

TRANSPORTATION AND ACCLIMATIZATION OF GIANT RIVER CATFISH *Sperata seenghala* (SYKES): AN ATTEMPT FOR ITS INDUCTION IN CULTURE SYSTEM

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The culture potential of *Sperata seenghala* was investigated in captive conditions. The fingerlings of *S. seenghala* were collected from Sajawal, Thatta, Sindh. The fish were air lifted to the NARC, Islamabad in oxygen-filled polyethylene bags with three sedative doses (20, 30 and 40 mgL⁻¹) of tricaine methane sulphonate (MS222) at two loading densities (50 and 75 fish per bag). The maximum survival of 90.66% was observed in fingerlings transported with sedative doses of 30mgL⁻¹ at loading density of 50 fish per bag. The fingerlings were acclimatized in circular tanks and concrete raceways. The survival and growth performance during the acclimatization period was better in concrete raceways compared to circular tanks. The cannibalism behavior was studied by the segregation of fish into four groups on the basis of their body weight while the fifth group was mixed size fish (control). A significant difference (p<0.05) of survival rate was observed among the segregated groups and mixed size fish. It was concluded that water and oxygen-filled polyethylene bags having 30 mgL⁻¹ of MS222 were effective for the live transportation of giant river catfish fingerlings. The fingerlings of giant river catfish were successfully acclimatized in captivity by segregating it on the basis of size.

Keywords: *Sperata seenghala*, cannibalism, transportation, acclimatization, survival rate

INTRODUCTION

The culture system in Pakistan mainly gyrates around carp fishes including both indigenous major carps and exotic Chinese carps (Basavaraga *et al.*, 1999). Indigenous major carps namely *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala* are the fish for culture. In order to improve aquaculture system Chinese carps i.e. *Hypophthalmichthys molitrix* (Silver carp), *Ctenopharyngodon idella* (Grass carp), *Aristichthys nobilis* (Bighead carp) and *Cyprinus carpio* (Common carp) were introduced to the culture system of Pakistan. These fishes have gained popularity in fish farming due to their number of traits, such as culture suitability in captive conditions and good growth in ponds (Mirza and Bhatti, 1999). Pakistan has about 198 freshwater fish species. Among the species at least 31 species are economically important. Bringing more indigenous species in aquaculture will boost the fish production in the country. The potential candidates are catfish like *Sperata seenghala*, *Wallago attu*, *Rita rita*, and *Channa marulius* (Rafique and Khan, 2012; Batool *et al.*, 2014; Bhatti *et al.*, 2014).

Research on freshwater aquaculture in Asia has mainly been focused on propagating carp culture and their breeding techniques that has been standardized or transferred to fish farmers. The catfish production mainly depends on catches from wild and, due to high demand and over exploitation of natural stock; the catfish population is decreasing in natural environment. Despite their great demand, catfish culture

systems are not yet established in many countries of Asia including Pakistan. Catfish culture has advantages over carp culture in terms of greater survival in oxygen depleted waters, tolerance to crowding and high stocking rates on artificial feeds.

Many commercially important catfish i.e. *Sperata seenghala* (giant river catfish), *Rita rita*, *Wallago attu* and *Clupisoma naziri* are found in the natural water bodies of Pakistan (Murugesan, 1978). Giant river catfish is a commercially important species, contributing significantly to the total inland fish production in South Asia including Pakistan. This species have high consumer preference due to good quality of meat, tasty flesh and the low number of intramuscular bones (Agbayani, 2004). It is a popular species to capture because it fetches a higher price than the carp (Tripathi, 1996). From aquaculture perspective giant river catfish has wide range of tolerance towards salinity and oxygen depletion (Pethiyagoda, 2005)

Despite the immense commercial importance, the aquaculture potential of giant river catfish has not been explored yet. The present study is the first step for its introduction in culture system with the objective to evaluate the transportation methods and acclimatization of fingerlings of giant river catfish in indoor fiberglass circular tanks and outdoor concrete raceways.

