Other problems involved in cage culture are clogging, fouling and autoentry. Out of these, the first two problems could be solved through periodical cleaning of the cage wall using a brush. Similarly the problem of autoentry could be solved to a certain extent by the periodical removal of the autoentered fin and shellfishes using scoop net or hand net.

1 Sundararaj, V. and Krishnadas, D., Proceedings of the National Seminar on Aquaculture Development in India, Thiruvananthapuram, 1990.
2 Santhanam, R , Srikrishnadas, B. and Natarajan, P , Proceedings of the National Seminar on Cage Pen Culture, Tuticorin, 1983.
3 Sampath, V. and Menon, R., *Bull. Dept Mar Sci , Univ Cochin*, 1975, VII, 3
4 Krishnan, P. R., Jalaluddin, S. and Jayasundari, K., Proceedings of the National Seminar on Cage Pen Culture, Tuticorin, 1983.
5 Uma Maheshwari, R , Proceedings of the National Seminar on Cage Pen Culture, Tuticorin, 1983.
6 Venkatasamy, G., Proceedings of the National Seminar on Cage Pen Culture, Tuticorin, 1984
7. Victor Chandra Bose, BOBP/WP/35.
8 Maruthupandian, S , M Phil Thesis, Annamalai University, 1987
9 Kunju, M M., Proceedings of the Summer Institute in Breeding and Rearing of Marine Prawns, CMFRI, Cochin, 1978
10 Subramanian, M , Proceedings of the Department of Fisheries, Govt of Tamil Nadu, 1972.
11. Krishnamurthy, N., Proceedings of the Seminar on Mar Mech. Fishing, Department of Fisheries, Govt. of India, 1972
12. George, K. V., CMFRI, Special Publ , 3.
13 Muthu, M S., Proceedings of the Seminar on Mar. Mech. Fishing, Govt of Tamil Nadu, 1978.

ACKNOWLEDGEMENT. We thank the Director for encouragement

Received 7 December 1992, accepted 3 September 1994

Effect of bacterial ulcer on the haematology of *Channa punctatus* (Bloch.)

S. M. P. Yadav and B. P. Akela

Department of Zoology, L. N. Mithila University, Darbhanga 846 004, India

Haemoglobin concentration and RBC count were made in control and ulcerative *Channa punctatus*. Bacterial ulcer caused an abrupt decrease in the number of erythrocytes along with reduction in the amount of haemoglobin. The loss of water from the plasma and tissue via wound proved to be anti haemopoietic and a reason behind fish death.

LIKE all animals, fishes have their full complement of disease and parasites and of abnormalities both malignant and benign. The ulcerative fish disease in epizootic form in some areas of Eastern Indian states such as Tripura, Meghalaya, Assam and West Bengal was reported in May 1988. The disease severely affected almost all districts of West Bengal[1]. Later the disease also spread to Orissa, Bihar, UP, Sikkim, Manipur and Nagaland.

Two fluorescent pseudomonads (R_1 and R_2), one aeromonad, *Aeromonas hydrophilia* (R_3) and *Micrococcus* variant (C) were isolated from the ulcer tissue of air-breathing fishes[2]. Other workers also studied the cause of ulcer and its effects on fishes[3–12].

The findings and views of earlier workers are not uniform and scanty work has been done on the haematological alterations in fishes due to ulcer. Hence, it seems necessary to study the changes in haematological parameters of fish due to ulcer on its induction.

The commonly available freshwater teleost, *Channa punctatus* was used as experimental animal, since this fish along with others was found to suffer from ulcer. Fishes were collected from ponds and swamps of Darbhanga. Care was taken to collect healthy and infected specimens. The healthy fishes were acclimatized in the laboratory aquarium for a fortnight with proper supply of fish-feed. The ulcer was induced in healthy fishes keeping a few ulcerative fishes amongst healthy ones. Blood was collected in a plastic syringe using EDTA as an anti-coagulant directly from cauda dorsalis. Haemoglobin was estimated by acid-haematin method[13]. Erythrocyte count was made by Thoma Zeiss haemocytometer[13].

The weight of healthy males was 47 ± 0.7 g. In these, the haemoglobin content was 14.99 ± 0.328 g% and the RBC count was $4.1016 \pm 0.178 \times 10^6$ mm^{-3}. The ulcerative males weighed 48.8 ± 0.55 g. The haemoglobin content and RBC count were 7.65 ± 0.221 g% and $1.8222 \pm 0.157 \times 10^6$ mm^{-3} respectively. Ulcer caused an abrupt and significant fall in the level of haemoglobin as well as in the number of erythrocytes (Table 1).

The control and ulcerative female specimens weighed 50 ± 0.65 g and 52.8 ± 0.67 g respectively. The haemoglobin content and number of RBC recorded in healthy fishes were 13.21 ± 0.203 g% and $3.7085 \pm 0.221 \times 10^6$ mm^{-3} respectively. In ulcerative females the haemoglobin content was 5.56 ± 0.296 g% and RBC count was $1.729 \pm 0.159 \times 10^6$ mm^{-3}.

Thus both haemoglobin and RBC count followed the same pattern as in the case of male specimens. The haemoglobin content and RBC count were higher in males than in females. However, the decreasing trend was similar in both the sexes.

Since the haemoglobin content of blood is directly related to the number of erythrocytes, in the present investigation the number of erythrocytes fell to a great extent. Thus, erythropaenia in the present work might be the reason behind the decrease in the concentration of haemoglobin.

Table 1. Effect of bacterial ulcer on haematology of *Channa punctatus*

Specimen	Sex	Weight (g%)	SE	Haemoglobin (g%)	SE	RBC ($10\ mm^{-3}$)	SE
Healthy	Male	47 0	0 734	14 99	0 328	4 1016	0 178
	Female	50 0	0 651	13.21	0 203	3.7085	0 221
Ulcerative	Male	48 8	0 534	7 65	0 221	1.8222	0 157
	Female	52 82	0 677	5 56	0 296	1 7291	0 159

Possibly loss of water from the plasma to the tissue or haemopoiesis resulted in reduction of the production of erythrocytes.

1. Pradhan, K., Pal, J. and Das, A, *Environ Ecol*, 1991, **9**, 510–515.
2. Pal, J and Pradhan, K., *J Fish Biol*, 1990, **37**, 833–839
3 Ajello, G. W and Hadley, A. W., *J Clin Microbiol*, 1985, **4**, 443–449
4 Aschehoug, V. and Vesterhus, R., *Zbl Bact* (Abt 2), 1993, **106**, 5.
5 Bangham, R. V and Hunter, G. W, *Zoologica*, 1939, **24**, 385–448.
6. Bedford, R H, *Progr Res Biol Stas*, Nanaimo and Prince Rupert, 1927, **33**, 23.
7 Bell, G. H, *Exp Physiol*, 1959, **126**, 278–282.
8. Bellet, R, *Ann N Y Acad Sci.*, 1965, **126**, 461–467.
9 Colwell, R. R, *Appl Bacteriol*, 1962, **25**, 117–158.
10. Das, M K and Pal, R N, *Indian J. Parasitol.*, 1987, **11**, 127–130
11. Davis, H S., *Invest Rep*, 1946, **12**, 98
12. Elliot, A M and Ressett, L R, *J. Parasitol.*, 1949, **35**, 183–196
13. Darmady, E. M and Davenport, S G. T, *Haematological Techniques for Medical Students*, J&A Churchill, London, 1914, vol 1

Received 24 August 1994, revised accepted 23 June 1994