# SELECTIVITY OF GILL AND TRAMMEL NETS FOR CYPRINUS CARPIO AND BARBUS BYNNI OF THE NOZHA HYDRODROME

*By*

M.T. Hashem, I.A. Soliman and A.A. Al-sayes

## INTRODUCTION

Gill nets are considered to be one of the most important fishing gears of the world. They are widely used in both marine and fresh water fisheries. In Egypt; especially in inland waters (Nile and lakes), trammel nets are also used on wide scale for fishing Tilapia and other fresh water fishes.

In order to evaluate the effect of mesh selection, comparative fishing experiments were carried out in the Nozha hydrodrome from April till December 1968, with both gill and trammel nets of four different mesh sizes.

The present work is carried out to give a review of these experiments, with the aim of studying the efficiency and selectivity of gill and trammel nets for the common carp (Cyprinus carpio) and Barbus bynni of the Nozha hydrodrome.

*Place of erperiments :*

The experiments were carried out in the Nozha hydrodrome, which is an isolated part of Lake Mariut (near Alexandria), having an area of 504 hectars and and average water depth of about six meters. The hydrodrome is regularly supplied with fresh water from the Nile through the Mahmoudiah Canal and is used as a fish farm for rearing fresh-water fishes, such as Tilapia species, Barbs bynni, Labeo niloticus, Lates niloticus and various cat-fishes of the genera Clarias, Bagrus and Synodontis (Elster, 1960).

Grey Mullets (Mugil cephalus and Mugil capito) and Anguilla vulgaris are annually transplanted as fry from the sea and contribute a considerable percentage of the catch of the Nozha hydrodrome. In order to utilize all the available food resources of the Nozha hydrodrome for the production of fish flesh, the common carp was introduced in February and March 1965. This exotic fish has successfully established itself in the new environment.

Commercial fishing operations were periodically carried out with different fishing gears, including gill nets, trammel nets, seine nets, cast nets, and wire traps. Eash of these fishing gears had different mesh sizes. Long lines with baited hooks were also used to catch Eels and Cat-fishes.

Table (1) shows the commercial catch of the Nozha hydrodrome during the period from 20 October 1968 to 27 April 1969. The percentage contribution of the different species in the catch can be considered as a good representation of the fish populations of the Nozha hydrodrome. The carp was the dominant fish, representing (50.48%) of the catch followed by Mullet (27.05%) and then Lates niloticus (10.92%) while the Barbus bynni contributed a small portion of the population (1.69%).

*Materials and methods :*

Experimental fishing operations were carried out by the Alexandria Institute of Oceanography and Fisheries. The catch data were obtained from experimental nylon gill and trammel nets. Four sets of each type, having different mesh sizes were used in the hydrodrome from April to December 1968.

TABLE 1.—The commercial fish production of the Nozha hydrodrome from 20 Oct. 1968 to 27 April 1969

| Fish species | Fish Catch | |
|---|---|---|
| | kg. | % |
| Carp . . . . . | 57400.0 | 50.48 |
| Grey Mullet . . . . . | 30761.0 | 27.05 |
| Lates niloticus . . . . . | 12418.0 | 10.92 |
| Tilapia . . . . . | 3224.0 | 2.84 |
| Bagrus bayad . . . . . | 3085.5 | 2.71 |
| Barbus bynni . . . . . | 1921.5 | 1.69 |
| Labeo niloticus . . . . . | 608.5 | 0.54 |
| Other species . . . . . | 4283.0 | 3.77 |
| Total . . . . . | 113701.5 | 100.00 |

Tables (2) and (3) show the mesh size, hanging ratios and the other dimensions of the different nets used. The sets were given serial numbers. The mesh size is measured as the length of two bars or in other words the distance between three successive knots.

In order to avoid that the nets do not meet statistically reliable conditions, the positions of the nets were changed symmetrically every day giving equal chances for every net to catch the fish. The fishing time was 24 hours daily.

Records on the catch of each mesh size for every species as regards the number and weight were kept separate. The total length and girth of carp were measured to the nearest millimeters.

*Efficiency of Gill and Trammel nets for different fish species :*

Tables (4) and (5) show the experimental catch from April to August 1968; when the experimental nets were operating alone in the hydrodrome; in this way the experimental catch gives an idea about the efficiency of the gill and trammel nets used. As for the efficiency of gill nets, Barbus bynni constituted 39.11% of its catch, Carp — 20.31% and Bagrus bayed — 15.67%. In case of trammel nets the Carp constituted 67.68% of its catch followed by Barbus bynni — 14.79%.

Therefore it can be concluded that both the gill and trammel nets were very efficient in catching the Carp and Barbus bynni. This is clearly observed in Fig. (1), where the percentage abundance by weight of every fish species in the experimental and commercial catch are represented.

On the other hand Tables (6) and (7) show the experimental catch during the months of November and December 1968 when the experimental nets were operating besides the different commercial fishing gears. It is obvious that the experimental catch of either the gill and trammel nets was mainly consisted of Carp and Lates *niloticus*.

About the stock of Carp and Barbus bynni of the Nozha hydrodrome during the period of investigation, it was clearly noticed that the small sizes predominated the Carp catch, while the catch of Barbus bynni was predominated by large sizes.

