GILLNET SELECTIVITY ON *CATLA CATLA* (HAMILTON, 1822) IN ALIYAR RESERVOIR, TAMIL NADU, SOUTH INDIA

B. Sundaramoorthy*, P. Parivallal and N. Neethiselvan

Department of Fishing Technology and Fishing Engineering
Fisheries college and Research Institute,
Thoothukudi - 628008. India

Received : 01.10.2013 Accepted : 06.12.2013

ABSTRACT

A study undertaken on the gillnet selectivity of Catla catla at Aliyar Reservoir revealed that the optimum mesh size for the commercial exploitation of this species is 13.7 cm. Among the gillnets presently being used, the usages of net A (mesh size 120 mm) is to be avoided to prevent the capture of immature and maturing animals. The net B (mesh size 140mm) and Net C (mesh size 160 mm) were not found to pose any threat to the fishery. The relationship between gilled girth(X) and fork length(Y) was found to be Y = 1.19 + 0.73 X. The technical status of the gillnets of Aliyar reservoir need to be improved through correct attachment of floats and sinkers to enhance the catch efficiency of the nets.

Keywords : Gillnet selectivity, *Catla catla,* Reservoir fisheries and Selectivity parameters

INTRODUCTION

Reservoirs, tanks and ponds are manmade structures and are useful to mankind in many ways including fish production. These water bodies are highly potential for fish culture and are mostly underutilized in most part of the world including India. Indian reservoirs being tropical, have high primary productivity and also have the capacity to yield more fish production. The annual average fish production of small, medium and big reservoirs of India has been estimated as 49.90 kg/ha, 12.30 kg/ha, 11.43 kg/ha respectively (Sugunan, 1995). In Tamil Nadu, there are 52 small, 8 medium and 2 large reservoirs with the mean fish production of 48.50, 13.74 and 12.66 kg/ha/yr respectively (Sugunan, 1995). Aliyar is one of the important small scale reservoirs constructed across the River Aliyar in Coimbatore district of Tamil Nadu.

*Corresponding Author E-mail : b_sundaramoorthy@yahoo.com

Though reservoirs are rich in fishery resources, the fishery managers of the reservoirs are facing problems due to lack of suitable fishing techniques. The presence of underwater obstacles such as stones, submerged plants and trenches restricts the use of active fishing gears like trawl nets in the reservoirs and the choice is often limited to the passive gears like gillnets. Indian Major Carps such as *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* constitute an important fishery in reservoir of Aliyar and gillnets are the only fishing gear employed to capture these carps.

Limited studies have been carried out on the selectivity and design improvement of inland fishing gears (Ranganathan and Venkataswamy 1967, Sulochanan *et al*, 1968 Kurian 1973, George *et al,* 1973 and Khan *et al,* 1975). Employing Baranov's method, Nayar *et al*, (1969) estimated the size of mesh bar suitable for fishing *Labeo calbasu* in Gandhisagar dam as 53mm. Similarly, nets with the 50mm mesh bar had been found to be more effective for the capture of commercially significant size groups of *L. displostomus* in Gobindsagar reservoir. Khan *et al* (1989) optimized the mesh size for the capture of *Barbus tor* in Govindsagar reservoir. They worked out the selectivity curve on the basis of maximum girth of fish in relation to perimeter of mesh. The optimum girth / mesh perimeter ratio was found to be 1.31. A linear regression of G = 0.445L + 12.8 was found useful for *Barbus tor* . Kartha and Rao (1991) optimized mesh bar lengths as 148, 89 and 60 mm for the judicious exploitation of commercial size groups of *Catla catla, C. mrigala* and *L. rohita* respectively in Gandhisagar reservoir. The present study was carried out with the aim of optimizing the mesh size of gill net for the commercial exploitation of *C. catla* in Aliyar reservoir in a sustainable manner.

MATERIALS AND METHODS

The study was carried out for one year from May 2007 to April 2008 at Aliyar Reservoir of Coimbatore District, Tamil Nadu. *Catla catla* was sampled from the big meshed gillnets with three different mesh sizes viz. 120, 140 and 160 mm. The nets were named based on the mesh size as Net 'A' (120mm), Net 'B' (140 mm) and Net 'C' (160 mm). They were operated with traditional coracles and sampling was made thrice in a week. The soaking time of the gillnets in the reservoir was between 4 P.M to 5 A.M

The length frequency data of *C. catla* were collected from the nets 'A', 'B' and 'C' besides analyzing the gilling pattern in each type of nets. The fishes were measured nearest to the millimeter and weighed nearest to the gram. The gillnet selectivity parameters such as length at first capture (L_b), mean selection length (L_c), length of escapement(L_d) and Selection Factor (SF) were estimated by the method described by of Sparre and Venema (1992).

