Journal of the Indian Fisheries Association
31, 2004, 87-96

INDICES AND FECUNDITY OF A THREATENED FRESHWATER CATFISH *MYSTUS MONTANUS*

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ABSTRACT

Fecundity of threatened catfish *Mystus montanus* was estimated from a collection of gravid females, which ranged from 290 to 27,972 according to body length and weight. The relationship between fecundity and BL, BW, GL and GW was analyzed by linear regression, which showed both positive and negative correlation. Gonado-somatic index (GSI), hepato-somatic index (HSI) and spleen-somatic index (SSI) ranged from 0.135 to 21.28, 0.358 to 21.33 and 0.126 to 1.08 in females and the correponding values for males were 0.17 to 10.68, 0.619 to 3.25 and 1.25 to 2.33 respectively.

Keywords: Fecundity, indices, threatened catfish, *Mystus montanus*

INTRODUCTION

The threatened freshwater catfish *Mystus montanus* (CAMP, 1998), commonly known as 'nari keliru' is a good table fish fetching good market value. It is widely distributed in Asian and African countries (Jayaram, 1999) but its population shows a declining trend in recent years due to increasing anthropogenic-induced degradation of it's natural habitat through land reclamation, environmental pollution and aggressive vegetational succession involving the replacement of the native lentic and lotic ecosystems by its introduction of alien fish fauna (Wilcox, 1985). Fecundity, gonado-somatic index (GSI), hepato-somatic index (HSI) and spleen-somatic index (SSI) are fundamentally useful to understand fish reproductive capacity. Fecundity influences other factors, including stock assessment, recruitment to exploited populations, production, potentials and also population dynamics (King and UDo, 2001). Mahboob and Sheri (1997) reported the relationship between the ovary weight, liver weight and body weight in *Ctenopharyngodon idella*. Similar relationship was established in *Kaiwarinus equula* between the reproductive cycle, spawning frequency and batch fecundity as reported by Yoneda *et al.,* (2002).

A good number of reports on indices and fecundity are available on species viz., *Puntius* sp (Mustafa *et al.,* 1982), *Channa* sp (Bhuiyan and Rahman, 1984), *Anabas testudineus* (Nargis and Hussain, 1988), *Heteropneustes fossilis* (Reddy and Rao, 1991), *Colisa fasciata* (Bhuiyan *et al.*, 1995), *Orechromis niloticus* (Bhuiyan and Afrose, 1996), *Nandus nandus* (Hossain *et al.*, 1997), *Barbodes gonionotus* (Bhuiyan *et al.*, 2000) and *Periophthalmus barbarus* (King and Udo, 2001). But similar reports on threatened / endangered fish species are very much limited and the present study on life history traits especially reproductive parameters in *Mystus montanus,* a threatened catfish present in river Tambaraparani was undertaken with an ultimate aim of conservation of its population.

MATERIAL AND METHODS

M. montanus were collected from Tambaraparani river fed (8^o 42' N: 7^o 24 E') systems. The collected individuals were preserved in 10% formalin and brought to the Center for Aquaculture Research and Extension (CARE). Their swollen abdomen and their genital opening facilitated in easily identifing the gravid females. The body length (BL) and body weight (BW) were taken using measuring board and the results were tabulated. The gonads, liver and spleen were taken out by dissecting the fish and the moisture was thoroughly wiped using absorbent paper and gonad weight (GW), liver weight (LW) and spleen weight (SW) were measured using an electronic digital balance. The total length of each gonad was also recorded using a measuring scale and divider. Fecundity was determined following gravimetric method. Sub samples were taken from the ovaries, weighed and kept separately in Gilson's fluid (with double amount of acetic acid as modified by Simpson, 1951). After three weeks preservation in Gilson's fluid, vials were shaken for release of oocytes from the cluster. The eggs were counted under compound microscope and fecundity was estimated following F = ni x gw / swi, where ni = number of eggs in the sub-sample, gw = total weight of ovary and swi = weight of sub-sample (Lagler, 1956; Reddy and Rao, 1991). Additionally GSI, HSI and SSI were calculated as: GSI = GW x 100 / FW - GW (GW = gonad weight and FW = fish weight); HSI = LW x 100 / FW - LW (LW = Liver weight) and SSI = SW x 100 / FW - SW (SW = Spleen weight) (Quasim and Qayyum, 1963; ICAR-NATP, 2001). The data was subjected into linear regression as described by Zar (1984).