TABLE 2.—The various dimensions of the gill nets used in the Nozha hydrodrome for experimental fishing

| Serial | Mesh size stretched in cms | Distance of Hanging(cms) | No. of meshes in the dist. of hang | Hanging ratio | No: of meshes depth | Distance between two floats (cm.) | Distance between two sinkers (cm.) | Depth of net in (cm.) | Length of net (m.) |
|---|---|---|---|---|---|---|---|---|---|
| A | 7.7 | 29 | 9 | 0.418 | 26 | 145 | 29 | 185.04 | 91.5 |
| B | 10.0 | 32 | 8 | 0.400 | 20 | 160 | 20 | 185.04 | 91.5 |
| C | 12.5 | 35 | 7 | 0.400 | 16 | 175 | 35 | 185.04 | 91.5 |
| D | 15.0 | 36 | 6 | 0.400 | 13 | 180 | 36 | 185.04 | 91.5 |

TABLE 3.—The various dimensions of the trammel nets used in the Nozha hydrodrome for experimental fishing

| Serial | Mesh size stretch. in cms. (dry) | | Dist. of Hanging (cm.) | Number of meshes in dist. of Hang. | | Hanging ratio | | Nomber of meshes in depth | | Dist. bet. two floats (cm.) | Dist. bet. two sinkers (cm.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | inner layer | outer layer | | inner layer | outer layer | inner layer | outer layer | | | | |
| A′ | 8.0 | 50.0 | 26.0 | 7 | 1 | 0.464 | 0.520 | 46 | 4.5 | 130.0 | 26.0 |
| B′ | 10.0 | 52.0 | 26.5 | 5 | 1 | 0.530 | 0.510 | 34 | 4.5 | 132.5 | 26.5 |
| C′ | 12.5 | 51.0 | 24.0 | 4 | 1 | 0.480 | 0.471 | 26 | 4.5 | 120.0 | 24.0 |
| D′ | 15.5 | 50.0 | 29.0 | 4 | 1 | 0.468 | 0.580 | 22 | 4.5 | 145.0 | 29.0 |

TABLE 4.—The experimental catch of Gill nets from Nozha hydrodrome during the period from April to August 1968.

| Fish species | A | B | C | D | Total catch | |
|---|---|---|---|---|---|---|
| | | | | | kg. | % |
| Carp . . . . . | 10.575 | 67.455 | 25.580 | 15.740 | 119.360 | 20.31 |
| Grey mullet . . . . | 3.220 | 11.595 | 3.465 | 1.720 | 20.000 | 3.40 |
| Lates niloticus . . . | 0.495 | — | 3.245 | — | 3.740 | 0.64 |
| Tilapia . . . . . | 4.585 | 17.945 | 5.695 | — | 28.225 | 3.86 |
| Bagrus bayad . . . . | 1.420 | 21.040 | 26.580 | 45.280 | 94.320 | 15.67 |
| Barbus bynni . . . . | 13.535 | 36.751 | 86.550 | 93.070 | 229.906 | 39.11 |
| Labeo niloticus . . . | 18.920 | 21.790 | 10.140 | 1.750 | 52.600 | 8.95 |
| Other species . . . . | 2.655 | 12.570 | 18.465 | 5.975 | 39.665 | 6.63 |

TABLE 5.– The experimental catch of trammel nets from the Nozha hydrodrome during the period from April to August 1968.

| Fish species | A′ | B′ | C′ | D′ | Total catch | |
|---|---|---|---|---|---|---|
| | | | | | kg . | % |
| Carp . . . . . | 144.310 | 269.995 | 192.315 | 429.190 | 1035.810 | 67.68 |
| Grey mullet . . . . | 12.116 | 18.765 | 2.020 | — | 32.901 | 2.15 |
| Lates niloticus . . . | 3.580 | — | — | — | 3.850 | 0.25 |
| Tilapia . . . . . | 24.995 | 41.740 | 10.400 | 1.165 | 78.300 | 5.76 |
| Bagrus bayed . . . . | 12.525 | 16.510 | 35.395 | 21.000 | 68.630 | 4.49 |
| Barbus bynni . . . . | 25.665 | 60.190 | 61.615 | 78.845 | 226.315 | 14.79 |
| Labeo niloticus . . . | 26.035 | 12.815 | — | — | 38.850 | 2.54 |
| Other species . . . . | 7.315 | 21.335 | 15.930 | 2.420 | 47.000 | 3.01 |

TABLE 6.—The experimental catch of gillnets from the Nozha hydrodrome during November and December 1968.

| Fish species | A | B | C | D | Total catch | |
|---|---|---|---|---|---|---|
| | | | | | kg. | % |
| Carp . . . . . | 24.775 | 41.753 | 69.660 | 17.875 | 154.063 | 71.45 |
| Barbus bynni . . . . | — | — | — | 3.100 | 3.100 | 1.46 |
| Bagrus bayed . . . . | 0.350 | — | — | — | 0.350 | 0.17 |
| Labeo niloticus . . . | 1.200 | 1.615 | 0.350 | — | 3.165 | 1.48 |
| Grey mullet . . . . | 1.175 | — | — | — | 1.175 | 0.54 |
| Lates niloticus . . . | 33.990 | 10.880 | 4.725 | 0.440 | 50.035 | 23.21 |
| Other species . . . . | — | — | — | 3.600 | 3.600 | 1.67 |

TABLE 7.—The experimental catch of Trammelnets from the Nozha hydrodrome during November and December 1968.

| Fish species | A′ | B′ | C′ | D | Total catch | |
|---|---|---|---|---|---|---|
| | | | | | kg. | % |
| Carp . . . . . | 67.195 | 62.470 | 78.450 | 10.190 | 218.305 | 85.42 |
| Barbus bynni . . . . | — | 0.450 | — | — | 0.450 | 0.17 |
| Bagrus bayad . . . . | 0.220 | — | 3.945 | 4.600 | 8.765 | 3.43 |
| Labeo niloticus . . . | 1.225 | — | — | — | 1.225 | 0.68 |
| Tilapia zillii . . . . | 1.180 | — | — | — | 1.180 | 0.65 |
| Grey mullet . . . . | 0.400 | 1.360 | — | — | 1.760 | 0.69 |
| Lates niloticus. . . . | 8.495 | 7.785 | 6.875 | 0.720 | 23.875 | 9.34 |
| Other species . . . . | — | — | — | — | — | — |