The linear regression between the gill girth and fork length was worked out, by taking fork length in X axis and gill girth in Y axis. Based on twine impression on the body of the fish, it was treated as snagged (held tightly in the front portion of the gill), gilled (exactly at

gill) and wedged (around the body). Measurements such as fork length, gill girth, gilled girth and maximum girth were measured. The percentage of snagging, gilling and wedging were separately worked out for different nets.

The length at first maturity was analyzed based on the method suggested by Chakrabarti, (1998). Length at which 50 % of the animals found matured was taken as the length at first maturity (L_m). The commercially significant size group of C. c*atla* in the fishery was worked out as a percentage of catch from the pooled catch data. Optimum length of capture of each species was fixed based on their significant contribution to the total catch and the length at first maturity. The optimum mesh sizes for the commercial exploitation of each species of cyprinids were worked out based on the following relation,

$$\mathbf{m} = \frac{\mathbf{L_{opt}}}{\mathbf{SF}}.$$

Where **'m'** is the stretched measure of mesh in cm, **'L_{opt}'** is either the mid-length of the commercially significant length group or mean length at first maturity of the respective species in cm and **'SF'** in the selection factor.

RESULTS AND DISCUSSION

The general description of gillnets operated in Aliyar Reservoir is presented in Table 1. The description of different length groups of *C. catla* caught in three meshes are given in Table 2. The length group 38-41 cm dominated the catch to the tune of 22.30% in Net 'A'. However in net 'B', the length group 47-50 cm dominated the catch to the extent of 20.62%. In the case of net 'C' the length group, 56-59 cm dominated as much as 22.91% of the catch.

The value of length at first capture 'L_b' was highest for the mesh combination 'C and B' (49.27 cm) and the lowest for the mesh combination 'B and A' (35.25 cm). The length at first capture varied between 35.25 - 49.27cm (Fig. 1). The mean selection length (L_c) refers to the length group, which is caught with highest probability in gillnet. The highest 'L_c' value of 56.97cm was observed for the mesh combination 'C and B' and the lowest 'L_c' value of 42.73 cm was observed for the mesh combination 'B and A'.

The value of 'Escapement length' (L_d) refers to the length of which 50% of fishes retain back due to the over size of the fish. The highest 'L_d' value 64.64cm was observed in the mesh combination 'C and B' and the lowest value of 50.39cm was observed for the mesh combination 'B and A'. (Fig. 1) The Selection Factor (SF) for the exploitation of *C.catla* in Aliyar reservoir was derived as 3.56. The commercially significant length group, 48.50cm was taken as the optimum length of capture as it was higher than the length at first maturity (47.25cm). Accordingly the optimum mesh size for the commercial exploitation of *C. catla* was worked out as 13.7cm which is expected to capture the commercially significant length group by gilling as much as by 80 %. It could be understand from the Table

4 that the net B with mesh size 140 mm recorded the maximum gilling percentage of 89 for the length range of 44-47 cm. As it is suggesting to reduce the mesh size from 140 mm to the optimum mesh size of 137mm, i.e., marginally by 3 mm, the net with proposed mesh size of 137 mm is expected to catch not less than 80% of fishes by gilling.

The length group of 32 - 35cm found gilled to the extent of 87% in net 'A' (Table 3). The net 'B' captured the length group 44 to 47cm to the extent of 89% in gilled condition (Table 4). In the case of net 'C' the length group of 50 to 53cm was found gilled to the extent of 89%.(Table 5) However, the respective L_c value were found to be 42.73, 49.95 and 56.97cm 'A', 'B' and 'C' respectively for nets with different mesh sizes. The relationship between the gilled girth and fork length was established as Y = 1.19 + 0.74 X. Estimated length at first maturity of *C. catla* revealed that male and female of this species attained maturity at different length. Male attained first maturity at 44.10cm while female attained first maturity at 50.40cm in Aliyar reservoir.(Fig. 2).

