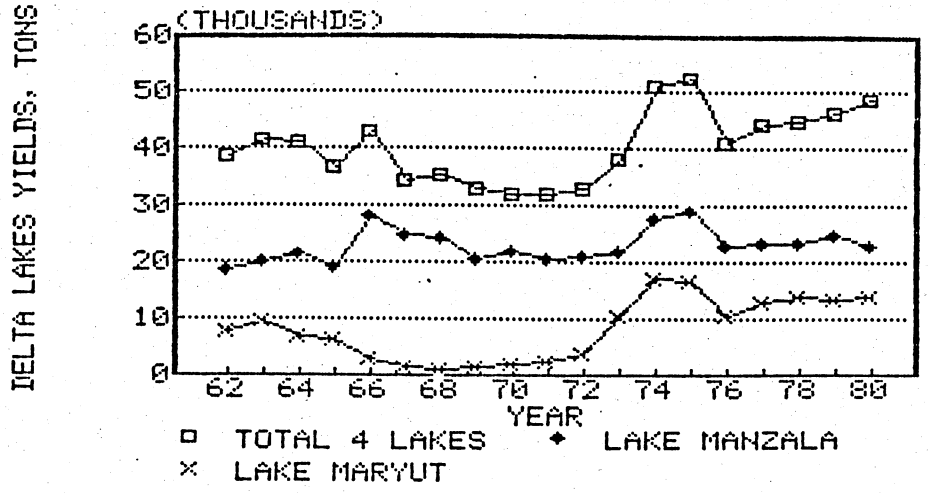


FIG.3. FISH YIELDS, 62-80

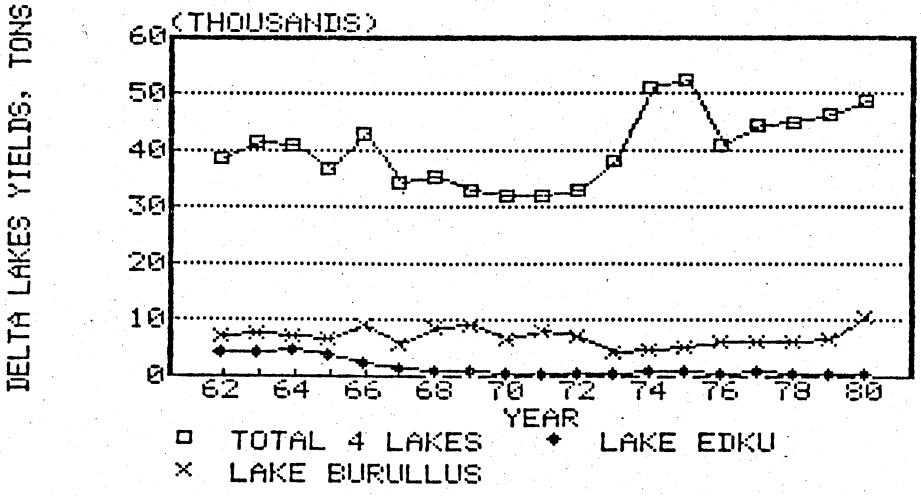
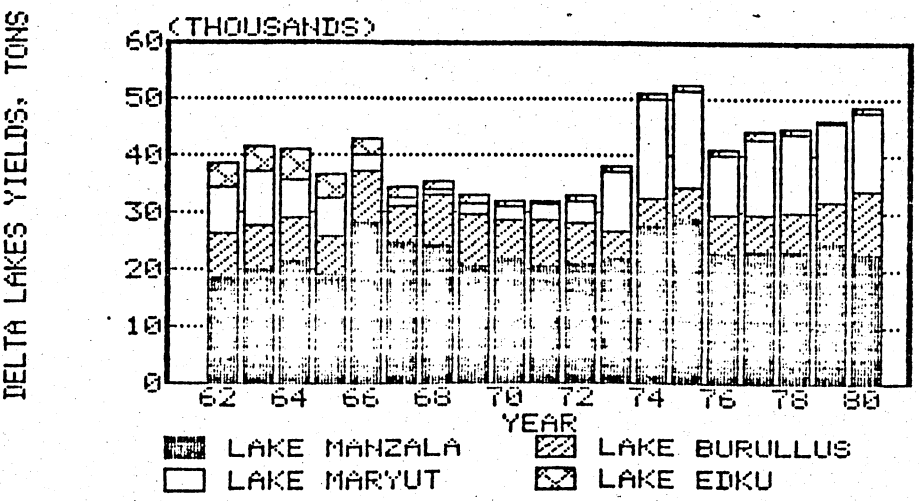