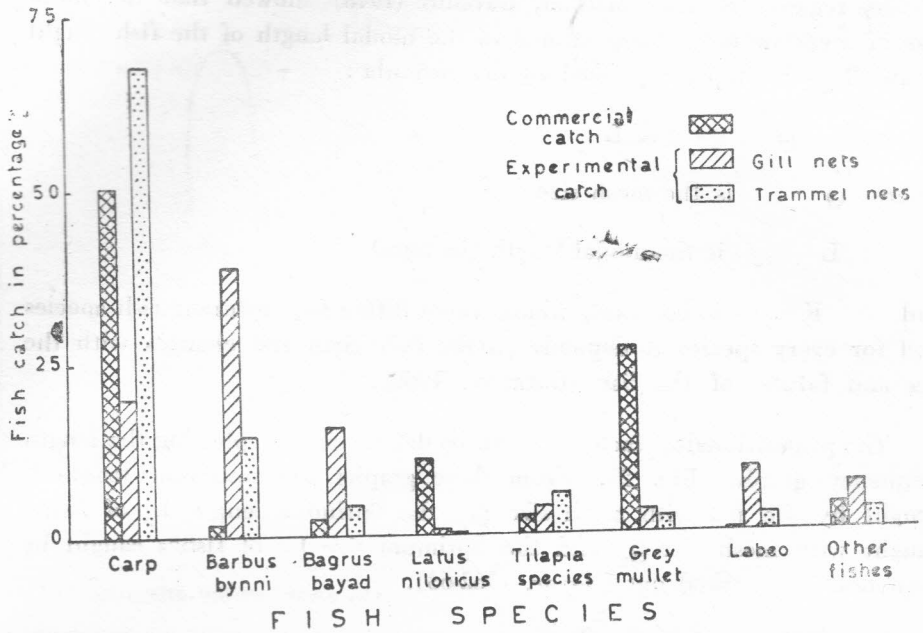


Fig. 1.—The experimental catch (April 1968 — August 1968) in Comparison with the commerical catch (October 1968 — April 1969) of the Nozha-Hydrodrome.

*Gill net selectivity :*

The gill net selectivity for the two fish species, namely Carp and Barbus bynni, is being studied in this work. A detailed study will be restricted to the selectivity of the first species which constitutes the highest bulk of the experimental catch.

The relationships between the mean selection length and the mesh size will be obtained for the different nets. Both Baranov's and Holt's formula will be applied for calculating the proportionality factor between such mentioned parameters.

*Methods of Calculation :*

The analysis of data follows two methods of calculation, the first of which was described by Baranov (1948) whereas the second was after Holt (1957).

As regards the first method, Baranov (1948) showed that the mesh size of a certain net is proportional to the modal length of the fish caught in it. This is simply expressed by the formula :

$$\Theta = K L$$

where $\Theta$ is the mesh size

$L$ is the modal length (in mm.)

and $K$ is constant, whose value differ for different fish species and for every species it depends on the fish girth and changes with the age and fatness of the fish (Baranov, 1960).

The proportionality factor (k) can be determined by plotting the length frequency graphs (Fig. 2). From these graphs the optimum length L caught by the net with mesh size $\Theta_1$, the optimum length $L_2$ of fishes caught with mesh size $\Theta_2$ and the optimum size Lo of fishes caught by both nets are worked out (Nayar, 1962-63).

$$\therefore K = \frac{2 ( \theta_1 \ \theta_2 )}{L_o ( \theta_1 + \theta_2 )}$$

When concerning the second method, Holt (1957) assumed that for two gill net units A and B, the meshes of which differ slightly in size, the shape of their selection curves is the same and the mean selection lengths are proportional to the mesh size. This method was successfully used in the study of gill net selectivity for the herring and halibut (Olsen, 1959 1961). It was also used for studying the selectivity of gill net for Nile Perch in the Nozha hydrome (Koura 1969).

Assuming that the growth of a fish is isometric, then the selection of length by a given mesh size may be expected to be distributed normally. For example when two gill net units A and B are fishing simultaneously then the logarithms of the ratios of the catch as successive length groups in the two units will have a linear relationship. The meshed fish selection curves are calculated as follows :

$$N_L \ \text{exp.} \ -(L - L_m) \ O^2$$

where $N_L$ is the number of fish of length L.

$L_m$ is the mean selection length.

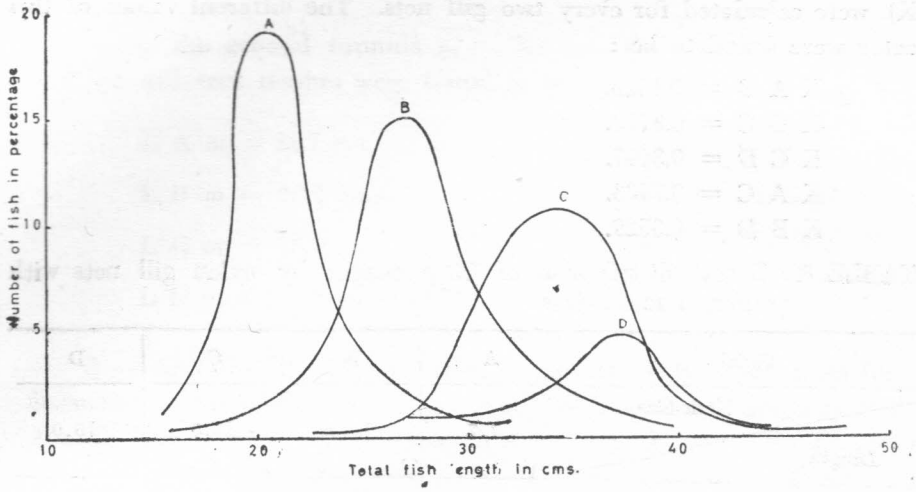


FIG. 2.—Length frequency of the Nozha Hydrodrome Carp caught by Nylon gill nets with different mesh sizes.

Thus, if the mean selection length $L_m$ is proportional to the mesh size then it could be written in a simple formula ;

$$L_{Am} = K\ \theta_A \quad \text{and} \quad L_{Bm} = K\ \theta_B$$

From the lines of best fit, the values of (K) and L ) can be calculated as follows :

$$K = \frac{-2\ b}{a\ (\theta_A + \theta_B)} \quad \text{and} \quad L_m = K^{-} \Theta$$

where K is the ratio between mean selection length (L ) and mesh size ( $\Theta$ ), and a and b are coefficients of the equation ($Y = a\ L + b$) describing the line of best fit for the logarithm ratios.

