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SELECTIVITY OF TRAMMEL NETS IN LAKE EDKU.

KH. A. HUSSEIN

Institute of Oceanography and Fisheries, Alexandria.

ABSTRACT

Family Mugilidae constitute a thriving industry in the Egyptian Lakes. Different **Mugil** species are mainly caught by the trammel nets. The analysis of experimental catch of **Mugil saliens** in Lake Edku during 1972, using trammel nets with slightly different mesh sizes (13.6, 15.4, 16.7 mm), showed that the optimal length L_m of each used net (A, B, C) was equal to: ${}_AL_m$ = 15.8 cm, ${}_BL_m$ = 17.9 cm and ${}_CL_m$ = 19.3 cm. Considering that **Mugil saliens** attains its first maturation at a total length of 12.5 cm, therefore the experimental trammel nets were fairly legal for fishing such species.

Optimal lengths determined from the selection curves, as their modal lengths, were slightly lower than calculated ones. The curves were slightly shifted to the left side causing such decrease.

INTRODUCTION

Grey mullets are catadromus fishes, enter the Egyptian northern delta lakes for feeding and return back to the sea for spawning. They constitute a considerable part of the fisheries of the lakes. Five species of Genus **Mugil** were identified in Lake Edku (Hussein, 1969, 1972, 1974; and El-Zarka et al. 1970).

Trammel nets are the principal gears for fishing **Mugil saliens** and other species in the lake especially during the spawning migration.

Holt (1957), stated that "the psychological effect of two working nets with slightly different mesh sizes on fish is similar". The formula L_m = KO expressed the relationship between the modal length L_m and mesh size O, K represented the selectivity constant. The selectivity of gill nets by Holt, 1957 was canfirmed by Olsen (1959, 1961).

Baranov (1948, 1960) stated that the catch of a net is represented by a normal distribution curve which known as "the selection curve". Its peak corresponds to the modal length of caught fish.

MATERIAL AND METHODS

Fishes were caught biweekly by means of nine experimental trammel nets operated in Lake Edku during 1972. The mesh size (mesh bar), and total length of each net are illustrated in Table 1. Nets were tied together and thrown into water in a simicircle with the two ends looped inwardly. Nets were left drifting for two hours, after which the gilled fish of **Mugil saliens** were collected. Position on each net was alternately shifted to permit similar propabilities for fishing. The catch net was analysed as regards, number, total length, and maximum girth. The experiment was repeated three times a day. The average mesh size was taken for the first three nets (A), and measured 13.6 mm, for net (B) 15.4 mm, and for nets (C) 16.7 mm. The number of caugth fish was adjusted according to the number of actual use and length of nets A and B.

TABLE (1)

Mesh Size and Total Length of the Used Experimental Trammel Nets.

No. of Net	Mesh Size (mm.)	Average Mesh Size (mm.)	Length of Net (m.)
1	13.4		16.0
2	13.7	13.6	14.6
3	13.8		19.5
4	15.4	15.4	17.8
5	16.5		20.0
6	16.5		14.7
7	16.6	16.7	19.5
8	16.8		20.5
9	16.9		23.4

RESULTS

1. Calculation of Selectivity Constant and Optimal Length:

Adopting Holt's method (Holt, 1958), the selectivity constants ${}_AK_B$, ${}_BK_C$, ${}_CK_A$ of trammel nets A, B, C were determined from the regression equations of log ratios of the number of gilled fish at each size group with the slightly different mesh sizes 0_A, 0_B, 0_C and the total fish length. The number of fish corresponding to each length, and log ratios of such number are shown in Table 2.