MATERIALS AND METHODS

Collection and transportation: Fingerlings of giant river catfish with the average weight of 9.0 g and length of 11.2 cm were collected from Sajawal Sindh, Pakistan during April 2009. The fingerlings were collected with the help of local fishermen. After collection, the fish were starved and conditioned for 24 hours in circular tanks prior to packing, following typical procedures practiced by nursery (Gomes *et al.*, 2006). To decrease the movement, fish were sedated using rapid anesthetic dose (200 mgL⁻¹) of tricaine methane sulphonate (MS222) before packing in polythene bags. After the rapid anesthesia dose fingerlings were transferred to polyethylene bags containing 10 liter water having three sedation doses of MS222 (20, 30, and 40 mg L⁻¹). Two loading densities (50 and 75 fish per bag) were kept for each sedation dose. Bags were filled with oxygen and packed into styrofoam boxes. Transportation proceeded by roads for 3h from Sajawal to Karachi. From Karachi the transportation boxes were air lifted time 2.5 h) to Islamabad. The experiment design was 3x2 factorial with three replicates, having three sedation doses of MS222 (20, 30, and 40 mg L⁻¹) and two loading densities.

Acclimatization of giant river catfish in captivity: After arrival at Aquaculture and Fisheries Program, NARC, the fingerlings were transferred to circular tanks with water flow system (60 L/h). Fingerlings from each bag were kept in separate circular tanks subsequent monitoring (Cavero *et al.*, 2003). The fish that got injuries during collection and transportation were treated at first step with KMnO₄, while in the second step, fish were treated with antibiotic bath, E.C.M 350 (oxy tetracycline 150g, Neomycin sulphate 60g, Furaltadone HCl 150g in 1000g of E.C.M).

Stocking of fingerlings: After recovery from injury, the treated fish along with healthy fish were transferred to fiberglass circular tanks and outdoor concrete raceways. The indoor circular tanks had 1000-liter water capacity, with controlled temperature that was maintained at 25°C with the help of water heaters. Aerators were used for continuous air supply. Outdoor Concrete Raceways were having 5000 liter water capacity with flow through water system (60 L⁻¹) from tube well. Fifty fingerlings of average initial weight 9.0g were kept in each of the circular tanks, while 100 fingerlings having average initial weight of 8.9g were kept in each of the five raceways.

Feeding of fingerlings: The fingerlings were offered live trash fish in start, but later on it was replaced with the freshly minced fish meat. After one week, the meat was gradually replaced with artificial diet containing 40% crude protein, energy 272.0 kcal and fiber 5.46%. Artificial diet was offered in form of pellets and dough along with minced meat. After complete shifting on artificial diet, the fish were fed twice daily till satiation (at morning and afternoon) seven days a week. The water in the tanks was renewed

every morning. Each time, the bottom of the tanks was cleaned thoroughly before offering the feed. On fortnightly basis, fish (n=10) were collected randomly using hand nets and the wet body weight and the total length were recorded. After recording the data on growth parameters, fish were released back into their respective system.

Study of Cannibalistic behavior: During the acclimatization it was observed that the number of live fish in cemented raceways was decreasing without any mortality. An experiment was designed to study this phenomenon. Fingerlings of Seengharee were segregated on the basis of difference in their body weight (15 in each group). Fish in first group was of the size 5-10 g (G₁); second group 11-15 g (G₂); third group 16-20 g (G₃); fourth group 21-25 g (G₄); and fifth group mixed size fish (G₅). Circular tanks (15 number) having water capacity of 1000-liter and running water system with controlled temperature were selected. Artificial feed containing 40% crude protein (CP) was fed at 5% of the body weight of fish twice a day. The observations were made daily morning to record the survival and disappearance of fingerling due to cannibalism for a period of two weeks. All fish were collected from each tank using hand net, counted at 7-days intervals in order to quantify cannibalism. In each tank the number of dead fish were recorded daily and were not replaced. Calculation of cannibalism was done based on difference in number of fish in each count excluding natural mortality (Qin and Fast, 1996).