*Calculation of Selection Curves :*

1 — According to Baranov's method, the mesh size of a certain net is proportional to the modal length of fish caught in it. As regards Carp, the number of fish in each length group caught for each mesh size is shown in Table (8). The data represent the empirical relationship between the mesh size of net and the modal length of the fish caught. This relationship is quite obvious and the size range of the fish grows

with the increase of mesh size. The values of the proportionality factor (K) were calculated for every two gill nets. The different values of this factor were found to be :

K A B = 0.3625.
K B C = 0.3703.
K C D = 0.3497.
K A C = 0.3403.
K B D = 0.3529.

TABLE 8.—Length distribution of Carp caught by nylon gill nets with different mesh sizes

| Serial | A | B | C | D |
|---|---|---|---|---|
| Mesh Size / Length | 7.7 | 10.0 | 12.5 | 15.0 |
| 15 | | | | |
| 16 | | 1 | | |
| 17 | | | 1 | |
| 18 | 2 | 2 | 2 | |
| 19 | 14 | 4 | | |
| 20 | 32 | 4 | 2 | |
| 21 | 52 | 5 | 1 | 2 |
| 22 | 43 | 4 | 3 | |
| 23 | 31 | 3 | 1 | |
| 24 | 26 | 14 | 1 | |
| 25 | 13 | 15 | 1 | 1 |
| 26 | 8 | 39 | 2 | 3 |
| 27 | 9 | 41 | 7 | 2 |
| 28 | 4 | 39 | 5 | 2 |
| 29 | 2 | 23 | 6 | 7 |
| 30 | 4 | 18 | 13 | 3 |
| 31 | 2 | 11 | 19 | 4 |
| 32 | | 12 | 21 | 3 |
| 33 | 2 | 12 | 23 | 5 |
| 34 | | 4 | 23 | 5 |
| 35 | | 7 | 24 | 7 |
| 36 | 1 | 5 | 27 | 8 |
| 37 | | 1 | 19 | 9 |
| 38 | | 4 | 8 | 9 |
| 39 | | 3 | 6 | 7 |
| 40 | | | 4 | 5 |
| 41 | 1 | | | 3 |
| 42 | | | | 1 |
| 43 | | | 1 | 2 |
| 44 | 1 | | | 1 |

where the indices A, B, C and D refer to the mesh sizes. Then the arithmetic mean (K′) is calculated to be 0.3551.

Using the general formula $\Theta = K' Lm$, the mean selection lengths for the different meshes were found to be :

L A m = 21.7 cm.

L B m = 28.2 cm.

L C m = 35.2 cm.

L D m = 42.2 cm.

2 — According to Holt's method, the fitted rgression lines for the logarithm ratios, of the Carp cauches at successive length per nets A, B, C, and D (which re of different mesh sizes) are shown in Table (9) and represented in Fig. (3). From Fig. (3) the plots of logarithm ratios A/B, B/C, A/C, C/D and B/D do not deviate so much from the linearity. This indicates that the number of observations is sufficient to calculate the proortionality factor (K) which is the ratio between the mean selection length (Lm) and the mesh size ( $\Theta$ ). The calculated (K) for the logarithm ratios was :

K B A = 2.7162.

K C B = 2.5341.

K C A = 2.7708.

K D B = 2.6244.

K D C = 2.8911.

When the arithmetic mean (K′) was calculated it was found to be 2.7073.

Using the general formula $Lm = K' \Theta$, the mean selection length (Lm) for the different meshes was found to be:

L A m = 20.85 cm.

L B m = 27.07 cm.

L C m = 33.84 cm.

L D m = 40.60 cm.

TABLE 9.—Length distribution and log. ratios for Carp meshed by nylon gill nets.

| Serial / Mesh size / Length | A | B | C | D | log.B/A | log.C/B | log.C/A | log.D/B | log.D/C |
|---|---|---|---|---|---|---|---|---|---|
| | 7.7 | 10.0 | 12.5 | 15.0 | | | | | |
| 17 | 2 | | | | | | | | |
| 18 | 14 | | | | | | | | |
| 19 | 32 | 4 | | | | | | | |
| 20 | 52 | 4 | | | −0.90309 | | | | |
| 21 | 43 | 5 | | | −1.11427 | | | | |
| 22 | 31 | 4 | | | −0.93480 | | | | |
| 23 | 26 | 3 | 1 | | −0.88941 | | | | |
| 24 | 13 | 14 | 1 | | −0.93819 | −0.47717 | −0.41499 | | |
| 25 | 8 | 15 | 1 | | +0.03221 | −1.14620 | −0.11453 | | |
| 26 | 9 | 39 | 2 | | +0.27390 | −0.17653 | −0.90309 | | |
| 27 | 4 | 41 | 7 | | +0.63679 | −0.28988 | −0.65326 | | |
| 28 | 2 | 39 | 5 | | +1.01072 | −0.76784 | +0.24304 | | |
| 29 | | 23 | 6 | | +1.29003 | −0.89211 | +0.39794 | | |
| 30 | | 18 | 13 | | | −0.58372 | | | |
| 31 | | 11 | 19 | | | −0.14134 | | | |
| 32 | | 12 | 21 | 4 | | +0.23724 | | | |
| 33 | | 12 | 23 | 3 | | +0.24304 | | −0.47517 | −0.72037 |
| 34 | | 4 | 23 | 5 | | +0.28257 | | −0.60236 | −0.88480 |
| 35 | | 7 | 24 | 5 | | +0.75967 | | +0.09691 | −0.64358 |
| 36 | | 5 | 27 | 7 | | +0.53516 | | −0.14612 | −0.68130 |
| 37 | | | 19 | 9 | | +0.73239 | | +0.14613 | −0.58636 |
| 38 | | | 8 | 9 | | | | | −0.32450 |
| 39 | | | 6 | 7 | | | | | +0.05107 |
| 40 | | | 4 | 5 | | | | | +0.06705 |
| 41 | | | | 3 | | | | | +0.09691 |

