Selectivity of Gill Nets for *Catla catla* (Ham) *Cirrhinus mrigala* (Day) and *Labeo rohita* (Ham) in Gandhisagar Reservoir*

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The results of the selectivity studies on gill nets conducted in Gandhisagar reservoir for exploitation of catla, mrigal and rohu are discussed in this paper. The optimum mesh bar values suitable for the judicious exploitation of commercial size groups of catla, mrigal and rohu are 148 mm, 89 mm and 60 mm respectively. Out of the three types of gill nets fabricated with nylon twines 210/1/3, 210/2/3 and 210/3/3 to study the effect of twine size, 61.48% catla is caught in 210/2/3 of 0.628 mm dia, and 56.25% and 61.18% mrigal and rohu respectively are caught in gill net with nylon twine 210/1/3 of 0.396 mm dia.

It is well known that gill nets are highly selective and the chief parameters that influence the efficient functioning of gill nets are the mesh size, twine size and fishing height. Information on mesh selectivity of gear is essential for recommending conservation practices based on mesh regulation and judicious exploitation of fishery resources. Examples of studies in this direction on gill nets are that of Buchanan-Wallatson (1927), Hodgson (1927), Havinga & Deedler (1948), Baranov (1948), Holt (1957), Oslen (1959), Nomura (1961), Joseph & Sebastain (1964), Sulochanan *et al.* (1968, 1975), David *et al.* (1969), Sreekrishna *et al.* (1972), Hamley (1975) and Panicker *et al.*, (1978). In the present communication the authors have reported the results of the selectivity of mesh size and twine size of gill nets operated in Gandhisagar Reservoir for the rational exploitatio;n of desired size groups of *C. catla, C. mrigala and L. rohita.*

Materials and Methods

The general pattern of rigging of gill nets followed for the selectivity studies of mesh size and twine size was similar to the simple gill nets described by Sulochanan *et al.,* (1968) except for certain modifications such as mesh size, twine size and size of the gear as incorporated inTables 1 and 2. The mesh sizes selected for the study were grouped into three major categories, namely, 100 and 200 mm bar for catla, 80 and 100 mm for mrigal and 60 and 80 mm for rohu. Gill nets made of nylon 210/1/3, 210/2/3 and 210/3/3 of mesh bar 150 , 90 and 60 mm were used in order to study the effect of twine size. During operation all the nets used for the two studies were arranged in statistical rotation giving equal chances for all the nets. 5 nets in each category were operated and 24 operations in 3 cycles of 8 each were made for the former study and 3 nets on each twine were operated and 12 operations in 3 cycles of 4 each were made for the latter study during February-April, 1985 and March 1986 respectively in the lower reaches of the reservoir at depth ranging from 5.0 - 20 m. The morphometric data such as length and weight of individual fishes were recorded species wise for each net separately.

The relation between mesh size and length of fish was worked out based on the method formulated by Baranov (1960).

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Table 1. *Design and Constructional details of small and large meshed gill nets operated for the three species of Major Carps*

Name of fish	Twine size	Mesh size in bar mm	No. of meshes Length	Depth	Net size after hanging Length m	Depth m	Hanging coefficient Horizontal	Vertical	No. of units operated
Catla catla	210/2/3	100	300	22	30	3.75	0.50	0.86	5
		200	250	11	30	3.75	0.50	0.86	5
Cirrhinus mrigala	210/1/3	80	375	27	30	3.75	0.50	0.86	5
		100	300	22	30	3.75	0.50	0.86	5
Labeo rohita	210/1/3	60	500	36	30	3.75	0.50	0.86	5
		80	375	27	30	3.75	0.50	0.86	5

Table 2. *Design and constructional details of gill nets operated to study the effect of twine size and mesh size relationship and vertical distribution of fishes*

	Twine size			No. of meshes Length	Depth	Net size after hanging Length	Depth	Hanging coefficient Horizontal	Vertical	No. of Units operated
	210/1/3	210/2/3	210/3/3	m	m	m	m			
Mesh size in bar (mm)	150	150	150	200	14	30	3.75	0.50	0.86	3 x 3
	90	90	90	333	24	30	3.75	0.50	0.86	3 x 3
	60	60	60	500	36	30	3.75	0.50	0.86	3 x 3

Results and Discussion.