FIG.4. FISH YIELDS, 62-80



declined steadily until 1971-72. A major upsurge in fish yields followed in 1973-75, before yields again fell sharply in 1976. The average annual rate of growth in fish yields from the northern delta lakes over the 19 year period 1962-80 was about 1.3%. Yields in Lake Manzala exhibit similar variations in yield over time. Lake Manzala is clearly the dominant fish producer, yielding about 48% of the total lakes catch in the early years, reaching some 63-65% of the catch in the early 1970's, and falling back to 52-54% of the catch in the late 1970's. By contrast, Lake Maryut's fish yields went into a proportionately much more serious decline in the mid-1960's than did the total lakes fish yields, and the decline began several years earlier. After 1968-69, however, Lake Maryut yields follow and contribute to the general trend in the total lakes fish yields. While Lake Manzala yields grew over the entire period by only 1.0%, 0.3% less than the total for all four lakes, Lake Maryut's dramatic recovery in yields after 1972 led to an average growth rate in Maryut's yields of 7.9% from 1962-80. These two lakes together accounted for about 81% of the northern delta lakes fish yields in the 1977-80 period.

Figure 3 shows the trends in fish yields for the total of all four lakes along with the trends for Lake Edku and Lake Burullus. Lake Edku yields rapidly declined after 1964, and, since 1969, they have remained at less than one-quarter of the 1964 yield. Throughout the 1962-80 period, Lake Edku yields declined at an average annual rate of 10.5%. Thus, Edku yields accounted for only 1.7% of the total northern lakes fish yields in 1980, as compared with 11.4% of the total yields in 1962.

Unlike the other lakes, Lake Burullus had high yields in the period 1968-72, and did not produce increased yields like Manzala and Maryut in the 1973-75 period. While 1980 yields jumped significantly, the overall Burullus yield trend was downward, showing an average rate of decline over the period of 0.6%.

From Figures 3 and 4, it is readily apparent that Lakes Edku and Burullus fish yield variations have not followed the patterns of yields exhibited by the two dominant fish producing lakes. Lakes Manzala and Maryut, on the other hand, have generated and are highly correlated with the total lakes' yield trends. Lakes Manzala and Maryut yields are highly correlated with the yields of all four lakes, with $r = 0.64$ and $r = 0.89$, respectively. Lakes Burullus and Edku, by contrast, are poorly correlated with the total lake yields, with $r = -0.19$ and $r = -0.06$, respectively.

II.2. Possible Causes of Fluctuations in Yields

Numerous suggestions have been advanced to explain these fluctuations in yields. Explanations include the establishment of a predominantly fresh water regime following the construction of the Aswan High Dam; the interruption of normal fishing practices during the periods of hostility in 1967 and 1973; and intensive fishing practices which overtax the productivity of the fish stocks in the lakes. An evaluation of these factors shows that no one of these factors can explain all of the variations.

II.2.1. Aswan High Dam

All the lakes, with the possible exception of Lake Maryut,

were subject to the same change in water regime after 1965, but elevated yields in Lakes Manzala and Burullus coincide with depressed yields in Lakes Maryut and Edku. Manzala exhibited higher yields each year from 1966 through 1968 than it did in any year before the change, 1962-65. Burullus' highest recorded official yields were in 1966 and 1969, and the 1966-69 yields averaged 12.4% higher than in the 1962-65 period. Maryut's yields fell steadily after 1963 until 1969, while those of Edku continued their pre-1965 decline. Thus, the change in the water regime is unable to explain these trends for all the lakes.