RESULTS AND DISCUSSION

The lowest fecundity (290) was noticed in a fish of 7.1 cm length. Similarly the highest fecundity (27,972) was noticed in a fish weighing 16.53 g (Tables 1 and 2) (Figs 1 - 4). Surprisingly some of the large sized fishes of 8.7 cm, 9.1 cm, and 9.7 cm length showed a very low fecundity (690, 783 and 1000 respectively) and fishes of 7.4 g, 8.9 g and 8.90 g weight also showed very low fecundity (762, 1024 and 890 respectively), which may be due to seasonal changes and / or malnutrition / stages of maturity.

In males the GSI was highest (8.92) in fish weighing 16.53 g and low (0.09) in fish weighing 4.76 g. In females the highest (5.57) and lowest (0.13) GSI was noticed in fishes weighing 6.38 g and 5.60 g

Table 1 : Body length (cm), gonad length (cm) fecundity and r-value of *M. montanus*

Sl.No.	Length	Gonad Length	Sex	Fecundity	r	Maturity condition
1.	6.1	0.9	M	-		Immature
2.	7.1	1.0	F	290	0.9220*	Immature
3.	7.4	1.6	M	-	-	Maturing
4.	7.4	1.8	M	-	-	Maturing
5.	7.5	1.8	M	-	-	Mature
6.	7.6	1.3	M	-	-	Mature
7.	7.7	1.5	M	-	-	Mature
8.	7.8	1.6	M	-	-	Matured
9.	7.8	1.4	F	424	0.9620*	Immature
10.	7.9	1.7	M	-	-	Matured
11.	8.1	1.6	M	-	-	Matured
12.	8.1	1.5	M	-	-	Matured
13.	8.1	1.1	F	595	0.9757*	Immature
14.	8.1	1.9	M	-	-	Maturing
15.	8.1	1.4	M	-	-	Matured
16.	8.3	1.2	F	1010	0.8851*	Maturing
17.	8.4	1.0	F	1372	0.8897*	Maturing
18.	8.5	1.7	M	-	-	Maturing
19.	8.5	1.8	M	-	-	Late Matured
20.	8.5	1.9	M	-	-	Late Matured
21.	8.7	1.3	F	690	0.9996@	Immature
22.	8.7	1.6	M	-	-	Late Matured
23.	9.1	1.2	F	1806	0.9300*	Matured
24.	9.1	2.0	M	-	-	Matured
25.	9.1	1.4	F	783	0.9996@	Maturing
26.	9.2	1.7	M	-	-	Late Matured
27.	9.2	1.4	F	1712	0.9520*	Matured
28.	9.2	2.0	M	-	-	Matured
29.	9.3	1.5	F	1476	0.9417*	Maturing
30.	9.3	2.2	M	-	-	Mature
31.	9.3	2.1	M	-	-	Maturing
32.	9.4	2.0	M	-	-	Matured
33.	9.4	2.0	M	-	-	Matured
34.	9.4	2.1	M	-	-	Matured
35.	9.4	2.0	M	-	-	Late Matured
36.	9.5	1.8	F	1801	0.9490*	Late Matured
37.	9.5	1.8	F	1918	0.9565*	Late Matured
38.	9.6	2.0	F	1871	0.9641*	Late Matured
39.	9.7	1.6	F	1000	0.9110*	Early Matured
40.	9.7	1.6	F	1311	0.9231*	Maturing
41.	9.8	2.3	M	-	-	Matured
42.	9.9	1.9	F	1595	0.9031*	Matured
43.	9.9	2.1	F	1708	0.9028*	Late Matured
44.	9.9	2.0	M	-	-	Matured
45.	10.1	2.2	F	4674	0.7707*	Late Matured
46.	10.1	2.2	M	-	-	Spent
47.	10.2	2.0	F	4785	0.9978@	Late matured
48.	10.4	2.5	M	-	-	Spent
49.	11.2	2.1	F	11026	0.7303*	Ripe
50.	12.3	2.3	F	15680	0.8130*	Ripe

* acceptable and @ not acceptable values of fecundity and respective length of *M. montanus*

Table 2 : Body weight (g), gonad weight (g) fecundity and r-value of *M. montanus*

