

**RELATIVE EFFICIENCY OF STATISTICAL SAMPLING DESIGNS
AT FORN EL-GRAYA FISHING CENTER IN LAKE MARIUT.**

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ABSTRACT

The aim of this study is to examine the relative efficiency of simple random statistical design, which is adopted in the major fish landing center in Lake Mariut of Forn El-Graya, and an alternative suggested design of stratified simple random method, by comparing co-efficients of variations of catch estimates under each design during the period of study from November 1983 till April 1984.

Under the suggested design, total number of merchant's shops located in Forn El-Graya center has been grouped according to size of its daily transactions of landed fish into three statistical categories.

It was found that for each month, the calculated values of coefficients of variations have been noticeably reduced in the suggested design than their corresponding values under the existing design. It can be concluded that, the alternative design has resulted in a higher precision of catch estimates than the existing design.

INTRODUCTION

Statistical sampling has been adopted at Lake Mariut since 1962, for estimating its annual fish catch. Eight landing centers has been defined on the Lake for collecting statistical data, on the basis of simple random sample type, at each of these centers.

Forn El-Graya is by far the major center on the Lake, its average contribution during 1971-1982 period was about 51% of total fish production from the Lake annually, (Anon. 1).

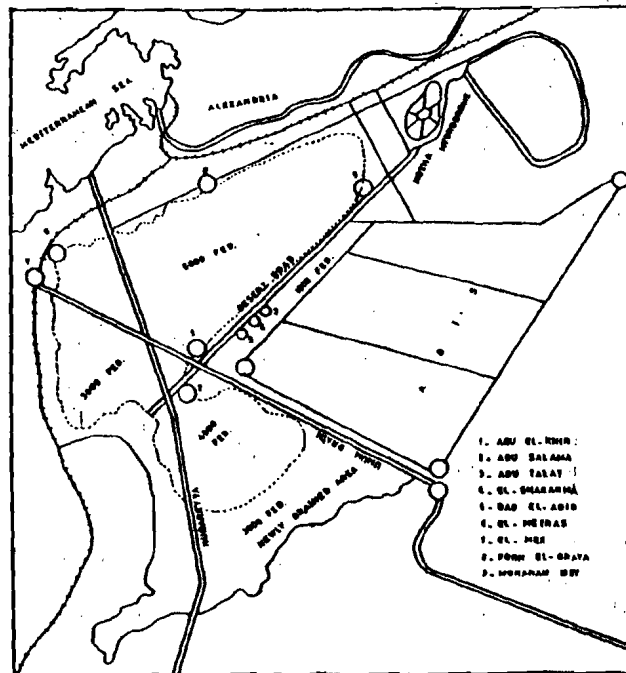
The study aims at examining the relative efficiency of the existing statistical design, which is applied at Forn El-Graya, i.e., simple type, and an alternative design of stratified simple random type, by comparing the calculated percentage sampling error, i.e., through calculating co-efficients of variations (C.V.) for each design.

Data needed for the study were collected and calculated from Frame survey (F.S.), and Catch Assessment Surveys (C.A.S.), which were executed in Lake Mariut in the years 1982 and 1983, through the Project of Fishery Statistics, as well as, from the statistical year-book of fish catch issued by the National Institute of Oceanography and Fisheries, and from the General Authority of Fish Resources Development in Alexandria.

DISCUSSION

Two statistical surveys has been conducted at lake Mariut, the first survey, i.e., F.S. was executed in September 1982, in order to define the existing outlets on the lake. The second survey, i.e., C.A.S. was executed in the same month to examine magnituded of fish landing at each outlet.

According to F.S., eight landing sites were defined at the Lake, namely, El-Mex, Forn El-Graya in addition to an outlet of passing fishes in Moharam Bey. (Fig. 1).



Map (1): The defined landing cepters at lake Mariut.