An additional factor that has bearing on the historical fish yields is the change in the species composition of the catch due to the altered water regime following the completion of the Aswan High Dam in the mid-1960's. The annual flushing of the lakes with Nile waters followed by gradual salinization by sea water has been replaced by a more or less steady inflow of fresh to brackish water from canals and drains. A fishery dominated by mullet and other marine fish has changed to one in which Tilapia comprise some 80% of the total fish yields. While the mullet are a larger, higher valued fish, the Tilapia are a much more biologically productive species which contribute to increasing the total yields.

Tilapia thrive in eutrophic waters and respond well to heavy fishing pressure. Disposal of most of Cairo's wastewaters into the El-Genki region of Lake Manzala and the consequent development of Manzala's Tilapia fishery have significantly increased fish yields from this lake. Increased wastewater disposal from Alexandria into the north eastern portion of Lake

Maryut has resulted in similarly elevated yields. Lakes Edku and Burullus, on the other hand, mainly receive agricultural drain waters, so although their fisheries are now primarily Tilapia fisheries, their yields reflect the low nutrient concentrations in the water.

II.2.2. Hostilities

Similarly, the periods of hostility cannot explain the individual lake fluctuations, since Manzala, the lake most affected by the hostilities with Israel, increased its proportion of total lakes fish yields from less than half in the early 1960's to more than 60% in the 1967-73 period. Maryut, on the other hand, farthest from the conflict, revealed the most depressed yields during that same period. While this factor is important in assessing the environment in which the fishing industry had to operate, it cannot explain individual lake fish yield fluctuations.

II.2.3. Intensive Fishing Practices

Fishermen on all the four lakes use many illegal fishing methods. Common to all the lakes is the use of undersized meshes which remove fish before they have reached sexual maturity and spawned. Since this is a universal practice it cannot explain fluctuations in yield. On Lake Manzala, however, and to a lesser extent on Lake Burullus, hosha has become a widespread method of fishing. Hosha is a technique of fish capture which involves enclosing an area in the lake by dykes, pumping the water out of the enclosure, and then harvesting the fish. This illegal fish

capture method indiscriminately removes all size classes from the lake and it is widely held that hosha is depressing yields from Manzala and Burullus because of the great frequency with which hosha operators drain their enclosures. Although the post 1975 decline in Lake Manzala's yield could be explained by a concommitant expansion in hosha, this argument does not hold true in Lake Burullus, where fishing yields and the use of hosha techniques have both been increasing. Furthermore, a strong argument can be made that Tilapia, the dominant fish species in the lakes, thrives best under intense fishing pressure so that hosha may contribute to increasing total yields if it is properly managed (MacLaren, 82).

Unfortunately, there are few data that reveal fishing intensities on these lakes. The official licensed boat data is of limited value since the authorities will license only a limited number of boats, the maximum number of which has not changed over the entire period under discussion. Variations in the official numbers of licensed boats are primarily due to irregularities in reporting and enforcement. Accordingly, the coefficients of variation for the officially licensed boats for 1962-79 were only 0.06, 0.07, 0.02, and 0.12 for Lakes Manzala, Burullus, Edku, and Maryut, respectively.

The inability to obtain a boat or fisherman license has not deterred new entrants to this industry. Several studies estimate that the actual number of boats in the lakes in recent years exceeds the number officially licensed boats by 40-50% (MacLaren, 82). The official licensed fishermen data is available but similarly of limited value. Furthermore, the officially licensed

fishermen data for 1962-79 is almost perfectly correlated with the officially licensed boat data.