Sl. No.	Length	Gonad Length	Sex	Fecundity	r	Maturity condition
1.	2.70	0.041	M	-	-	Immature
2.	3.57	0.024	M	-	-	Immature
3.	3.75	0.020	M	-	-	Immature
4.	3.85	0.033	M	-	-	Immature
5.	3.96	0.01	M	-	-	Immature
6.	4.07	0.014	M	-	-	Immature
7.	4.10	0.053	F	362	0.8064*	Immature
8.	4.11	0.03	M	-	-	Immature
9.	4.24	0.125	F	490	0.7494*	Immature
10.	4.25	0.013	M	-	-	Immature
11.	4.30	0.023	F	383	0.7531@	Immature
12.	4.35	0.048	M	-	-	Immature
13.	4.46	0.014	M	-	-	Immature
14.	4.55	0.802	F	1071	0.7551*	Maturing
15.	4.63	0.019	M	-	-	Immature
16.	4.76	0.048	M	-	-	Immature
17.	4.76	0.046	M	-	-	Immature
18.	5.04	0.03	M	-	-	Immature
19.	5.16	0.073	F	776	0.7476@	Immature
20.	5.24	0.024	M	-	-	Matured
21.	5.55	0.095	F	408	0.7485@	Immature
22.	5.57	0.014	M	-	-	Early Matured
23.	5.60	0.19	F	1762	0.7567*	Mature
24.	5.60	0.73	F	2323	0.7557*	Mature
25.	5.61	0.069	M	-	-	Maturing
26.	5.62	0.038	M	-	-	Mature
27.	5.79	0.063	M	-	-	Maturing
28.	5.82	0.20	F	976	0.7490@	Early Matured
29.	5.90	0.100	M	-	-	Mature
30.	5.90	0.010	F	872	0.7283@	Spent
31.	5.91	0.130	F	3173	0.7578*	Late Matured
32.	6.09	0.044	M	-	-	Mature
33.	6.25	0.391	F	5243	0.7521*	Matured
34.	6.38	0.38	F	6774	0.7632*	Matured
35.	6.38	0.34	F	1243	0.7462@	Early Matured
36.	6.49	0.036	M	-	-	Early Matured
37.	6.56	1.25	F	7423	0.7659*	Late Matured
38.	7.10	0.112	M	-	-	Maturing
39.	7.17	0.017	M	-	-	Late Matured
40.	7.22	0.14	F	3274	0.6681@	Matured
41.	7.41	0.022	M	-	-	Matured
42.	7.43	0.06	F	762	0.6689@	Spent
43.	7.80	0.020	M	-	-	Mature
44.	7.81	0.023	M	-	-	Maturing
45.	7.82	0.037	M	-	-	Matured
46.	8.84	1.75	F	18090	0.7723*	Matured
47.	8.89	0.082	F	1024	0.6772@	Early matured
48.	8.90	0.060	F	890	0.6897@	Spent
49.	9.40	0.258	M	-	-	Matured
50.	16.53	3.966	F	27972	0.7487*	Matured

* acceptable and @ not acceptable values of fecundity and respective length of *M. montanus*