Using Holt's formula, the following different selectivity constants were determined to each alternate pair of nets,

$${}_AK_B = -2a / b (0_A + 0_B)$$
$${}_BK_C = -2a / b (0_B + 0_C)$$
$${}_CK_A = -2a / b (0_C + 0_A)$$

where a and b are the intercept and slope respectively in Holt's formula;

$$\log {}_BC_L / {}_AC_L = L ({}_BL_m - {}_AL_m)/.6^2 + ({}_AL_m - {}_BL_m)/ 2\ 6^2 + \log {}_BP_m / {}_AP_m$$

Considering that the propability (P) is similar during fishing, therefore ${}_BP_m = {}_AP_m = 1$ and log 1 = zero, hence the preceeding formula represents a straight line (Y = a + bL). The values of a and b were determined by using the least squares method. For the first pair of nets (B/A); a = -7.0256, b = 0.4418, for the second pair (C/B); a = -6.1433, b = 0.3190 and for the third pair (C/A); a = -11.3733, b = 0.6379. Therefore tha values of the selectivity constants of the three used nets were calculated as follow:

$${}_AK_B = -2a / b (0_A + 0_B) = -2 \text{ X } -7.0256 / 0.4418 (1.36 + 1.54) = 10.9670$$
$${}_BK_C = -2a / b (0_B + 0_C) = -2 \text{ X } -6.1433 / 0.3190 (1.54 + 1.67) = 11.9987$$
$${}_CK_A = -2a / b (0_C + 0_A) = -2 \text{ X } -11.3733 / 0.6379 (1.67 + 1.36) = 11.7685$$

Using the simple Holt's formula $L_m = K0$, the optimal engtth of net A is:

${}_AL_m = {}_AK_B\ 0_A = 14.9$ cm, optimal length of net B is:
${}_BL_m = {}_BK_C\ 0_B = 18.5$ cm, and optimal length of net C is:
${}_CL_m = {}_CK_A\ 0_C = 19.5$ cm.

This result shows that the optimal length 14.9 cm is caught by net A with a mesh size 13.6 mm, whereas the optimal length 18.5 cm is caught by net B with a mesh size 15.4 mm, and the optimal length 19.5 cm is gilled by net C with mesh size 16.7 mm.

TABLE (2)

The Log Ratios of Fish Numbers of Each Two Alternate Pairs of Nets A, B and C

and the Corresponding Total Fish Length.

Total Fish Length (cm.)	A 13.6 mm.		B 15.4 mm.		C 16.7 mm.	log B/A	log C/B	log C/A
	Fish Number	Adjusted Number	Fish Number	Adjusted Number	Fish Number			
10	013	022.4	01	005.1	001	- 1.4796	-1.6291	-3.109
11	161	278.0	04	020.6	993	-2.6023	-1.9268	-4.5289
12	420	725.2	22	113.2	015	-1.8573	-2.0212	-3.8785
13	471	813.2	49	252.2	025	-1.1709	-2.3113	-3.4822
14	423	730.3	94	483.8	063	-0.4117	-2.0389	-2.4502
15	301	519.7	99	509.5	166	-0.0198	-1.1214	-1.1412
16	173	298.7	86	442.6	180	+0.3935	-0.8996	-0.5066
17	085	146.8	36	185.3	116	+0.2328	-0.4683	-0.2356
18	024	041.4	13	066.9	035	+0.4799	-0.6477	-0.1679
19	008	013.8	01	005.1	016	-0.9954	+1.1425	+0.1476
20	002	003.4	--	--	009	--	--	+0.9733

2. Calculation of Selection Curves:

The data representing a typical relationship between mesh size and fish length was proposed by Baranov (1948). He cleared that the mesh size (mesh bar) was proportional to the modal fish length (optimal length) of the gilled fish.

For a normal distribution the following formula of Baranov (1948) was commonly adopted,

$$P(X) = 1 / 6\ \ 2\ \ . e^{-(x-a)2} / 2\ 6^{2}$$

where P(X) = propability of fishing denisty,
X = fish length,
a = average calculated length of fish gilled by each net, and
6 = standard diviation.

Table (3) shows the length groups of **Mugil saliens** and the propability of fishing denisty for each used net at $P_{max.} = 1$.

The normal selection curves of the three slightly different (in mesh size) trammel net are represented in Fig. (1). The peak of the three bell-shaped curves are shown to be slightly shifted to the left side, i.e. the modal length of each curve is slightly less than the calculated one.