Currently, researchers are attempting to develop indices of fishing effort for the northern lakes. Preliminary efforts to explain the variations in fish yields by variations in the numbers of boats have not been encouraging. Only on Lake Manzala were there statistically significant linear relationships between yields and licensed boats ($r^2 = 0.49$) and between annual changes in these variables ($r^2 = 0.44$). No similar relationship was found on Lake Edku, for example, because Edku maintained a fairly steady number of licensed boats from 1962-79, while its yields were fluctuating, but declining at an average annual rate in excess of 10%. And Lake Maryut reported slightly fewer licensed boats in the 1977-79 period than in the 1962-64 period, despite the fact that its yields exhibited wide fluctuations and were were 60% higher in the later period than in the earlier. Reliable data are not yet available to determine the extent to which variations in fishing intensity can explain variations in the fish yields.

Difficulties in measuring fishing effort or intensity are compounded by institutional arrangements on the lakes. The apparent free access is limited by informal arrangements among fishermen dividing up the lakes into "private plots." While there are some open areas where all can fish, most of the more productive areas are divided up and the rights to fishing in those areas are claimed by families by tradition. Due to this, fishing intensity is regulated to a certain extent by the limited

ability of the individual boats (the "firms") to vary their fishing intensity in their own fishing areas.

III. Problems With Official Yield Statistics

III.1. Inconsistent Collection and Underreporting

The official historical fish yield statistics are useful for discerning the general trends in fish catches in the northern Nile delta lakes, but the methods of collection and reporting have varied considerably over the years and there has been little effort to resolve the inconsistencies. The two major data collection agencies, the IOF and the MOA, each uses techniques that lead to serious underreporting. The IOF, in cooperation with the Egyptian Coast Guard, has obtained fishery statistics since 1962 by weekly surveys of 20 ports. After 1966, these collection techniques deteriorated, and the IOF itself suggested that the official yields were underreported by up to 40% by the mid-1970's (MacLaren, 82).

The MOA estimates are unavailable for the years 1972-73. Prior to that the MOA estimates were based on yields which required the fishermen to pay a one piaster tax per kilo of fish at official checkpoints, a method notorious for encouraging underreporting. After 1974, the MOA estimates were based on monthly interviews with the fishermen collected at the governorate level. These interviews are conducted at the official landing sites, leading to underreporting of the actual catch figures, since an unknown quantity of fish bypasses these official sites. CAPMAS, the only agency with a relatively

complete series of fish catch data, actually used IOF data through 1976, after which it switched to using MOA data.

III.2. Open Lake Fishing Versus Hosha Fishing

While the unsystematic collection techniques contribute to some of the wide variations in the reported data, another quite severe problem with the official fish yield data is the uncertainty as to what it includes. Fish production in and around the lakes is composed of three components: open lake fishing, hosha, and fish farming. Hosha was introduced into the lakes some 35 years ago, and has been spreading widely in the last 4 or 5 years, particularly in Lake Manzala. The MOA estimates that this illegal fish capture method now occupies an estimated 90,000 feddans, mainly in Manzala, with some in Burullus, a small area in Edku, and none in Maryut. The MOA reports that the hosha yield in 1982 was some 30,000 tons of fish, but it is unknown what proportion of this hosha catch has been included in the official lakes fish yield statistics. All of the hosha yields that pass through the official landing sites and are sold by the lake side merchants are presumably counted in the surveys. Unfortunately, since the harvesting method is illegal and since there is a great deal of antagonism between open lake fishermen and hosha operators, one can only speculate on the extent to which the official lakes fish yields are representative of total actual yields.

It appears that steps are being taken to introduce better fishery management practices in the lakes. Being unable to eliminate hosha by making it illegal, the government in the past

few years has decided to legitimize it, even licensing it on Manzala and Burullus if the operators will cooperate with MOA officials by switching from a pure capture technique to a modified hosha-fish farm technique. The MOA is encouraging fish feeding and rearing, thus reducing the frequency with which the enclosures are drained. In addition, the new policies continue to discourage hosha enclosures in the immediate vicinity of the bougaz (opening to the sea), adjacent to the islands in the lakes, at the mouths of drains and canals, or within 200 meters of each other. The new policies thus discourage hosha if it impedes water flows within the lakes or excessively endanger the breeding habitats of fish in the shallow waters near the shores.

