

### Acknowledgement

I am grateful to Dr. B. R. Subba, head of the Department of Zoology, P. G. Campus,

Biratnagar for his valuable suggestions and encouragements to carry out the present work.

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## 6. Oxygen Uptake of German Carp *Cyprinus carpio var communis* L.

The oxygen uptake is a valid measure of energy requirements that is largely influenced by various extrinsic and intrinsic factors viz. temperature, photoperiod, pollutants, season and time, pH, salinity, oxygen, carbon dioxide tensions, body weight, state of activity, nutrition, stage in life cycle, sex, gonadal cycle and hormones etc in organisms. Several workers have studied the quantitative relationship between body weight and oxygen uptake in Indian major carps (Singh 1977, Roy and Munshi 1984). A deep body, short head, protractile mouth with two pairs of barbels, completely and uniformly covered with scales are the characteristic feature of the German Carp. The carp is bottom and margin feeder, which is commonly cultivable.

Live specimens of *Cyprinus carpio var. communis* L. of different weight were brought from Tarahara agricultural fish farm and acclimatized for a week in the cemented

cistern of P. G. Campus, Biratnagar. They were fed with kneaded flour and oilcake. Before 24 hours of experimentation, netting was done using nylon net and desired weight of fishes were sorted out and kept in a rectangular aquarium (76×45×45cm<sup>3</sup>). The experimental fish was starved for 12 hours. The oxygen uptake rate from water was measured in a cylindrical respirometer (24 cm long and 7 cm diameter) having volume of 722 ml. One end of respirometer was connected to a water reservoir (69×30×30 cm<sup>3</sup>) aquarium. The outlet was connected to two conical flasks in series for collection of expired water. Metal clips were used to control the water flow. The experimental fish was weighed and introduced into the respirometer of completely filled water. The flow of water from the reservoir to respirometer was maintained slowly to 15ml/min so that fish did not show any symptom of suffocation and stress. The

respirometer was covered with a piece of black cloth (to avoid disturbance to the fish) leaving a small window for observation of opercula movements for 5 minutes at regular intervals and an average opercula frequency per minute was calculated. Two sets of water samples i.e. the inspired water (collected before the respirometer) and expired water (the water coming out of the respirometer) was collected. Oxygen concentration of inspired and expired water was determined by means of Winkler's volumetric method (Welch 1948). The oxygen uptake per unit time and body weight was determined by the difference of dissolved oxygen of inspired and expired water flow per unit time and body weight of the fish. The atmospheric and water

temperatures were recorded and pH of the water was also measured. For each fish three readings were taken at every half an hour's interval. The experiment was carried out using 22 fishes of different weight

It has been found from the result of the experiment that small fish take more oxygen than large fish because of high metabolic rate. It also suggests that oxygen uptake is directly proportional to the metabolic rate. This finding corroborates the finding of several workers in other fishes (Roy and Munshi 1984, Singh and Munshi 1985, Kunwar *et al.* 1989, Subba 1999, Bhattacharya 2000). The oxygen uptake of the fishes of different weight has been shown in Table 1.

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**Table 1.** Oxygen Uptake in relation to body weight in summer at  $28 \pm 1^\circ\text{C}$

S. No	Body	Atm.	Water	Opercula	Oxygen uptake		
	Wt. (g)	Temp	Temp	Freq/min	mlO <sub>2</sub> /hr	ml O <sub>2</sub> /g/hr	mlO <sub>2</sub> /kg/hr
1	1.09	27.75	27.25	98.25	.049	44954	449.54
2	2.37	28.87	27.12	90	.56	.23628	236.28
3	4.64	28	27.37	93.5	1.05	.22629	226.29
4	9.2	28.5	28	90	1.68	.18260	182.60
5	15.3	29	28.5	90	2.52	.16470	164.70
6	17.34	29.5	28.5	97	3.08	.17762	177.62
7	20.53	28.75	28	85	2.66	.12956	129.56
8	27.24	28.5	27.5	65	3.08	.11306	113.06
9	35.07	28	27.5	65	3.92	.11177	111.77
10	49.1	28	28	62	3.36	.06843	68.43
11	74.35	27.5	27.5	75	3.92	.05272	52.72

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## 7. Structure of Gills of *Xenentodon cancila* ( Ham.)

Fishes bear excellent structures, the gills for the extraction of oxygen from water. Modifications of the architectural plan of the gill structure have been studied by several workers from different habitats (Goodrich 1930, Benelander 1930, Hughes and Munshi 1968, Hughes and Morgan 1973, Subba 1999). For the same study, an attempt has made done in *Xenentodon cancila* (Ham.) from Koshi River of eastern Nepal. It is a small fish belongs to family Belontiidae and commonly called as 'Chuchhe Bam'. Its most distinguishable feature is, the presence of elongated beak- like jaws and a deep longitudinal groove along the upper surface of the head.

The specimens were collected. After taking the fresh weight of the body, the opercula were removed; gills were separated carefully and then immediately fixed in Bouin's fluid. All the measurements were made under dissecting binocular microscope with ocular micrometers.

It has four pairs of holobranchs. Each gill arch oriented in such a fashion that its ventral part lied more anterior than the dorsal one. In the entire gill, filaments were borne by epi and

ceratobranchials only. The first gill arch bears a greater number of filaments than the others. The total number of gill filaments on the first, second, third and fourth gill arch were 122,109,79, and 58 respectively. Distance between primary lamellae was 19.3  $\mu$  and inter lamellar space were 2.3  $\mu$  (average). The gill filament were swollen at their tips and narrow towards their bases. An interesting feature in the anatomy of the gills of *X. cancila* was the absence of gill racker. The inter branchial septum extended almost to the middle of the holobranch.

Anterior and posterior hemibranchs of each gill showed variation in the length of filaments at different regions of the gill arch. In the first pair of gill arches the filament length of the posterior hemibranch were greater than their counterparts of the anterior hemibranch. In second pairs of gills, the filament lengths of both the hemibranchs were more or less equal. However, in the third and the fourth pairs of gill arches, the length of filaments of the anterior hemibranchs were comparatively greater than the corresponding filaments of the posterior hemibranchs.