never attain a length of 44 mm can be found on the Transvaal highveld.

With any quantitative character in tadpoles, such as a ratio, absolute size, or degree of pigmentation, keys should be thought of as applicable not to every individual tadpole, but to most of a population – in a good key 99 per cent or more. So far few corrections have been found to be necessary in the keys in Van Dijk (1966). One such involves the ratio of distance between the nostrils to nostril-width, where the limits were set at less than 6x and more than 10x; in the case of *Phrynobatrachus* (field key and p. 248) instead of 10x or greater the ratio should be set at more than 6x.

ACKNOWLEDGEMENTS

I wish to thank Dr B. R. Stuckenberg and Professor J. A. J. Meester for reading the manuscript and making valuable comments.

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EFFECTS OF SODIUM CHLORIDE ON THE FRESHWATER FISH LABEO CAPENSIS DURING AND AFTER TRANSPORTATION

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Accepted: July, 1976.

INTRODUCTION

The effects of capture and transportation on freshwater fish have been studied by many workers (Fujiya 1961; Bouck & Ball 1966; Mann 1965; Narasimhan & Sundararay 1971; Hattingh & Van Pletzen 1974, to name but a few). Amongst other things, it would appear that fish experience osmoregulatory problems during and after capture (Wedemeyer 1972; Hattingh & Van Pletzen 1974). To counter this phenomenon, it has been suggested that commercial salt (about 98 per cent NaCl) be added to the transportation water and the fish kept in this solution for some time afterwards (Hattingh *et al.* 1975). By using this method, a much lower mortality is obtained during transport.

The question now arises as to the nature of the protective function of the added NaCl. Is it merely a physical effect of increasing the osmotic pressure of the water and thus limiting water absorption through the skin and gills, or is there a more physiological effect? This paper reports some of our findings.

MATERIALS AND METHODS

The freshwater fish, *Labeo capensis*, was used in this study. Adult and healthy specimens were seined in local waters. For the first set of

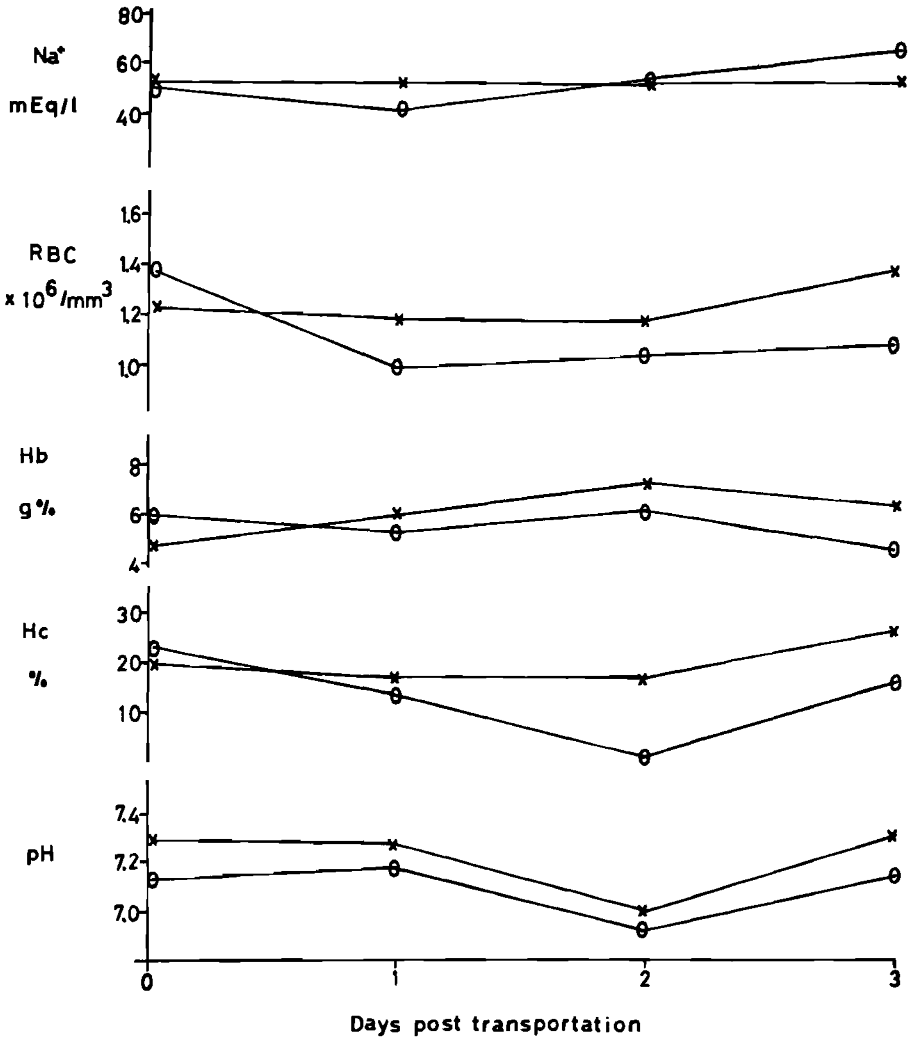

FIGURE 1

Effects of transportation in fresh and in salt water on blood parameters of *L. capensis*. x——x, salt water; o——o, freshwater. Only mean values are presented.

experiments the animals were acclimatized in the laboratory, either in aged tap water or in aged tap water containing 0,7 per cent NaCl (salt water fish) for at least three weeks. After acclimatization various haematological parameters were investigated.