IV. The Survey of Fishermen

IV.1. Survey Methods

As part of the study for the optimal development of the northern lakes, an ADS research team conducted a survey of fishermen on their boats in the lakes in November and December, 1982. The sample was stratified by lake and by production site (fish landing site), selecting the number of observations from each production site according the the proportion of official fish yields landed at each site. Approximately 8% of the official number of licensed fishing boats in 1982 were sampled. Out of the total of 680 interviews conducted with boat captains, 379 were in Manzala, 120 were in Burullus, 40 in Edku, and 141 in Maryut. A pre-test of the interview document was run in late October-early November, following which the final survey instrument was designed and interviewing was conducted over the

next two months by MOA enumerators who took boats into the lakes to accomplish the survey.

The survey produced a wealth of data concerning the fishermen, their yields by kilo, by type of fish, and by season, their marketing methods, credit facilities, prices received for their fish, their costs of production, including capital and variable costs, boat maintainence costs, numbers of hired and family laborers and their wages, and a host of information concerning the age, family size, residence, and so forth of the fishermen. First, highlights of the survey results will indicate the nature of the fishing industry in the northern Nile delta lakes. Second, the total fish yields of the lakes is estimated from the survey results.

IV.2. Survey Results

IV.2.1. Fishing Firms

The survey confirmed the thesis that each fishing boat usually represents a fishing firm. 97.5% of the boat captains reported fishing as their main occupation, and 93.5% reported owning their own boats. These fishing firms are primarily family operations, with almost 60% of the total fishing labor being reported as family labor. Only 15.5% of the fishing labor was hired as permanent labor, the remaining 24.5% of the labor being seasonal and temporary. Furthermore, about 97% of all temporary and seasonal labor and about 54% of all permanent workers reported in the sample were employed on Lake Manzala, confirming that Manzala has the most productive and most commercialized

fishing industry. The boats on Manzala, too, are much larger than those on the other lakes, having an average value of LE 609, as compared with an average value of LE 497, LE 236, LE 136 per boat on Burullus, Edku, and Maryut, respectively.

Out of the 680 boats in the sample, 595 were officially licensed, while 85 were unlicensed. Other studies (e.g., MacLaren, 80) and government officials suggest that there are about 40% more boats actually fishing on the lakes than are officially licensed. Our sample showed only 12.5% unlicensed boats. There is some complexity in estimating the number of fishing boats primarily because it is difficult to decide what is the proper fishing unit. On Lake Manzala it is common for one large fishing boat (markeb) to be accompanied by one or more small boats (faloukas). These smaller boats, owned by the owner of the main fishing vessel, do not operate independently of the "mothership."

The total number of smaller boats accompanying the interviewed boat captains was not recorded. However, the enumerators did record 91 additional "helper boats," mainly on Lake Manzala, which together with the unlicensed boats in the sample might suggest that there are at least 26% more boats actively fishing than the number of licensed boats in the sample. However, our survey focussed on the "fishing firms" in the lakes and thus these smaller "helper boats" were not included in the total number of licensed and unlicensed boats used to project total fish yields in the lakes.

IV.2.2 Marketing

Most of the boats market their fish through a single channel, primarily through shore-based merchants (teygir). However, some merchants send collector boats into the larger lakes to collect the fish catch from fishermen and land-based hosha or fish farm operations. On Maryut and Edku, the smallest lakes, all but 4 of the sampled boats marketed 100% of their fish through shore-based merchants. On Manzala and Burullus, about 97% of the boats marketed all of their fish through a single channel. The Burullus fishermen were divided about equally between those marketing solely to shore merchants and those marketing solely to collector boats. The Manzala fishermen depended primarily on shore merchants (about 68% versus about 28% depending on collector boats).