Water quality analysis: Physico chemical parameters viz., salinity, pH, dissolved oxygen, electrical conductivity (EC), and TDS were recorded before & after transportation during acclimatization using Limnology field meter (Consort Model C6030, Belgium).

Data analysis: The data on water quality, mortality rate and survival during transportation was analyzed through analysis of variance (ANOVA) by using MS Excel. When F value was found significant, treatment means were compared using DMR test.

RESULTS AND DISCUSSION

Transportation of fingerlings: Data on survival rate of fingerlings of Seengharee during transportation from Sajawal, Sindh to AFP, NARC, Islamabad under different doses of anesthesia and loading density are given in Table 1. The survival rate of fingerlings was maximum under anesthetic dose 30 mgL⁻¹ MS222 with loading density of 50 fish per bag followed by 30 mgL⁻¹ MS222 with loading density 70 fish and 40 mgL⁻¹ MS222 with loading density 50 fish per bag. The minimum survival rate was observed in anesthetic dose 20 mgL⁻¹ MS222 with loading density 70 fish and 20 mgL⁻¹ MS222 with loading density 50 fish. In present study, MS222 at 30 mgL⁻¹ was found best for the transportation of fingerlings of Seengharee in plastic bags.

Table 1. Survival percentage of fingerlings of Seengharee during transportation from Sajawal Sindh in oxygen filled polyethylene bags.

Packing density	Sedation Dose 1 (20 mgL ⁻¹)	Sedation Dose 2 (30 mgL ⁻¹)	Sedation Dose 3 (40 mgL ⁻¹)	Mean
50 fish per bag	29.67e	90.66a	68.33c	62.88A
75 fish per bag	24.67f	80.00b	59.00d	58.72B
Mean	27.16C	85.33A	63.67B	

The values with different letters are significantly different (p<0.05).

The results were in agreement with Shawn *et al.* (2004) and Islam (2013) who reported 25 to 50 mgL⁻¹ of MS222 for sedation of *Ictalurus punctatus* (Channel catfish). Anesthetics at low doses should be preferred for transportation because heavily sedated fish cease swimming, loose equilibrium, and if they all are settled to the tank bottom fish will die from suffocation. Some species, including tilapia required up to 100 mgL⁻¹ for sedation. The effective dose of MS222 for trout is 40 mgL⁻¹ and the maximum safe dose is 63 mgL⁻¹. As temperature raises the safety dose margin become less and for fish of small size its value is smaller (Ross, 1999; Das *et al.*, 2013).

The data on water quality parameters before and after transportation are shown in Figure 1. There was an increase in water temperature in all treatments. DO concentration was very low in T₁ and T₄ while in all other treatments DO levels was high; pH value was decreased in all treatments. The minimum survival observed in T₄ (20 mgL⁻¹ MS222 with loading density 70 fish) and T₁ (20 mgL⁻¹ MS222 with loading density 50 fish) might be leakage of oxygen from some polyethylene bags.

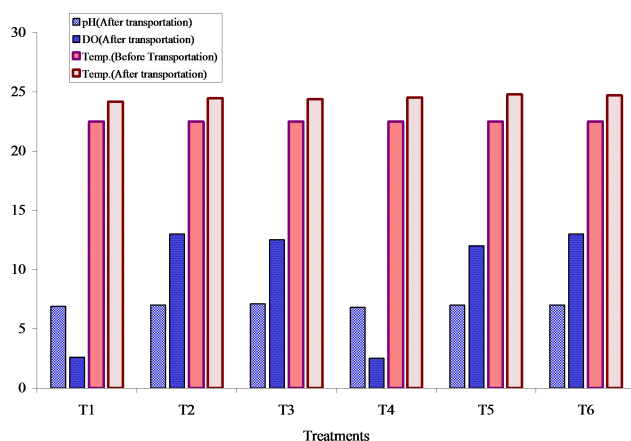


Figure 1. The important water parameters before and after transportation during transportation from Sajawal Sindh in oxygen filled polyethylene bags.