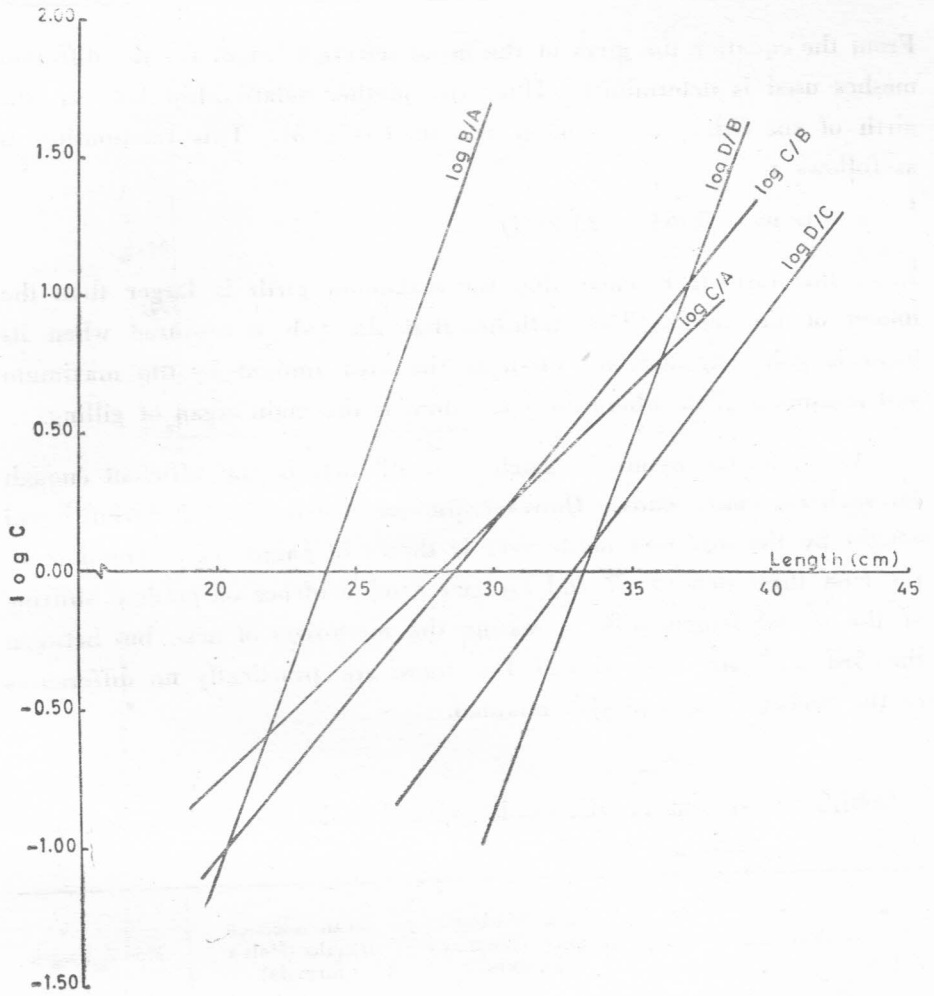


FIG. 3.—Plots of logarithm ratios against length.

For the sake of comparison, Table (10) shows the mean selection lengths for all gill nets used. The lengths which are computed by both Baranov's and Holt's methods, when compared with the modal lengths no great differences are observed.

*Girth-Length relationship :*

The relation between the girth and total length of Carp from the Nozha hydrodrome is shown in Fig. (4). The regression representing this relationship is found to be as follows :

$$\Theta = 16.5 + 7.33\ L$$

From the equation the girth of the mean selection length for the different meshes used is determined. This give another relationship between the girth of the fish and the mesh size used (Fig. 5). This relationship is as follows :

$$G\ m = 8.463 + 2.049\ \Theta$$

From this ratio it is clear that the maximum girth is larger than the lumen of the mesh. This indicates that the fish is captured when its head is going through the mesh as the area limited by the maximum and minimum girth, where the operculum is the main organ of gilling.

As for Barbus bynni, its catch with gill nets is not sufficient enough for such foregoing study. However, the size distribution of Barbus bynni caught by the different mesh sizes is shown in Table (11). The data of the first three nets (A, B and C) give good evidence on gradual shifting of the modal length with increasing the mesh-sizes of nets, but between the 3rd and 4th nets (C and D), there are practically no differences in the average length of fish retained.

TABLE 10.—The mean selection length and modal lengths for the gill nets used.

| | Mesh size in (cm.) | Mean selection lengths. (Baranov's formula) | Mean selection lengths (Holt's formula) | Modal length |
|---|---|---|---|---|
| A | 7.7 | 21.7 | 20.85 | 20.0 |
| B | 10.0 | 28.2 | 27.07 | 27.0 |
| C | 12.5 | 35.2 | 33.84 | 34.0 |
| D | 15.0 | 42.2 | 40.60 | 38.0 |

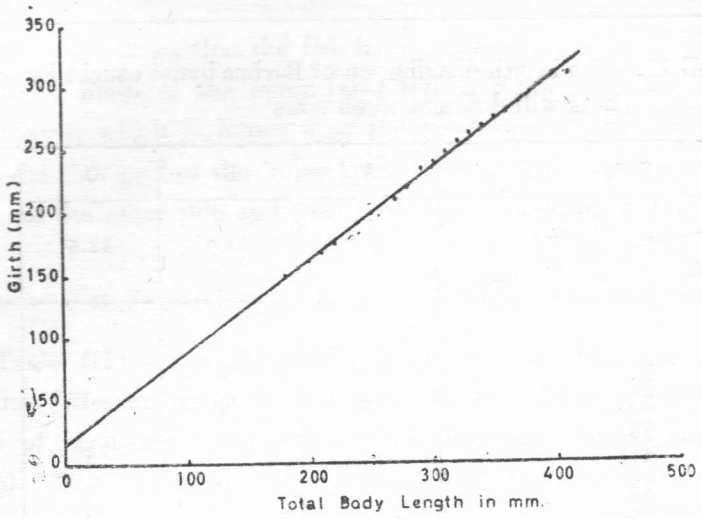


FIG. 4.—Relationship between total length and maximum girth of the common Carp in the Nozha Hydrodrome.