Additional study of the 1982 survey data is expected to reveal the extent to which the competitiveness of the fishing industry is constrained by institutional factors such as the role of the limited number of fish merchants. While there are more than 8,000 licensed boats operating on the four lakes, the MOA estimates that there are fewer than 100 regular fish merchants. However, most of the credit extended to fishermen is from the merchant to whom the fish catch is marketed. Out of the 379 boat captains interviewed on Lake Manzala, 216 had loans outstanding in 1982, 87.5% of which were loans from the merchants to whom they sell their fish. Loans were relatively uncommon on the other lakes. Just as in Egyptian agriculture, Egypt's fisheries are composed of both market-oriented and traditional elements, which together determine the industry' efficiency.

IV.2.4. Fishing Days

The total lakes fish yields are projected from the estimates of yields per boat per fishing day. Our total lake yield projections are thus sensitive to the number of fishing days actually fished. There were 275 fishing days in 1982. This is consistent with the general view that fishermen do not fish on Fridays and with the Department of Meterology's report that there were 55 days in 1982 during which boats should not have been on the lakes due to bad weather. Most of these bad weather days were in the winter season and only about 15% of them fell on Fridays. Our estimate of fishing days falls between the Lake Manzala Study estimate of 267 fishing days in 1979-80 and the Lake Burullus Area Development Study estimate of 295 fishing days on Lake Burullus in 1982.

IV.3. Fish Yields

IV.3.1. Total Yields

Based on interviews with 680 fishing boat captains, the fish yields per boat per day of fishing were calculated. These estimates were used to project the total fish yields by lake. The total yields by lake were calculated by multiplying the yield per boat per day by season times the total number of boats and the fishing days by season by lake, and then adding up the seasonal and lakes totals. Table 4 shows the projected estimates. The total lakes fish yields were estimated at 99,497 tons, some 91% higher than the 1982 yield projected from the (least squares regression) trend in the official historical data.

Table 4. Estimated Northern Lakes Fish Yields, 1982

	Total Lakes	Manzala	Burullus	Edku	Maryut
Yield, Tons	99,497	59,093	17,561	6,635	16,478
Proportion of Total, %	100%	59	18	6	17
Yield/Boat, Tons	12.03	20.85	6.01	4.74	14.06
Yield/Fed, Tons (1)	.31	.35	.15	.23	1.02

Notes: (1) Yields divided by areas from Table 1.

Since virtually all independent estimates of fish yields have been higher than the officially reported yields, these survey yields are not surprising. However, the variations among the lakes is highly revealing. Manzala produced 59% of the total northern lakes fish catch, a finding consistent with the historical series. Burullus, Edku, and Maryut accounted for 18%, 6%, and 17%, respectively, of the total fish yields. The yields of Burullus and Edku were both substantially higher than expected. The relative inaccessibility of Burullus, and the relatively small size of Edku with its small family operations and its proximity to Alexandria, probably result in fish leaving the lake without going through official marketing channels and so depressing official yields. The 1982 survey suggests, too, that Lake Maryut's officially reported yields are more closely in line with actual yields than are those reported for other lakes. This better reporting may be due to the very small size of Maryut and the highly organized marketing cooperatives in the Alexandria.

On the other hand, the relatively low 1982 Maryut yields revealed by the survey may be an early indication of falling yields in the lake most in danger of excessive pollution and eutrophication.

The official fish yield statistics do not reflect the actual yields. The official yield series represent only about 52% of the actual catch as estimated from the 1982 survey. The historical series are now recognized as being inadequate, and, accordingly, the official statistics for 1981 and 1982 have not yet been released. The MOA Undersecretariat of Aquatic Resources' planners use "unofficial" yield estimates for the lakes for 1982 that are substantially higher than would be expected by following the trends in the historical data and are much more in line with the projections from the 1982 survey than are the earlier data. It would appear that the MOA's own catch assessment procedures are currently undergoing some revision.