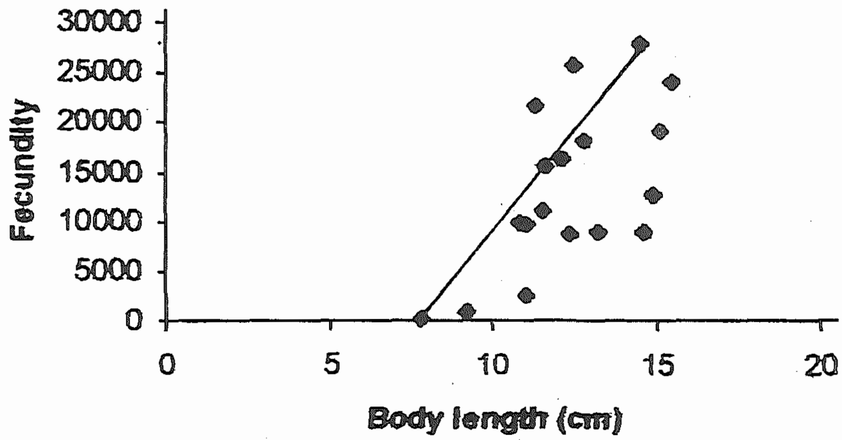

Fig. 1 : Relationship between body length (cm) and fecundity of Mystus montanus

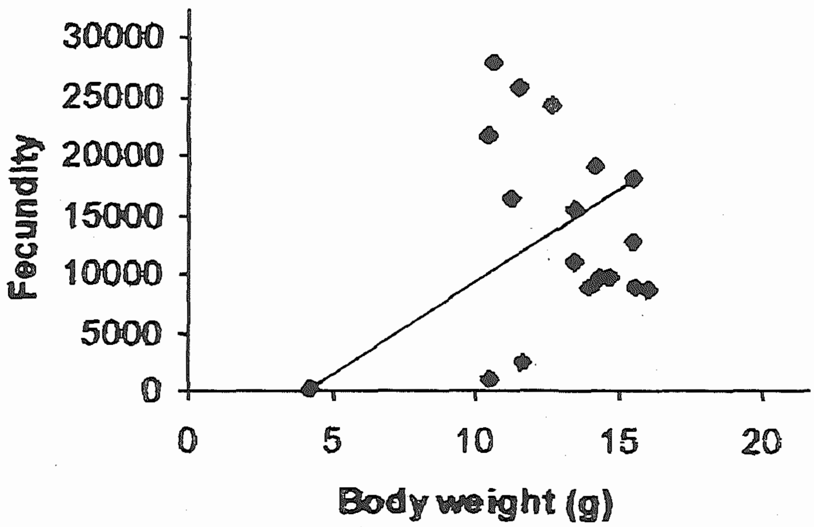

Fig. 2 : Relationship between body weight (g) and fecundity of Mystus montanus

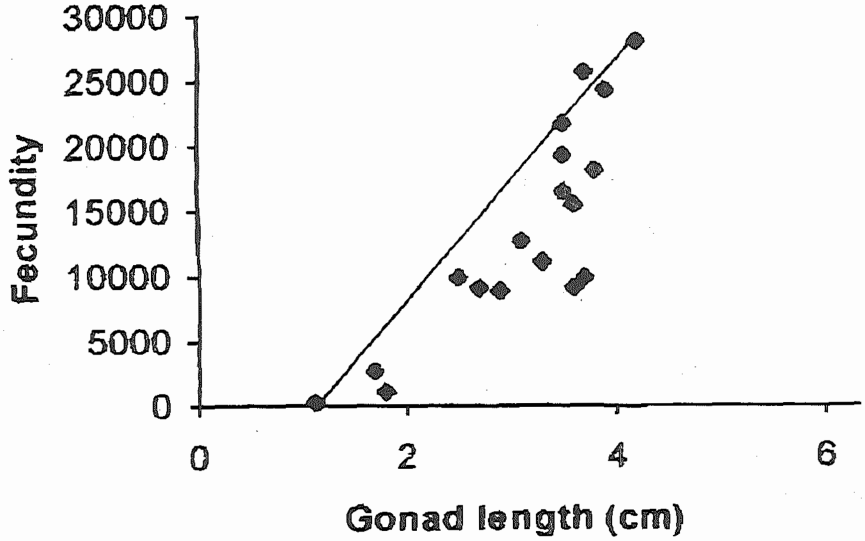

Fig. 3 : Relationship between gonad length (cm) and fecundity of Mystus montanus

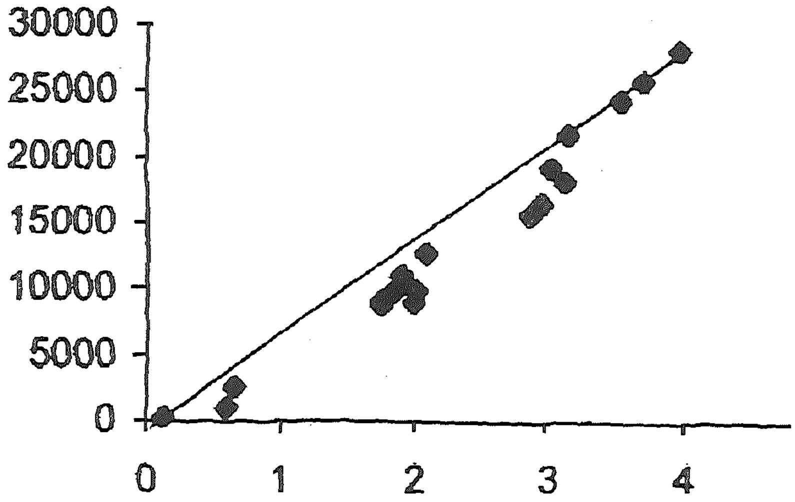

Fig. 4 : Relationship between gonad weight (g) and fecundity of Mystus montanus

respectively. Similar trend was observed in HSI and SSI. The HSI ranged between 0.38 and 7.69 in both males and females weighing 2.70 and 5.60 g respectively. The SSI values varied from 0.15 to 0.75 in females weighing 5.82g and 6.56g respectively. In males SSI ranged from 0.14 to 1.88 with fish weighing 2.70g and 5.61 g respectively (Table 3).