Acclimatization captive conditions: Data on growth performance of seengharee fingerlings during

acclimatization in circular tanks and raceways are shown in Table 2. The initial weight of fingerlings kept in fiber glass tanks and outdoor concrete raceways was 9.0g and 8.9g, respectively. The final average weight of fingerlings kept in outdoor concrete raceways was higher (13.3g) compared to fish stocked in fiber glass tanks (12.9g). The average weight gain of the fingerlings stocked outdoor concrete raceways (4.4g) was higher (p<0.05) compared to those stocked in fiber glass tanks (3.9g). The specific growth rate (0.36 and 0.32) and percent weight gain followed the same pattern. A survival rate of fish during acclimatization was not better; although raceways had higher survival rate (42.31%) than circular tanks (31.54%). The significantly (p<0.05) better growth achieved in the raceways compared to the circular tanks might be due to the difference in water volume; rate of water circulation and daylight among them. This may also be due to the difference of temperature in two treatments which was relatively higher in raceways compared to tanks (Jensen and Crew, 1997). All the physico-chemical parameters of water recorded during the experimental period were under suitable range as reported by Wellborn (1988) and Morris (1993) the average temperature during acclimatization period was 24.8°C in tanks and 27.9°C in raceways.

Table 2. Growth performance of giant river catfish in indoor fiber glass tanks and outdoor concrete raceways during acclimatization.

Parameters	Indoor fiber glass tanks	Outdoor concrete raceways
Initial average weight(g)	9.00a	8.90a
Final average weight (g)	12.90b	13.30a
Weight gain (g)	3.90b	4.40a
Specific growth rate	0.32b	0.36a
Percent weight gain	43.33b	49.44a
Survival rate (%)	31.54b	42.31a

The means with different letters in rows are significantly different (p<0.05).

Weight gain (WG): Weight final – Weight initial

Percent weight gain (PWG): $W_f - W_i \times 100 / \text{initial weight}$

Specific growth rate (SGR) : $[(\ln W_f - \ln W_i) \times 100] / \text{days}$

During acclimatization in Circular tanks and Raceways no mortality were observed but survival rate of Seengharee

decrease with time (Fig. 2). The observation was that numbers of small sized fish decreased with passage of time without any mortality. It was supposed that this decrease in number may be due to cannibalism behavior of this fish (Plate 1).

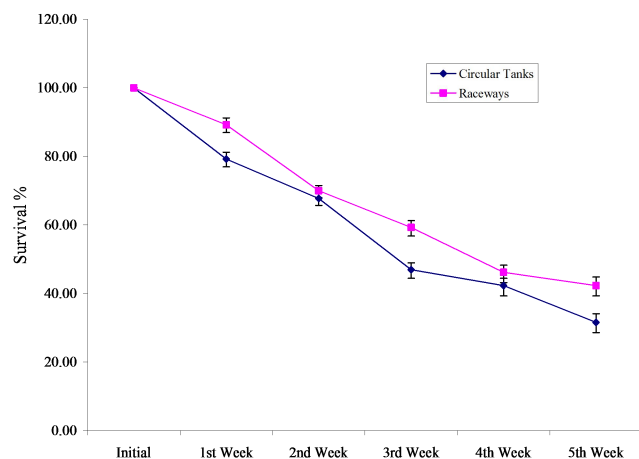


Figure 2. Survival of giant river catfish during acclimatization in circular tanks and circular raceways.



Plate 1. Cannibalism behavior of giant river catfish (*S. seenghala*).

The cannibalistic behavior of Seengharee was confirmed by segregating of fish on the basis of their body size. The size grading decreased the cannibalism among the fry/fingerlings of Seengharee (Fig. 3).