IV.3.2. Yields Per Boat

According the 1982 survey, the yields per boat are quite substantial. In Manzala each boat averages more than 75.8 kg/day of fishing. This compares with yields in Burullus, Edku, and Maryut of more than 21.9, 17.2, and 51.1 kg/day of fishing, respectively. Total annual fish yields per boat in the 1982 survey were 20.85 tons in Lake Manzala, compared to 6.01, 4.74, and 14.06 tons per boat per year in Lakes Burullus, Edku, and Maryut, respectively.

Lake Maryut provides an interesting case study. It has been so sculpted to non-fishing uses that only a small extremely productive portion of the lake is currently fished; small boats

in small family operations on Maryut are thus the most productive per unit of investment on any of the lakes.

IV.3.5. Yields Per Feddan

The fish yields for the lakes can also be expressed on the basis of yield per unit area. These values are shown in Table 4. There is wide variation between the values, Lake Manzala having 0.35 tons per feddan, Lake Burullus having only 0.15 tons per feddan, Lake Edku having 0.23 tons per feddan, and Lake Maryut producing 0.91 tons/feddan. These figures highlight the relative productivity of each lake, but can be misleading if considered in the absence of local knowledge. For instance, the Lake Manzala value of 0.35 tons/feddan does not reflect the extremely heterogeneous nature of this large lake in terms of productivity, it being less productive than Lake Burullus in the north and considerably more productive than Lake Maryut in the southern El-Genki region. Lake Maryut, on the other hand, is fished almost exclusively in approximately 6,000 feddans of nutrient enriched waters northeast of the Mersha Matruh Causeway.

IV.3.4. Seasonal Yield Patterns

The seasonal yield pattern has always followed a general pattern of rising yields per boat from the spring until mid to late autumn. Although the peak fishing month was October in the 1962-66 period, the peak fishing month gradually became earlier in the year so that in the 1975-80 period, August was the peak month. Yields then declined until February or March, after which the lakes again exhibited rising yields per boat per day.

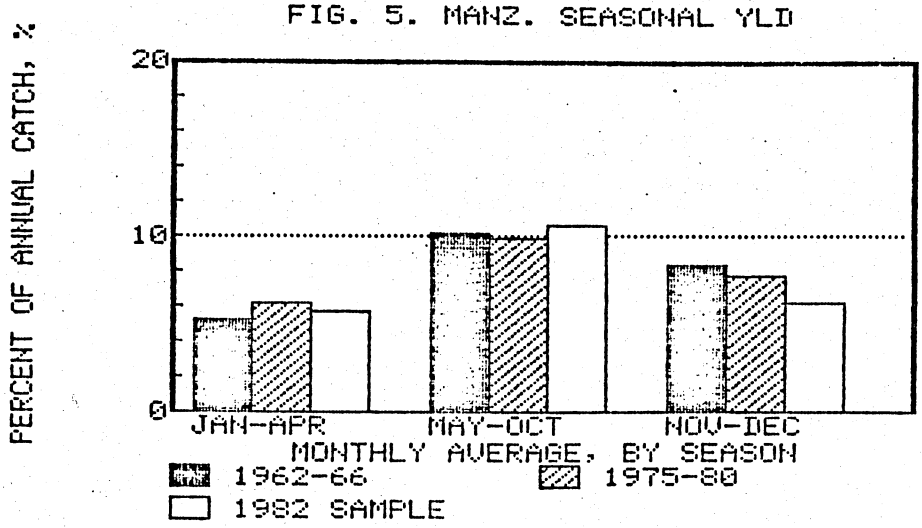
The 1982 sample confirmed the general seasonal patterns in the historical series. Fishermen classify the fishing year into 3 seasons, January to April (the off-season), May to October (the peak season), and November to December (the poor season). Figure 5 shows the monthly average percentage of annual catch by fishing season for Lake Manzala for the 1962-66, 1975-80, and 1982 sample periods. The Jan-Mar period has yielded about 5-6% of the annual catch each month, while the May-Oct period has yielded 10-11% of the annual catch each month, and the Nov-Dec period has yielded 6-8% of the annual catch each month. The 1982 survey data suggest that the trend toward declining productivity in the Nov-Dec period relative to the May-Oct period is continuing. The decline of the mullet and other marine fishes, which formerly contributed a large portion of the Nov-Dec catch, in Lake Manzala has contributed to this trend.