In most of the teleostean species gonad weight depends on the part of body weight (Mahboob and Sheri, 1997). In the present study fecundity estimation is high in small size groups and possessing high egg production, which strongly depends on the body weight. There was a positive relationship between the fecundity and their body length, body weight, gonad length and gonad weight. Some negative relationship was also noticed in different size groups. The changes were due to various factors including seasonal changes, monsoon failure, non-availability of adequate food etc. Similar results have been observed in *Heteropneustes fossilis* as reported by Reddy and Rao (1991). King and Udo (2001) reported that the fecundity of *Periophthalmus barbarus* increased with total and somatic weight as expected. King (1991) stated that fecundity was more strongly correlated with the total body weight than somatic weight in *Illisha africana*. Nikolsky (1963) noted that an increase in quantity of food increases the relative energy allocation to their reproductive capacity. The egg production was lower in some larger fishes due to the failure of ovarian maturation and feeding conditions and it may be mediated by the reproductive physiology (Hussain *et al.*, 1997). In brown trout *Salmo trutta* the weight of the eggs declined as the fecundity increased due to the non-availability of mature eggs in the ovary (Bagenal, 1969).

Among the three indices *viz.* GSI, HSI and SSI, gonado-somatic index plays a prominent and major role in reproductive biology. In female fish the ovary consists of lipid and protein for vitellogenic processes / synthesis (Valming, (1974). These nutritional materials were synthesized from visceral organs *viz.,* liver

Table 3 : Body weight (g), GSI, SSI, HSI and correlation between body weight (BW) vs. GSI, SSI, HSI of *M. montanus*