The commercially significant length groups in the fishery was found to be 47 - 50cm. On analyzing the impact of operation of gillnets on the fishery of *C. catla,* it is understood that the net 'A' has captured mostly immature and maturing individuals. Only 33.11% of the catches from the net 'A' consisted of matured animals of 45.50 – 63.50 cm length group and 66.89% of the catches were juvenile and maturing animals fall within the size groups 33.5 – 42.50cm. Therefore, the usage of net 'A' for capturing *C. catla* should be avoided in order to prevent the capture of immature and maturing individuals. In India, reservoirs are stocked with major carp fingerlings produced through induced breeding by the respective state Fisheries Departments. Contribution of natural stock to recruitment may be insignificant. However, Indian Major Carps are found to breed naturally in the reservoirs to restore their stock. Further in the biological point of view, catching of immature fishes would lead to the low yield per recruit. Therefore, it is better to encourage the fisherman to capture matured fishes to ensure auto stocking and to increase yield of flesh per recruit. In the case of net B, 23.26% catch consisted of immature and maturing animals and 76.74% of fishes were found matured. In the net 'C' only 1.25% of the catch constituted immature and maturing animals and the remaining 98.75% were found as matured animals revealing the fact that the net 'B' and 'C' do not pose any threat to *C. catla* fishery of Aliyar reservoir . The design of the big meshed gillnets of Aliyar reservoir need to be improved. Lead sinkers need to be evenly distributed in the foot rope and irregular shaped thermocole need to be replaced with circular plastic floats following even distribution in the head rope .

Table 1. Description of the big meshed gill nets operated in Aliyar reservoir

Sl.No.	Parameters	A	B	C
1.	Webbing material	Polyamide	Polyamide	Polyamide
2.	Twine specification	0.16mm ϕ	0.16mm ϕ	0.16mm ϕ
3.	No. of meshes in length	3600	3600	3600
4.	No. of meshes in breadth	40	35	35
5.	Mesh size	120 mm	140 mm	160 mm
6.	Horizontal hanging co-efficient	0.5	0.5	0.5
7.	No. of floats Not in definite shape and size	3 – 6	3 – 6	3 – 6
8.	No. of sinkers	360	360	360
9.	Specification of sinkers	20g	20g	20g
10.	Head rope material	Polyamide	Polyamide	Polyamide
11.	Head rope specification	Twisted twine 210/6/3	Twisted twine 210/6/3	Twisted twine 210/6/3
12.	Foot rope material	Polyethylene	Polyethylene	Polyethylene
13.	Foot rope specification	Braided twine 2mm ϕ	Braided twine 2mm ϕ	Braided twine 2mm ϕ

Table 2. Percentage of length frequency for *Catla catla* caught in different nets

Length (cm)	Percentage of length frequency		
	A	**B**	**C**
32 – 35	8.74	0.98	-
35 – 38	17.05	2.95	-
38 – 41	22.30	6.55	-
41 – 44	18.80	12.77	1.25
44 – 47	15.74	14.73	2.91
47 – 50	10.06	20.62	7.92
50 – 53	3.50	16.70	12.91
53 – 56	1.75	10.80	17.92
56 – 59	1.31	6.88	22.91
59 – 62	0.44	3.93	16.25
62 – 65	0.31	1.96	11.25
65 – 68	-	0.65	4.59
68 – 71	-	0.33	1.67
71 – 74	-	0.14	0.41
74 - 77	-	-	0.51

Table 3. Enmeshing pattern of various size groups of *Catla catla* in net 'A'

Size range (cm)	Percentage of enmeshing		
	Snagged	**Gilled**	**Wedged**
32 – 35	**7**	**87**	**6**
35 – 38	19	81	-
38 – 41	63	37	-
41 – 44	88	12	-
44 – 47	97	3	-
47 – 50	100	-	-
50 – 53	100	-	-
53 – 56	100	-	-

Table 4. Enmeshing pattern of various size groups of *Catla catla* in net 'B'

Size range (cm)	Percentage of enmeshing		
	Snagged	**Gilled**	**Wedged**
32 – 35	-	7	93
35 – 38	-	35	65
38 – 41	-	76	24
41 – 44	-	85	15
44 – 47	**7**	**89**	**4**
47 – 50	19	81	-
50 – 53	65	35	-
53 – 56	87	13	-
56 – 59	95	5	-
59 – 62	100	-	-

Table 5. Enmeshing pattern of various size groups of *Catla catla* in net 'C'