For the second set of experiments, fish were seined and transported to the laboratory in either river water or in river water containing 0,7 per cent NaCl as described previously (Hattingh *et al.* 1975). Haematological parameters were investigated immediately on arrival at the laboratory and then on subsequent days up to the third day on both groups of fish.

The haematological parameters were blood pH, haematocrit (Hc), haemoglobin concentration (Hb), erythrocyte counts (RBC) and plasma sodium (Na^+) concentration. The methods have been described in detail elsewhere (Hattingh & Van Pletzen 1974). Each experimental group consisted of at least 15 animals.

RESULTS

Laboratory-acclimatized animals yielded the following information for fresh and salt water (means $\pm$ S.D.):

Hb: 6,30 $\pm$ 1,00; 5,35 $\pm$ 0,70 g%
Hc: 23,72 $\pm$ 2,86; 20,00 $\pm$ 4,00%
pH: 7,20 $\pm$ 0,01; 7,31 $\pm$ 0,01
RBC: 1,59 $\pm$ 0,34; 1,30 $\pm$ 0,47 $\times$ $10^6/mm^3$
Na^+: 50,57 $\pm$ 2,93; 52,19 $\pm$ 2,33 mEq/1.

The salt water fish, therefore, showed lower mean values for Hb, Hc and RBC but higher mean blood pH and Na^+ values.

The effects of transporting fish in either freshwater (river water) or in river water plus NaCl (and keeping the animals in this water after transport) are shown in Figure 1. On arrival at the laboratory (day 0 in Figure 1), salt water fish again showed lower mean Hc, Hb and RBC values. Blood pH and Na^+ values were higher in these fish than in freshwater animals. Compared with the values obtained from laboratory-acclimatized animals, it was found that Hb was lower in the case of salt-water-transported fish but that the other values corresponded closely to their respective counterparts in the other experimental group. On the days subsequent to transportation, it is clear that salt-water animals showed remarkably constant blood Na^+, Hc and RBC values. In the case of blood pH and Hb, these fish followed the same general trends as were observed in freshwater animals, but returned to normal values within the three-day study period. The freshwater-transported fish, on the other hand, had not returned to normal after three days and the mortality in this group was high.

DISCUSSION

One of the problems associated with a study such as the present, is the comparison of experimental data obtained from laboratory acclimatized and freely swimming fish. It is usually assumed that laboratory acclimatized fish will yield the same results as wild animals if the experiments are performed during the same season on similar animals. This may not be the case, and although essentially similar values were obtained for laboratory acclimatized animals and from fish immediately after transportation to the laboratory, it may well be that the values for the wild animals are in fact higher than those measured. It has been suggested that water enters the animals during capture and transportation, causing dilution of the blood with subsequent decreases in Hc, Hb, RBC, etc. (Hattingh & Van Pletzen 1974). The present results on freshwater-transported animals confirm this. If the addition of salt to the transportation water acted merely to increase the osmotic pressure and therefore limited the inflow of water, it would have been expected that fish transported in salt water should show higher values than fish transported in freshwater. This was observed only in the pH and Na^+ values and it thus appears that the salt has some other function.

The fact that salt-water-transported fish showed a constant blood Na^+ concentration, indicated that a stable blood osmotic pressure was maintained. This fact probably explains the constancy of the RBC and Hc values compared with freshwater-transported animals where the decrease in blood Na^+ concentration is known to be associated with a decrease in blood osmotic pressure (Hattingh & Van Pletzen 1974). This eventually leads to haemolysis. Maintenance of a constant blood Na^+ concentration during transportation therefore seems to be crucial for these animals and they most probably do this by absorbing NaCl from their medium.

Finally, although it is apparent that addition of salt to the transportation water aids the fish, the decrease in blood pH on the second day is indicative that some stress is still experienced. The cause of this remains to be investigated.

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SAND SOLIDIFIED BY GEMSBOK URINE AS SELECTED BURROW SITES BY GERBILS

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Accepted: August, 1976.

Gerbillurus paeba is widely distributed throughout the arid parts of southern Africa (Roberts 1951). Its range extends into the central Namib Desert where it is most often found on sandy areas of the central Namib plains or in the interdune valleys (Coetzee 1969). Its semi-permanent burrows are excavated in the sand either in the open (Laycock 1975) or, more often, close to dune-grass clumps (Coetzee 1969) and other vegetation. The sand at the base of perennial vegetation clumps (*e.g. Acanthosicyos horrida, Stipagrostis sabulicola, Trianthema hereroensis*) is solidified by fog precipitation falling from the plants and by the presence of the roots which facilitate burrow construction. Distribution of gerbil burrows in dunes is thus limited by the occurrence of perennial vegetation or other suitable burrow sites in the more compact pebbly soils of the interdune valleys.

Unconsolidated sandy interdune valleys can be successfully colonized only under special conditions. One such opportunity is presented by the occurrence of sand patches which have been solidified by gemsbok (*Oryx gazella*) urine. The concentrated gemsbok urine lightly cements a block of sand averaging 0,025 m^3 ($n = 20$) in diameter which is more resistant to wind erosion and other disturbance than the surrounding loose