Increasingly, there are simply two fishing seasons, May-Oct and Nov-Apr, with the productive May-Oct period producing about two-thirds of the annual catch (64% in the 1982 survey), or yielding about twice the catch per boat per day of fishing as in the other six months of the year.

V. Conclusions and Recommendations

The northern Nile delta lakes are productive fisheries for Egypt, but there are indeed serious problems in the techniques used for collecting and reporting the estimated fish yields from these fisheries. In part, these difficulties arise from the relatively traditional and unorganized elements in the fishing industry. More serious, however, are the inadequacies in the

FIG. 5. MANZ. SEASONAL YLD



sampling techniques employed, the selection of the enumerators, the irregular or intermittant collections, and the lack of a centralized, coordinated organization to follow through on the catch assessments. There is also little information on the marketing and consumption of fish to act as checks on the yield data.

Hosha is another aspect of the fishery on which there is little data collection. Hosha is an increasingly important component of the total yields in the lakes, and it is likely to become an even more important part of the total yields as hosha techniques become redirected to fish culture rather than simple capture, and as hosha becomes licensed and better accepted. Since improved hosha will tend to increase the average fish size in the total catch, the tonnage, and more importantly, the value (since larger fish are relatively more valued per kilo than smaller fish) will further increase.

The results of the fishing survey highlight the need for the Egyptian government to implement improved methods for fish yield surveys. A statistical approach to such surveys would enable an official agency to minimize costs while ensuring that the data obtained are both valid and reliable. Such survey techniques are clearly defined by G. P. Bazigos in The Design of Fisheries Statistical Surveys--Inland Waters (74). Fisheries management also requires assessments of the fish stocks. Management and licensing of fishing units and techniques must be based on accurate fish stock assessments in order to determine the fishing intensity that will maximize the value of the fish yields. The FAO has numerous publications on this subject, including that by

J. A. Gulland, Manual of Methods for Fish Stock Assessments (69).

Both data collection on the lakes and research on the status of the lakes is being undertaken by a number of unrelated agencies. It would seem highly desireable that for purposes of planning that a single agency be responsible for the data on these lakes and fisheries. Such an agency would be well suited to provide reliable information for policy makers on such varied issues as assessing the returns to Egypt of continuing to channel the bulk of Cairo's wastewater to Manzala, assessing the net impact of the El-Salaam Canal and concurrent developments of the Sinai and assessing the returns to reclaiming all parts of the northern lakes for agricultural uses instead of maintaining or improving the existing fisheries.

References

1974 Bazigos, G. P. The design of fisheries statistical surveys--inland waters. FAO Fisheries Technical Paper, (133), 122p.

1980 El-Kholei, O. A research proposal: an economic investigation of reclaiming soils of northern Egyptian lakes versus their development for fish production. Agricultural Development Systems Project, University of California, Ministry of Agriculture, Cairo, Egypt.

1969 Gulland, J. A. Manual of methods for fish stock assessment, part 1. fish population analysis. FAO Fisheries Manual in Fisheries Science No. 4, Rome, Italy, 154p.

1983 Ifagraria. Lake Burullus area development study. ARE Ministry of Development, Governorate of Kafr El-Sheikh, and Ifagraria, s.p.a., Rome, Italy, (March), 372p.

1982 MacLaren Engineers, Planners & Scientists, Inc. Lake manzala study. ARE/UNDP/EGY/76/001-07, Cairo, 11vols.

1983 Reid, Turid and John Rowntree. The northern Nile delta lakes and their fisheries. ADS Economics Working Paper No. 90, ARE Ministry of Agriculture-University of California, Cairo, Egypt, 84p.