From table 1, it is obvious that total catch from the entire Lake in the survey day was about 53.1 tons. By examining the relative importance of these outlets, it can be seen that Forn El-Graya is the biggest outlet accounting for about 63.9% of the total catch. The contribution of El-Metras and Moharam Bey were 11.1% and 9.3% respectively, while the contribution of the remaining outlets did not exceed more than 1-2%. About 65% of the total number of fishermen in Lake Mariut works at Forn El-Grata. As to time of landing fish, it was found that some 63.5% of the total catch was landed during morning hours, the remaining catch was landed mainly at Forn El-Graya after noon. (Table. 1).

According to the results of the survey, sample data from Forn El-Graya center, were continued to be collected on the basis of the existing design, i.e., simple random method, where data on catch are recorded on eight days randomly selected per month. The work lasts at each sample day for 24 hours.

Tabulation of data and statistical analysis:

Primary statistical data collected for September and October 1983 were revised and tabulated. To calculate estimates of total catch for each month, the following statistical method was used (Panse et al., 1957 and Eid, 1983).

$$\hat{Y} = N \bar{Y}$$

Where, \hat{Y} is the estimated total catch per month; N is the total number of days in the month; \bar{Y} is the average catch per day.

Table 2 shows that, the estimated total catch at Forn El-Graya in September and in October 1983 were 492.2 tons and 689.0 tons respectively. To estimate the percentage sampling error in each of these two months, the following equation was applied (Panse et al., 1957) (Eid, 1983):

$$C.V.\bar{Y} = S_{\hat{Y}} \cdot 100 / \hat{Y}$$

where, $S_{\hat{Y}}$ is the standard error of the estimated total catch Y.

The estimated percentage sampling error (C.V.), calculated for each month was high and amounted to about 16.5% and 36.8% respectively, (Table 2).

A particular nature of delivering the catch has been observed during P. S. and C. A. S. at Forn El-Graya, which differ than the situation in any of the other centers in Lake Maruit. From table 1, it can be seen that the work at this center lasts almost all the day round at several merchant's shops with a total of 21 shops scattered on a long shore which constitute about 65.5% of total shops at the entire Lake. Such a situation, together with lack of enumeration staff makes it difficult to record all the landed catch on sample days of all the merchants. The higher observed values

TABLE 1
Magnitude of fish landed at the defined outlets around Lake Mariut
in the survey day.

Outlets	L.g.	Landings %	Time of landing		Fisherman number	Merchant's stoops number	%
			morning	after noon			
Abu El-Dhir	5881	11.1	5020	861	360	5	15.6
Abu Salama	2822	1.5	7751	71	59	-	-
Abu Talef	6687	1.2	667	-	37	2	6.3
E1-Sharara	660	1.2	660	-	70	2	6.3
Bab El-Abid	1097	2.1	1097	-	68	2	6.3
E1-Matras	4548	8.6	4548	-	285	-	-
E1-Max	561	1.1	561	-	38	-	-
Forn El-Grays	3398	63.9	15582	18316	1680	21	65.5
Beharar Bay	4963	9.3	4850	103	-	-	-
Landings L.g. %	53087	100.0	33736 63.5	19351 36.5	2597	32	100.0

Source: Frame Survey, and Catch Assessment Survey at Lake Mariut-Sep. 1982, project of Fishery Statistics, Egypt.

TABLE 2
 Monthly catch estimates (\hat{Y}), and co-efficient of variation (C.V.) at Form El-Graya
 fishing center by two statistical designs for the period Sep. 83-Apr. 1984.

Design	Existing		Alternative	
	Y	C.V. %	Y	C.V. %
Month				
September 1983	492.2	16.5	-	-
October 1983	689.0	36.8	-	-
November 1983	328.1	14.1	367.3	9.8
December 1983	332.8	15.5	394.3	10.8
January 1984	334.9	12.3	383.9	5.6
February 1984	381.4	15.2	432.5	6.2
March 1984	301.8	9.9	346.7	8.4
April 1984	223.9	10.7	243.9	6.7

Source: Collected and calculated from survey data, and from general Authority for fish resources development, Alexandria, Egypt.

of C.V. in table 2 might be raised from these factors. Consequently, another design of stratified simple random method was suggested to be compared with the existing design.