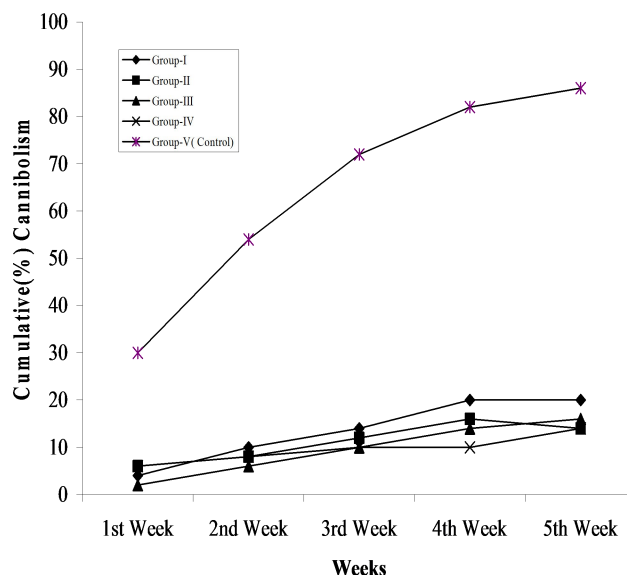


Figure 3. Effect of segregation on cumulative mean percent cannibalism of *S. seenghala* kept in circular tanks over a time of 5 weeks.

The survival rate among the fish of different segregated groups was non-significant but highly significant with non-segregated group. The rate of survival was more in segregated tanks in comparison to non-segregated tanks. The survival was 80.0, 86.0, 84.0 and 86.0 segregated tanks, while in non-segregated tanks survival rate was only 14.0, respectively at the end of five weeks of rearing period (Table 3). This might be due to the absence of bigger cannibals in the segregated tanks decreasing the chance of predation. Fujiya (1976) and Parazo *et al.* (1991) also observed the beneficial effect of segregation in different fish species. The results showed that suitable management practice could

Table 3. Effect of segregation on cumulative mean percent survival of Seengharee kept in circular tanks over a time of five weeks.

Time in Weeks	G ₁ (Wt. 5-10 g)		G ₂ (Wt. 11-15 g)		G ₃ (Wt. 16-20 g)		G ₄ (Wt. 21-25 g)		G ₀ (mixed size fishes)	
	No.	Survival rate (%)	No.	Survival rate (%)	No.	Survival rate (%)	No.	Survival rate (%)	No.	Survival rate (%)
Start	50	100	50	100	50	100	50	100	50	100
1 st Week	48	96	47	94	49	98	47	94	35	70
2 nd Week	45	90	46	92	47	94	46	92	23	46
3 rd Week	43	86	44	88	45	90	45	90	14	28
4 th Week	40	80	42	84	43	86	45	90	9	18
5 th Week	40	80	43	86	42	84	43	86	7	14
		88.67a		90.67a		92.00a		92.00a		46.00b

significantly reduce cannibalism among *S. seenghala*. Sahoo *et al.* (2002, 2006) suggested that the size grading decreased the cannibalism among the larvae of catfish. Segregation of larvae during rearing enhanced their rate of survival. Folkvord and Ottera (1993) opined that strict size-grading reduced cannibalism in Atlantic cod. The cannibalism increased with variation in size of the stocked snakehead (*C. striatus*) and due to injuries with hard spine mortality rate were also increase (Qin and Fast, 1996).

The cumulative cannibalistic pattern in *S. seenghala* per week revealed that segregation according to size resulted in lowest cannibalism (Fig. 4). Cannibalism was noticed first either from head or tail. Size variation in fishes have been found to be a main reason of cannibalism in fish size variation may be caused by either inadequate food supply or genotype differences (Hecht and Appelbaum, 1988). For controlling cannibalism, decreasing the size difference could be further effective than the food availability as reported by De Angelis *et al.* (1979).

Conclusion: For the live transportation of giant river catfish fingerlings the sedation concentration of 30 mgL⁻¹ of MS222 with loading density of 50 fingerling per bag were effective in oxygen filled polyethylene bags packed in styrofoam boxes. The giant river catfish fingerling of was successfully acclimatized in captivity by segregation it on the basis of size.

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