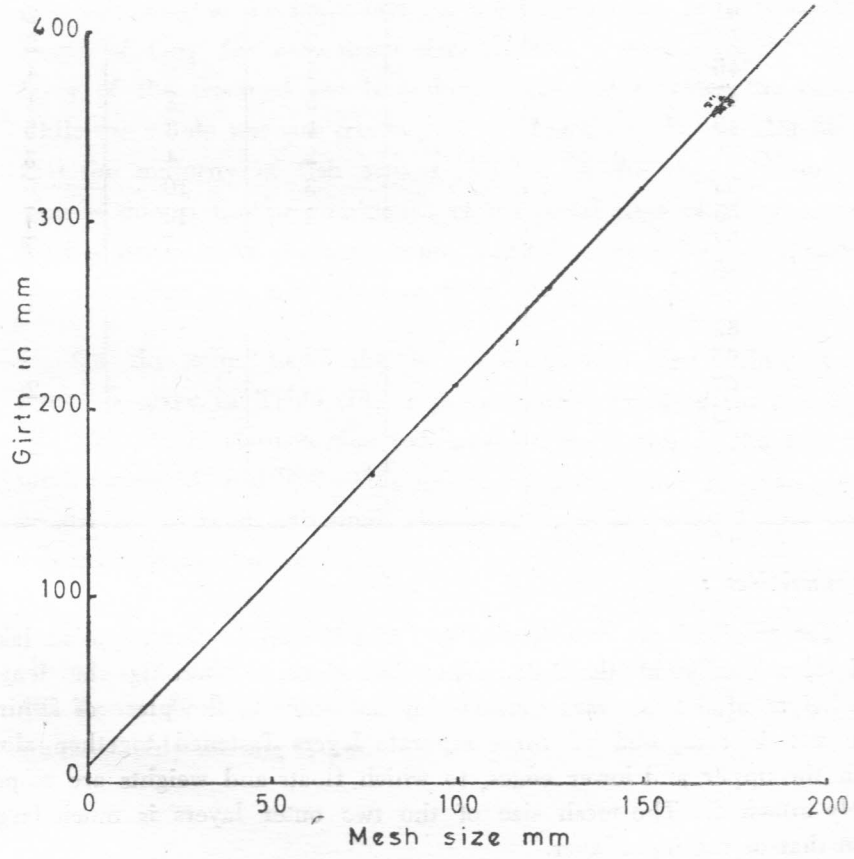


FIG. 5.—Relationship between the girth of the mean selection length of Carp and mesh size

TABLE 11.—The length distribution of Barbus bynni caught by nylon gill nets will different mesh sizes

| Serial | A | B | C | D |
|---|---|---|---|---|
| Mesh Size (cm) / Length | 7.7 | 10.0 | 12.5 | 15.0 |
| 25 | 11 | 3 | | |
| 27 | 14 | 4 | | |
| 29 | 15 | | | |
| 31 | 11 | | 1 | |
| 33 | 1 | 1 | 1 | |
| 35 | 1 | 6 | 1 | |
| 37 | | 5 | | |
| 39 | | 2 | 1 | |
| 41 | | 1 | | 2 |
| 43 | | 2 | | 2 |
| 45 | | 1 | | 4 |
| 47 | | 3 | 3 | 1 |
| 49 | | 1 | 3 | 5 |
| 51 | | 3 | 4 | 3 |
| 53 | | 3 | 10 | 5 |
| 55 | | 1 | 10 | 7 |
| 57 | | | 7 | 7 |
| 59 | | | 3 | 2 |
| 61 | | | 2 | 1 |
| 63 | | | | |
| 65 | | | | |
| 67 | | | | 2 |
| 69 | | | | |
| 71 | | | | 2 |

*Trammel Net :*

The trammel net is a special sort of net used in the Egyptian lakes and occasionally in the Nile. The dimensions, concerning the length and height of the net vary considerably according to the place of fishing. The net is composed of three separate layers fastened together along both the upper and lower edges, to which floats and weights are respectively attached. The mesh size of the two outer layers is much larger than that of the inner layer.

The idea being that the fish in trying to escape, easily passes through the larger mesh of the outer layer but is stopped by the small meshed inner layer, which is looser than the outer one, so that in struggling for ward the fish pushes the inner layer through the large mesh of the outer layer on the other side and thus finds itself caught in a pocket.

*Trammel Net Selectivity :*

Table (12) shows the length frequency distribution of Carp caught by the different trammel nets used in the Nozha hydrodrome. The catch of each net is concentrated in two size groups (small and big fishes). When comparing the selectivity of the inner layer of the trammel net, with the corresponding mesh sizes of the previously mentioned gill nets, Table (13) is given to show the mesh size of the different gill nets and those of the inner layer of the trammel nets as well as the modal length of Carp for each mesh size. It can be concluded that the inner layer of the trammel net is acting as gill net to catch the small sizes, while the whole net was trammeling the big sizes. It can also be noticed that the majority of fish caught lies within the range of small fishes. This is due to the predominance of the small sizes of Carp during that fishing period. At the same time, big fishes were few in number, and so trammeling was not effective (Fig. 6).

On the other hand the length frequency distribution of Barbus bynni is given in Table (14) and the correspoding curves are shown in Fig. (7). It is obvious that two peaks were found in the two smallest meshes used (A' and B'). This indicates that the inner layer was operating as gill net to catch the small sizes of Barbus bynni while the whole set was trammeling the big sizes.

, Regarding the catch of the trammel nets (C′ and D′), it can be concluded that their inner layer, having relatively large meshes, could not gill the small sizes of Barbus bynni, while the whole net was acting to trammel only the big fishes.