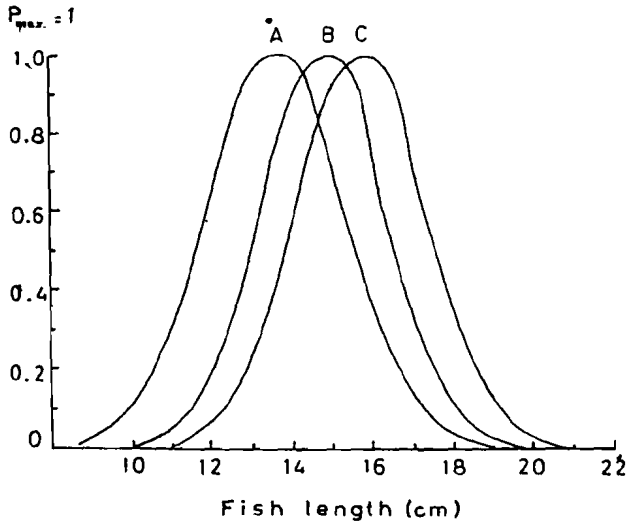

Fig. 1 Relationship Between Fish Length and Propability of Fishing by Nets A, B, C, at $P_{max.}$=1.

TABLE (3)

Propabilities of Fishing Intensities at $P_{max.}$ = 1, of Different Length Groups of **Mugil saliens** Gilled With Different Mesh Sizes.

Total Fish Length (cm)	10	11	12	13	14	15	16	17	18	19	20
Adjusted Fish Number at											
O_A = 13.6 mm.	22.400	278.000	725.000	813.200	730.300	519.700	298.700	146.800	041.400	013.800	3.400
Propability of Fishing											
Intensity at $P_{max.}$ = 1	00.101	00.300	000.630	000.936	000.974	000.714	000.369	000.135	000.034	000.006	0.001
Adjusted Fish Number											
at O_B = 15.4 mm.	05.100	20.600	113.200	252.200	483.800	509.500	442.600	185.300	066.900	005.100	--
Propability of Fishing											
Intensity at $P_{max.}$ = 1	00.006	00.042	000.180	000.492	000.868	000.991	000.734	000.351	000.108	000.921	--
Actual Fish Number											
at O_C = 16.7 mm.	01.000	03.000	015.000	025.000	063.000	166.000	180.000	116.000	035.000	016.000	9.000
Propability of Fishing											
Intensity at $P_{max.}$ = 1	00.001	00.011	000.060	000.223	000.546	000.899	000.986	000.725	000.354	000.117	0.025

DISCSSION AND CONCLUSION

The ligitimacy of gill nets is based on the fact that these nets virtually save the fish stock. They select the fish size in accordance to the used mesh size, hence the optimal fish length (L_m), is fairly proportional to the used mesh size.

The validity of gill net as a saving gear for herring and halibut was previously studied by Olsen (1959, 1961). The trammel net was considered by Piatrikin (1959) as a selective net when he analysed the catch and fitted the selection curves.

The minimum calculated optimal length of **Mugil saliens** was 14.9 cm, gilled by a trammel net with mesh size of 13.6 mm. This fish size was previously considered as a legal size for fishing (Hussien, 1969, 1974). **Mugil saliens** attains its first sexual maturation on attaining an average length measuring 12.5 cm. The optimal lengths obtained from the other two nets with slightly higher wider mesh sizes were 18.5 and 19.5 cm, respectively. These optimal lengths are considered as legal fishing sizes, related to fishes which spawned more than one spawning.

The three selection curves representing size distribution of fishes gilled by the experimental trammel nets with slightly different mesh sizes were similar in shape. The assumption of Baranov (1948), and Holt (1957) concerning the similarity in selection curves was therefore valid. The calculated optimal lengths of **Mugil saliens** were slightly than the modal lengths determined from the fitted selection curves. The shifting of peaks of these curves to the left side had greatly affected the optimal length value. This shifting may be caused by the fish sizes actually gilled by each net. Besides, the hand fitting of selection curves may also affected the value of the modal length.

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