Size range (cm)	Percentage of enmeshing		
	Snagged	**Gilled**	**Wedged**
38 – 41	-	-	100
41 – 44	-	18	82
44 – 47	-	30	70
47 – 50		75	25
50 – 53	**7**	**89**	**4**
53 – 56	29	71	-
56 – 59	77	23	-
59 – 62	99	11	-
62 – 65	100	-	-
65 – 68	100	-	-

Fig. 1. Selection curves of *Catla catla* for the mesh types 'A', 'B' and 'C'

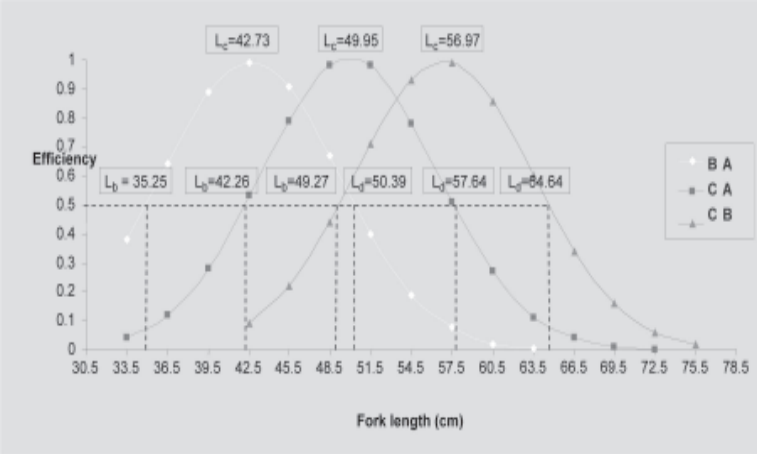
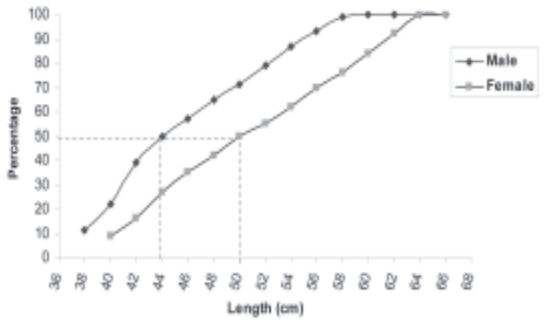


Fig. 2 Determination of length at first maturity of *Catla catla*



REFERENCES

Chakrabarti, N.M., (1998). Biology, Culture and Production of IMC – A review. Narendra Publishing House Delhi, India. 175p.

Geroge, V.C., R.M. Naidu and K.K. Kunjipaulu, 1973. Exploratory fishing experiments in Hirakud reservoir – Orissa state (1967-70). *Fishing Technology* **X**(1):71-78.

Kartha, K.N. and K.S. Rao, 1991. Selectivity of gill nets for *Catla catla* (Hamilton), *Cirrhinus mrigala* (Day) and *Labeo rohita* (Hamilton) in Gandhisagar reservoir. *Fishing Technology* **28**: 5-10.

Khan, A.A., N.A. George, and O.P. Pandey, 1975. On the fishing power of monofilament and multifilament gillnets. *Fishing Technology* **12**(1):64-69.

Khan, A.A., N.A. George, T. J. Mathai and A.K.K. Nair, 1989. On the optimum mesh size for the capture of Barbus for (Hamilton). *Fishing Technology* **26**(2):92-99.

Kurian, G.K., 1973. Fishing gear in freshwater reservoirs of India. *Fishing Technology* **X**(1):1-5.

Nayar, S.G., M. Shahul Hameed and M.D. Varghese, 1969. "Experimental fishing in Gandisagar reservoir, Madhya Pradesh" paper presented at symposium 'on ecology of reservoirs' CIFRI, Barrackpore.

Ranganathan, V., E.R. Venkataswamy, 1967. On the efficiency of mettur Rangoon nets in Bhavanisagar reservoir. *Madras Journal of Fisheries* **II** : 46-60.

Sparre, P. and S.C. Venema, 1992. Introduction to tropical fish stock assessment Part I. Manual. *FAO Fisheries Technical Paper,* No.3061. Rev. 1 Rome. pp. 172-199.

Sugunan, V.V., 1995. Reservoir Fisheries of India. FAO Fisheries Tech. Report. Daya Publishing house Delhi (India). 345p.

Sulochanan, P., V.C. George and K.M. Naidu, 1968. Experimental fishing in Hirakud reservoir, Orissa (1965 – 67). *Fishing Technology* **2**:81-95.