TABLE 12.—Length distribution of Carp caught by nylon trammel nets with different mesh size

| Serial | A′ | B′ | C′ | D′ |
|---|---|---|---|---|
| Mesh Size / Length | inner 8.0<br>outter 50.0 | 10.0<br>52.0 | 12.5<br>51.0 | 15.5<br>50.0 |
| 16 | 1 | | | |
| 18 | 29 | | | |
| 20 | 79 | 7 | 2 | 2 |
| 22 | 58 | 5 | 2 | 2 |
| 24 | 43 | 17 | 1 | 1 |
| 26 | 41 | 79 | 3 | 4 |
| 28 | 32 | 120 | 8 | 6 |
| 30 | 26 | 68 | 6 | 5 |
| 32 | 32 | 44 | 6 | 6 |
| 34 | 19 | 30 | 8 | 8 |
| 36 | 14 | 32 | 7 | 8 |
| 38 | 12 | 16 | 6 | 5 |
| 40 | 2 | 7 | 21 | 10 |
| 42 | 3 | 1 | 4 | 2 |
| 44 | | | 4 | 2 |
| 46 | 1 | | 1 | 3 |
| 48 | 1 | | 2 | 2 |
| 50 | | 1 | 2 | 2 |
| 52 | | 1 | | |
| 54 | | | | |
| 56 | | | 1 | 1 |
| 58 | | 1 | | |
| 60 | | | 2 | 2 |
| 62 | 2 | 2 | 3 | 4 |
| 64 | | 2 | 5 | 6 |
| 66 | 4 | 5 | 3 | 3 |
| 68 | 1 | 1 | 7 | 7 |
| 70 | 3 | 3 | 6 | 13 |
| 72 | 1 | 4 | 4 | 11 |
| 74 | 3 | 3 | 5 | 10 |
| 76 | 2 | | 4 | 8 |
| 78 | 1 | | 1 | 4 |
| 80 | | | | 1 |

TABLE 13.—The mesh sizes of gill nets and the inner layers of trammel nets

| Serial | Mesh size in cms. | Modal length in cms | Serial | Mesh size in cms. | Modal length in cms |
|---|---|---|---|---|---|
| A | 7.7 | 20.0 | A′ | 8.0 | 21 |
| B | 10.0 | 27.0 | B′ | 10.0 | 28 |
| C | 12.5 | 34.0 | C′ | 12.5 | 35 |
| D | 15.0 | 38.0 | D′ | 15.5 | 41 |

TABLE 14.—Length distribution of Barbus bynni caught by nylon trammel nets with different meash sizes

| Length \ Serial / Mesh size | A′ | B′ | C′ | D′ |
|---|---|---|---|---|
| 25 | 3 | | | |
| 27 | 7 | | | |
| 29 | 8 | | | |
| 31 | 3 | | | |
| 33 | 4 | 2 | | |
| 35 | 2 | 2 | | |
| 37 | 1 | 2 | | |
| 39 | | 2 | | |
| 41 | | | | |
| 43 | | 1 | | |
| 45 | | | | |
| 47 | | 3 | | |
| 49 | 3 | | | 1 |
| 51 | 1 | 6 | 2 | 4 |
| 53 | 1 | 5 | 7 | 10 |
| 55 | 2 | 9 | 6 | 13 |
| 57 | 1 | 5 | 4 | 7 |
| 59 | 1 | | 6 | 4 |
| 61 | | | 2 | |
| 63 | | | 2 | |

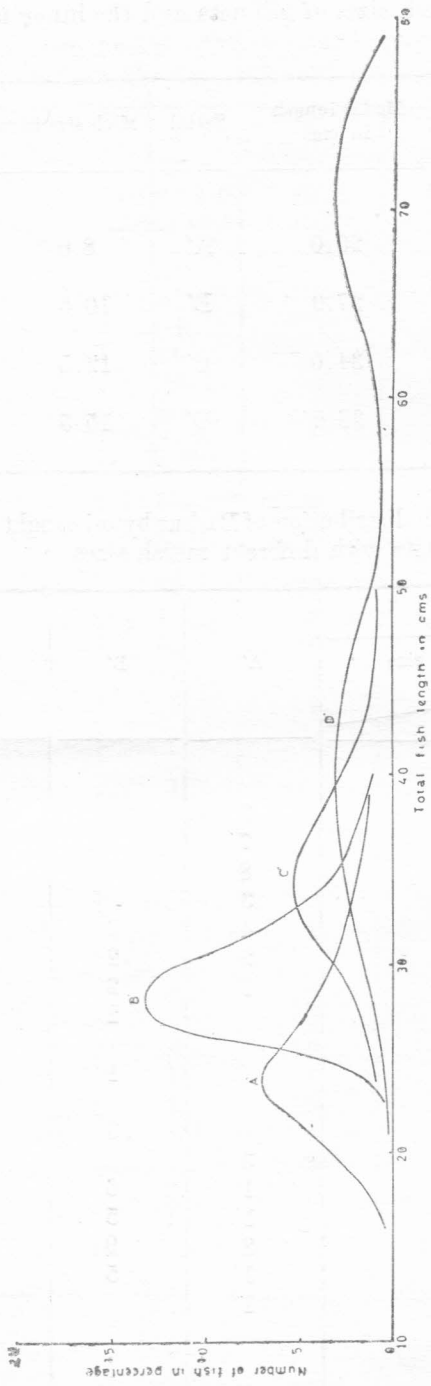


FIG. 6.—Length frequency of the Nozha Hydrodrome Carp caught by the Nylon trammel nets with different mesh sizes.