The length frequency distribution in respect of catla, mrigal and rohu caught in nets of different meah sizes are given in Figs. 1, 2 & 3.

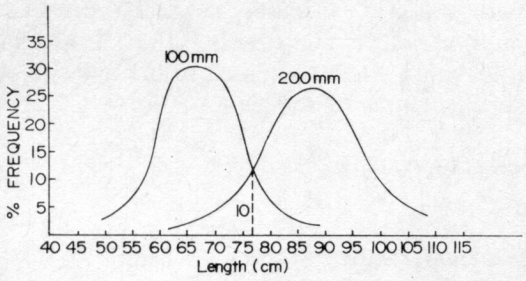

Fig1 Length frequency distribution curve of *Catla catla* caught in gill nets of mesh sizes 100 and 200 mm bar

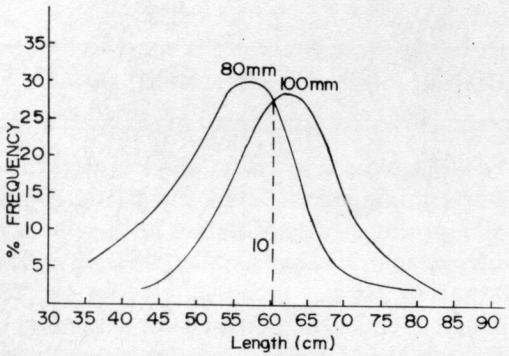

Fig.2 Length frequency distribution curve of *Cirrhinus mrigala* caught in gill nets of mesh sizes 80 and 100 mm bar

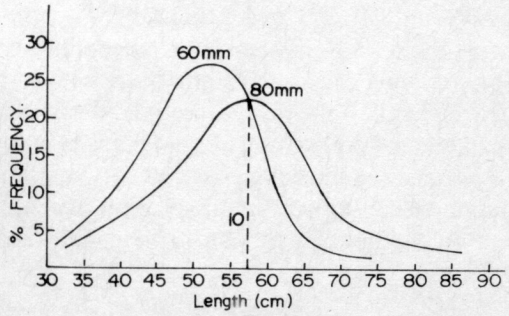

Fig.3 Length frequency distribution curve of *Labeo rohita* caught in gill nets of mesh size 60 and 80 mm bar

According to Baranov (1948) the mesh sizes is proportional to modal length of fish caught by it

i. e. $a = Kl$

where 'a' is the mesh bar in mm 'K' is the proportionality coefficient and 'l' the modal length in mm.

The proportionality coefficient 'K' can be calculated by using the formula

$$K = \frac{2a_1 - a_2}{l_0 (a_1 + a_2)}$$

where 'a_1' and 'a_2' are the mesh bar lengths of small and large meshed nets respectively; 'l_0' the length of fish in mm caught in equal proportions in both the nets. The factor 'l_0' can be obtained from the length frequency curves of each fish. Though the frequency curves drawn for most of the fishes have shown moderate skewness to estimate 'K' values they are approximated to near symmetry. The proportionality coefficient 'K' for *Catla catla, Cirrhinus mrigala* and *Labeo rohita* are 0.1732, 0.1469 and 0.1182 respectively.

The percentage length frequency distribution of each species obtained (Fig. 4) in

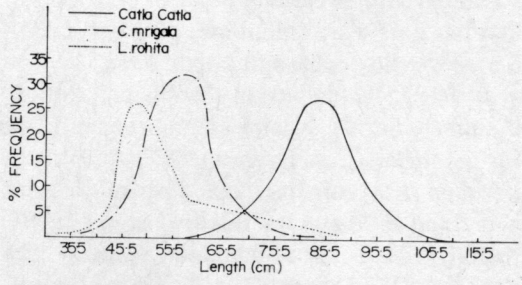

Fig.4 Length frequency distribution curve of C. catla, *C. mrigala and L. rohita* using pooled landings

gill nets of all the mesh sizes pooled together showed that the optimum catches of catla, mrigal and rohu were in size groups of 80.50 - 90.50 cm; 55.50 - 65.50 cm and 45.50 - 55.50 cm respectively. The mesh bar values suitable for individual species of average length 85.50 cm, 60.50 cm and 50.50 cm were worked out by multiplying the length of fish with corresponding proportionality coefficient. They were 148 mm for *Catla catla*, 89 mm for *Cirrhinus mrigala* and 60 mm for *Labeo rohita*.

