INTRODUCTION

It is well known that the migratory fishes, in general, can withstand a wide range of environmental conditions. The anadromous and catadromous fishes which migrate from salt-water to freshwater and vice versa respectively are exposed at different times of the migration to a medium of either fresh or salt water alone or a varying mixture of both. One of the most important problems which a migratory fish should confront therefore, is the maintenance of a more or less constant body composition with respect to water and electrolytes in the face of a changing outer environment. Fishes do not feed during migration. The energy required for the long migratory movement, gonadal development and the maintenance of body processes must come, therefore, from the body reserves of lipids, protein etc. during the long period of starvation. A sequence of physiological phenomena bringing about the catabolic changes in the maintenance of homeostasis must be taking place.

The histological changes in the major organs and tissues and the physiological changes in blood which occur during migration in Salmon genera have been reported by Robertson and Wexler (1960) and Robertson *et al.* (1961 a & b). However, no studies have been made on the changes in the neurosecretory and the muscular systems.

The present thesis is concerned with the organs

of alimentation and certain other internal organs and forms a part of a team work undertaken to shed light on the various aspects of migration. Comprehensive studies were made on two fishes, the migratory Hilsa ilisha and the non-migratory Hilsa toli.

Hilsa ilisha (Ham.) and Hilsa toli (Cuv. & Val.) are closely related species. These are common food fishes found on the west coast of India. It is known that H. ilisha migrates up the major rivers of India for spawning twice a year. The major run of migration occurs in monsoon, the second in March-April. The fingerlings of H. ilisha return to sea and further growth takes place there. From the stomach examinations it was found that H. ilisha do not feed during migration and spawning. The hormonal system must be expected to play an important role in mobilizing the body reserves of lipids etc. during starvation and in maintaining the electrolyte balance during movement from hypertonic to hypotonic media. Important physiological changes must be expected in the muscle to meet the requirement for its sustained activity during migration. Alterations as a result of starvation and other functional changes in the organs of alimentation and the glands associated with it should also be expected. A comprehensive study was planned to investigate the nature of changes taking place in the neuroendocrine system, the muscle tissue and the various other tissues and organs during migration of H. ilisha. Similar studies were also carried out on the closely related H. toli which is a marine,

non-migratory fish. H. toli which were drifted into the river due to the force of tidal current on the highest high tide day were also studied.

Chaper 1 presents a concise account of the biology, habit, habitats and fishery of the two fishes, H. ilisha and H. toli. As mentioned earlier H. ilisha do not feed during migration and spawning. As a result atrophic and degenerative changes in the alimentary canal should be expected. Green (1926, c.f. Robertson and Wexler, 1960) and Robertson and Wexler (1960) have reported such alterations in the Pacific salmon. The histological studies of alterations in the alimentary canal were carried out on the same lines in the migratory H. ilisha. The results were compared with those observed in the non-migratory H. toli from sea and drifted H. toli from river (Chapter 2).

Starving fishes are known to draw upon their body reserves like lipids, proteins etc. during migration and spawning. Lipids are stored prior to migration. Liver is one of the chief organs storing lipids in addition to the subcutaneous fat depot. Since the liver plays an important role in intermediary metabolism, the histological alterations in the liver as well as the lipid content of liver during various stages were studied (Chapter, 3 and 4).

Variations of localization and types of Cholinesterases in alimentary canal and liver has been reported (Gerebtzoff, 1959). However, their exact role in the above

organs has not been fully ascertained. A study of cholinesterases in the liver and alimentary canal, especially when the fish is starving, was thought of interest (Chapter, 5).

Pancreas, like liver, plays an important role in intermediary metabolism. During starvation, blood sugar level is expected to show changes. Also the effect of various hormones and lipolysis on carbohydrate metabolism is known (Weil, 1965). This will secondarily affect the insulin output and pancreas structure. A study of pancreas was therefore undertaken (Chapter, 6).

Adrenal hormones bring about change in the structure of spleen, especially the lymphocytes. In the Pacific salmon, 17-hydroxycorticosteroid is known to increase during migration and spawning. No direct estimations of corticosteroids in blood have been made, but to derive indirect conclusions, a comparative histological study of the spleen in the migratory and non-migratory fish was undertaken (Chapter, 7).

In hypertonic medium the fishes have to retain water and excrete excess of salts whereas in hypotonic fresh water they must conserve salts and excrete more water. Kidney is one of the important sites of electrolyte exchange. Many factors play varying roles in the maintenance of homeostasis of which the corpuscle of Stannius is also one (Chan *et al.*, 1967). Hence a histological study of the kidney and the corpuscle of Stannius were carried out in *H. ilisha* and *H. toli* during the different phases of life cycle. Comparison of these

results with those of drifted H. toli captured from river was of great interest as the drifted fish experienced abrupt changes in external environment for which its hormonal system was not prepared (Chapter, 8 and 9).

The paired ultimobranchial bodies, situated on the sides of oesophagus has been a subject of different interpretations. No specific functions have been proven, though speculations attributing endocrine functions similar to thyroid and parathyroid glands are many. With a view that, study of these ultimobranchial bodies during different phases of life cycle, in relation to changes in salinity, the endocrine system etc. may help to throw some light on their functional aspects more specifically, histological alterations in these structures were studied (Chapter, 10).

The existence of catecholamine secretory granular cells in the heart of lower vertebrates is well known (Bloom et al., 1962). The role of catecholamine as stimulator of contraction in mammalian heart was demonstrated by Hoffman (1945). During migration the swimming activity is increased and the rate of contraction of heart may increase so that more blood could be pumped to the body parts. This reasoning led to the proposition that catecholamine secretory granular cells might exsist in the heart of Hilsa. As expected the presence of these cells were located in the heart of Hilsa employing histological methods. The secretory cycle during various phases of life cycle were also studied.