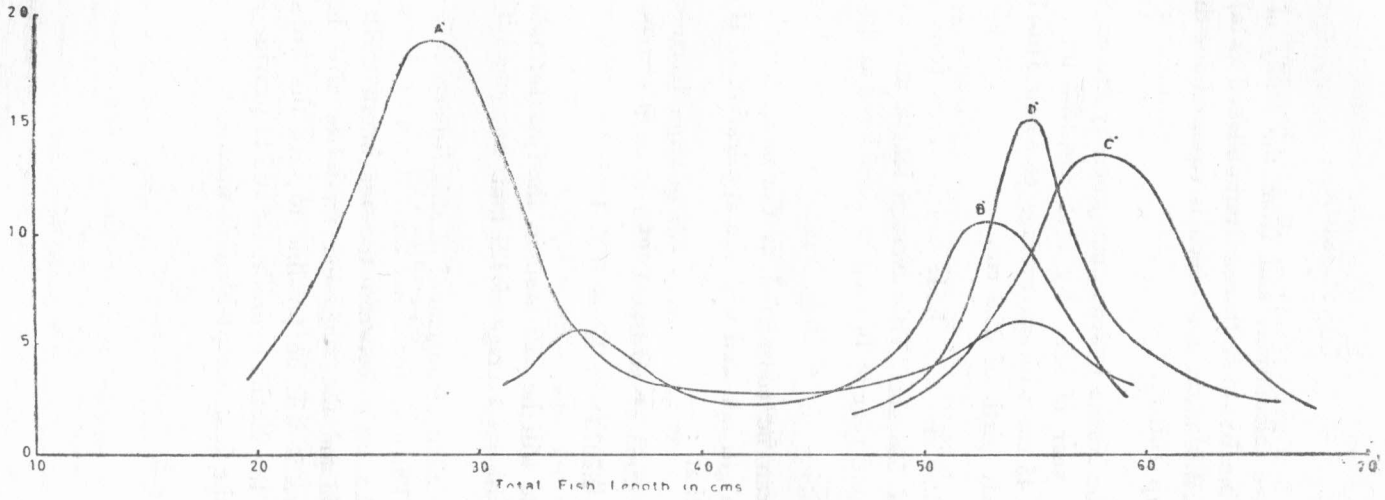


FIG. 7.—Length frequency of the *Barbus bynni* caught from the Nozha Hydrodrome by Nylon trammel nets with different mesh sizes.

## CONCLUSION

From the above calculations and from the study of the biology of the Carp in the Nozha hydrodrome (unpublished data), it is possible to propose the suitable mesh size which is essential for the proper management of the Carp fishery.

The Carp in the Nozha hydrodrome generally attains its first maturity during the second year of life. By that age, the total length of Carp varies from 25 to 45 cm with an average of 33 cm.This length is related to a maximum body girth of 25.8 cm.

At the same time the total body weight varies from 250 to 1450 gm, with an average of 550 gm. This average length and weight reached by the Carp in its second year of life can be considered as the best marketable size in our country.

Thus if this can be considered as the mean selection length or the modal length for a gill net, and with the application of Holt's or Baranov's method we find that :

$$L_m = K'\Theta \quad \text{or} \quad \Theta = K L_m$$

Where $K' = 2.7073$ $K = 0.3551$

The mesh size will be 125 mm. in the first formula and 117 mm. in the second one, with an average of 121 mm.

So, for an efficient management of this fishery, it is advisable to limit the mesh size to 120 mm. for either the gill net or the inner layer of the trammel net. The ratio between the maximum girth of Carp at the marketable length and the suggested mesh-size will be 1.075. By this protective measure, it will be possible to save the breeding stock of the common Carp in the Nozha hydrodrome and to provide the market at the same time with the best acceptable fish sizes.

## SUMMARY

Nylon gill and trammel nets with different mesh-sizes were used in the Nozha hydrodrome in 1968, with the aim of studying the efficiency and selectivity of these nets for the common Carp and Barbus bynni.

The relationship between mesh size ( $\Theta$ ) and mean selection length (L m) of the Commoh Carp is determined by both Baranov's and Holt's methods. This relation is :

$$Lm = \frac{1}{0.3551} \times \Theta \quad \text{(Baranov)}$$

$$L = 2.7073 \times \Theta \quad \text{(Holt)}$$

where $\frac{1}{0.3551}$ & 2.7073 are the values of the constant (K′ ) which show the ratio between L m & $\Theta$ according to Baranov's and Holt's methods respectively.

The relation between the length, girth of the common Carp and the mesh size of the gill net is determined by the following equations .

$$G_m = 16.5 + 7.33\ L \quad \text{and} \quad G_m = 8.463 + 2.049\ \Theta$$

From the biological study of the Carp in the Nozha hydrodrome, this fish should be caught at a mean total length of 33 cms. For the selection of such length the proposed mesh size of either the gill net or the inner layer of the trammel net should be 120 mm. The use of this mesh size, beside providing the market with the most acceptable size, will save the breeding stock of the common Carp in the Nozha hydrodrome.


## REFERENCES


BARANOV, F.I. 1948.—The theory and assessment of fishing gear. Moscow, Pischepromizdat.

BARANOV, F.I. 1960.—The technique of commercial fishing. Moscow, Pischepromizdat.

ELSTER, H.J. and KW. JENSEN 1960.—Limnological and fishery investigations of the Nozha-hydrodrome near Alexandria, Egypt, 1954-56. Min Agr. Egypt, Hydrobiological Dept. Notes and Memoirs No. 43.

HOLT, S.J. 1957.—A method of determining gear selectivity and its application. Paper No. 615. Sci. Meeting ICNAF/ICES/FAO. Lisbon.

KOURA, R. and A.A. SHAHEEN 1969.—Selectivity of gill nets for Nile Perch (Lates niloticus, L.). Stud. Rev. gen. Fish. Coun. Medit. (39).

NAYAR, G. (1962-63).—Report on the deputation to the USSR under a FAO fellowship for training in Reservoir fishing & fisheries, and Fishing gaer technology. Cochin, India.

OLSEN, S. 1959.—Mesh selection in herring gill nets. J. Fish. Res. Bd. Canada, 16 (3).

OLSEN, S. and J. TJEMSALSN 1961.—The selectivity of halibut gill-nets. ICES Compensative Fishing Committee, No. 18.