In order to study the effect of twine size, the number of fishes caught in nets of nylon twine 210/1/3, 210/2/3 and 210/3/3 were recorded in Table 3. This study recommended nylon twine of 210/2/3 of 0.628 mm dia for catla and 210/1/3 of 0.396 mm dia for mrigal and rohu. Further it could be observed that out of three types of nylon twines used for the study nylon 210/2/3 was more efficient, contributing 43.67% of the total catch when compared to the other two specifications of twines.

Table 3. *Comparative efficiency of different twines irrespective of the mesh size for the capture of major carps*

	Twine size	Catla	catla	Cirrhinus	mrigala	Labeo	rohita	Total	
		No.	%	No.	%	No.	%	No.	%
Nylon	210/1/3	25	5.52	225	56.25	397	61.18	657	39.00
	210/2/3	391	61.48	130	32.50	215	31.12	736	43.67
	210/3/3	210	33.00	45	11.25	37	5.70	292	17.33
Total		636	100.00	400	100.00	649	100.00	1685	100.00

The importance of optimum mesh size for judicious exploitation of reservoir fishery has been emphasised by Kuriyan (1973), Anon (1976) and Natarajan (1976). Sulochanan *et al.*, (1968) fixed 75 mm bar nets for the fishery of Hirakud reservoir, Nair *et al.*, (1969) found that nets of 53 mm were used for the capture of *Labeo calbasu* in Gandhisagar reservior. But this observation is untenable as the recent major fishery has subsequently switched over to catla in place of calbasu. 55 mm bar nets were found ideal for harvesting *Labeo displostoma*, and *Labeo bata* (George *et al.*, 1975). Natarajan (1976) determined the mesh bar 91,41 and 52 mm respectively for *C. catla, C. mrigala* and *L. calbasu*. In Hirakud reservoir the mesh size for *C. catla* was fixed at 90 mm bar (George *et al.*, 1979). Anon (1980) recommended a mesh bar between 100-150 mm for *C. catla* in Govindsagar reservoir.

Thickness of twine plays a vital role in determining the efficiency of gill nets with reference to species of fish to be caught. In Govindsagar, Hirakud and Gandhisagar nylon twine 210/2/3 was found suitable for simple as well as entangling gill nets for major carps (George *et al.*, 1985). In marine condition 210/1/3 and 210/2/3 were used for sardine and mackerel (Joseph & Sebastian, 1964), 210/2/3 for hilsa and pomfret (Panicker *et al.*, 1978) and 210/6/3 and 210/12/3 for *S. guttatus* and *S. commersoni* respectively (Sreekrishna *et al.*, 1972 and Sulochanan *et al.*, 1975). Selection of twine of proper diameter for fabrication of gill net is of prime importance and hence twines of smaller diameter having sufficient strength depending on the species of fish to be caught are prefered.

There exists a definite relationship

between twine diameter and mesh bar in gill nets. Baranov (1960) has worked out the relationship of twine size and mesh size in gill net empirically as $\frac{d}{a}$ = 0.01 to 0.02 where 'd' is the diameter of the twine in 'mm' and 'a' mesh bar in 'mm'. However, singnificant variations occurred in the range depending upon the nature of fish population namely smaller ratio for sparse population and higher ratio for shoaling fishes. In the case of complicated design the ratio varied from 0.006 to 0.005 and for frame net the ratio was 0.0045. In the present study d/a ratio obtained was 0.0042 for *Catla catla*. 0.0045 for *Cirrhinus mrigala* and 0.0066 fior *Labeo rohita*. The present values could be considered more or less similar to values suggested by Baranov (1960) for frame nets.

The importance of reducing twine diameter from the point of view of efficiency of the gear has been pointed out by Baranov (1960), Von Brandt (1964) Sulochanan *et al.*, (1968, 1975) and Nair *et al.*, (1969). George *et al.*, (1985) after thorough survey of the mesh size and twine size of the existing gill nets pointed out that the relationship as formulated by Baranov (1960) did not hold good in toto for Indian fishery. The inconsistency noted by George *et.al.*, (1985) might be due to variations in diameter of the twine manufactured in India and the mesh sizes selected for the multi-species fishery of the country. Further studies in this line are necessary to arrive at definite relationship between twine size and mesh size suited to Indian fishery.

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