A census type survey was executed on this purpose in September 1983 at Forn El-Graya center, to record all merchant's shops, and to examine the size of their daily transactions of fish, beside recording the catch landed outside shops, and passed directly to outer markets.

According to the survey, a list of names of the owners of these shops was made, and two outlets had been defined east and west of the center.

The survey data were recorded and tabulated for statistical analysis. The merchant's shops were grouped according to the size of transaction into different categories. The standard error for each category was calculated, to test the degree of precision at 5% level of significance, values were calculated and compared with its corresponding tabular values.

According to the analysis, three statistical categories were defined as follows:

The first category: Thirteen merchants are included in this category. The size of their daily transaction is less than 500 kg with an average of 250 kg /day. The following estimates were calculated:

Standard error = 37.277 kg;

t value = 0.196

tabular t value

d.f 11, 5% = 2.301

Merchants of this category are given code numbers from 101 onward till 113.

The second category: Six merchants are included in this category. The size of their daily transaction is larger than 500 kg with an average of 100 kg / day, the following estimates were calculated:

Standard error = 159.459 kg;

t value = 0.758

tabular t value

d.f 5, 5% = 2.571

Merchants of this category are given code numbers from 201 till 206.

The third category: This category includes the remaining two merchants, the work at their shops starts before sunrise or lasts after sunset. They are coded with numbers 301 and 302 respectively.

As to the catch which is not delivered at any of the merchant's shops, it will be recorded in one of the two defined outlets. The work at these outlets will continue for 24 hours at each of the sample days.

The new design is a simple stratified two-staged sampling. The primary units of sampling are 8 days, randomly selected for each month as in the former design, while the next stage in the new design will be the number of merchants shops randomly selected at each category. A sample of two shops will be drawn at each of the three categories on sample days.

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In the new design, data of landed fish will be collected in each sample day from the selected shops at each category, in addition to data on passed fishes at the two outlets,

The new suggested design was put under study from November 1983, together with the existing design. Sample days which were selected every month, will be the same for each of the two designs, i.e., for each sample day, two different groups of data were recorded.

Tabulation of data and statistical analysis

The estimated total catch at Forn El-Graya was collected for each month on the basis of new design. For each category, total catch was estimated as in the former design by the simple method, (Panse et al., 1957 and Eid, 1983), as follows:

where, \hat{Y}_j is the estimated total monthly catch landed at the j^{th} category, N is the total number of days in the month, and \bar{Y}_j is the average daily catch landed at the j^{th} category which is calculated by the following equation (Panse et al., 1957 and Eid, 1983):

$$\bar{y}_j = M/m \left(\sum_{i=1}^n Y_i \right) / n$$

where m is the number of selected merchants in the j^{th} category, and M is the total merchants of this category, n is the number of sample days per month, and Y_i is the catch landed in the i^{th} day at the selected shops.

For each outlet, the total of the catch which was not delivered during the sample days at any of the merchant's shops was estimated by the simple method (Panse et al., 1957 and Eid, 1983) as follows:

$$\hat{Y} = N \bar{y}_k$$

where k is the number of outlets.

So, the estimated total catch at Forn El-Graya center, is obtained as follows:

$$\hat{Y} = \sum_{j=1}^3 \hat{Y}_j + \sum_{k=1}^2 \hat{Y}_k$$

From Table 2, it can be observed that, while the values of C.V. for the existing design range from 9.9% to 15.2%, these values had been reduced noticeably, under the suggested design, it ranged from 5.6% to 10.8%.

According to the above findings, it can be concluded that, the new design for collecting statistical data at Forn El-Graya center has resulted in a higher precision to catch estimates. It is recommended to follow applying the suggested design for different fishing seasons, in prelude to substitute the existing design.

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