Sl. No.	Body Weight	Sex	GSI	SSI	HSI	BW vs. GSI	BW vs. SSI	BW vs. HSI
1.	2.70	M	1.54	1.88	0.38	P<0.05	P<0.05	P>0.05
2.	3.57	M	0.67	0.56	0.95	P>0.05	P>0.05	P<0.05
3.	3.75	M	0.53	0.48	1.40	P>0.05	P>0.05	P<0.05
4.	3.85	M	0.86	0.67	1.58	P<0.05	P<0.05	P<0.05
5.	3.96	M	0.25	0.25	1.57	P>0.05	P>0.05	P<0.05
6.	4.07	M	0.34	0.27	2.05	P<0.05	P<0.05	P<0.05
7.	4.10	F	0.73	0.22	1.08	P<0.05	P>0.05	P>0.05
8.	4.11	M	0.62	1.72	1.05	P<0.05	P<0.05	P>0.05
9.	4.24	F	2.68	0.95	1.72	P<0.05	P<0.05	P<0.05
10.	4.25	M	0.30	0.55	1.18	P>0.05	P>0.05	P>0.05
11.	4.30	F	3.09	0.18	1.32	P<0.05	P>0.05	P<0.05
12.	4.35	M	1.04	0.50	1.17	P<0.05	P<0.05	P>0.05
13.	4.46	M	0.31	0.47	1.29	P>0.05	P>0.05	P<0.05
14.	4.55	F	2.13	0.46	2.13	P<0.05	P>0.05	P<0.05
15.	4.63	M	0.41	0.38	1.44	P<0.05	P>0.05	P>0.05
16.	4.76	M	0.09	0.48	1.16	P<0.05	P<0.05	P>0.05
17.	4.76	M	1.06	1.70	1.66	P<0.05	P<0.05	P<0.05
18.	5.04	M	0.59	0.19	1.04	P>0.05	P>0.05	P>0.05
19.	5.16	F	0.85	0.50	1.55	P>0.05	P<0.05	P<0.05
20.	5.24	M	0.45	0.49	1.15	P>0.05	P>0.05	P>0.05
21.	5.55	F	0.98	0.39	1.66	P>0.05	P>0.05	P<0.05
22.	5.57	M	0.34	0.14	0.86	P>0.05	P>0.05	P<0.05
23.	5.60	F	3.51	0.19	7.69	P<0.05	P>0.05	P<0.05
24.	5.60	F	0.13	0.21	0.86	P>0.05	P<0.05	P>0.05
25.	5.61	M	1.24	0.14	1.20	P<0.05	P>0.05	P<0.05
26.	5.62	M	0.67	0.21	1.10	P>0.05	P<0.05	P>0.05
27.	5.79	M	1.09	0.45	0.88	P<0.05	P<0.05	P>0.05
28.	5.82	F	3.57	0.15	7.59	P<0.05	P>0.05	P<0.05
29.	5.90	M	0.17	0.40	1.28	P>0.05	P<0.05	P>0.05
30.	5.90	F	3.24	0.44	1.05	P<0.05	P<0.05	P>0.05
31.	5.91	F	1.47	0.19	1.12	P>0.05	P>0.05	P<0.05
32.	6.09	M	0.72	0.21	0.99	P<0.05	P>0.05	P>0.05
33.	6.25	F	5.05	0.30	6.60	P<0.05	P<0.05	P<0.05
34.	6.38	F	5.57	0.28	0.82	P<0.05	P<0.05	P>0.05
35.	6.38	F	5.18	0.26	0.71	P<0.05	P<0.05	P>0.05
36.	6.49	M	5.01	0.29	3.12	P<0.05	P<0.05	P<0.05
37.	6.56	F	0.68	0.75	0.61	P>0.05	P<0.05	P>0.05
38.	7.10	M	1.60	0.25	0.86	P>0.05	P<0.05	P>0.05
39.	7.17	M	0.23	0.37	0.90	P>0.05	P<0.05	P<0.05
40.	7.22	F	1.94	0.13	0.70	P>0.05	P>0.05	P>0.05
41.	7.41	M	0.29	0.28	0.14	P>0.05	P<0.05	P>0.05
42.	7.43	F	0.81	0.13	0.71	P>0.05	P>0.05	P>0.05
43.	7.80	M	0.24	0.23	0.90	P>0.05	P<0.05	P<0.05
44.	7.81	M	0.31	0.31	0.80	P>0.05	P<0.05	P>0.05
45.	7.82	M	0.47	0.38	0.66	P>0.05	P<0.05	P>0.05
46.	8.84	F	0.60	0.27	1.10	P>0.05	P>0.05	P<0.05
47.	8.89	F	0.50	0.12	1.04	P>0.05	P>0.05	P<0.05
48.	8.90	F	0.76	0.13	1.02	P>0.05	P>0.05	P<0.05
49.	9.40	M	0.10	0.22	3.25	P>0.05	P>0.05	P<0.05
50.	16.33	F	8.92	0.15	0.35	P<0.05	P>0.05	P>0.05

P>0.05 - not significantly different; P<0.05 - significantly different and spleen and are involved in the oocyte maturation. The correlations of HSI and SSI are also made on the same assumption as GSI. In male *Apogon doederleini* the HSI declined rapidly during the breeding season (Okuda and Yanagisawa 1996). This species has no intestinal fat in their mesentery such as a non-fatty fish. It is well known that non-fatty fish store a large quantity of lipid in the liver, which may lead to poor reproduction and the liver weight decreases throughout the breeding season (Morales and Moranta, 1997).

Mahboob and Sheri (1997) reported a significant and positive correlation between the ovary weight, liver weight, spleen weight and body weight in *C. idella.* In the dap *Limanda limanda,* HSI vary throughout the year in both male and female due to seasonal changes (Htun-Han, 1978). HSI was lowest during post spawning season, suggesting that liver was depleted during yolk formation. Similar results were achieved in Plaice *Pleruronectes platessa* and observed that HSI found to be higher in pre-spawning season (Valming, 1974).

M. montanus is listed in the category of threatened status. Thus, they should not be caught from the wild, before they attained maturity in order to safeguard the spawning biomass. To restore the population of this species culture practices are necessary.

ACKNOWLEDGEMENTS

Support of Indian Council of Agricultural Research-National Agricultural Technology Project (ICAR-NATP) is gratefully acknowledged. Thanks are due to Dr. A. G. Ponniah, former Director and Dr. D. Kapoor, Director, National Bureau of Fish Genetic Resources (NBFGR), Lucknow who have selected St. Xavier's College as Centre for Aquaculture Research and Extension (CARE), for captive breeding research. Thanks are due to Rev. Dr. A. Antonysamy, S. J., Principal St. Zavier's College, Palayamkottai for providing necessary facilities to carry out the research work.

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