



**Figure 10.** The EAFFRO laboratory at Jinja, Uganda. The wing that I added during my 1963–65 directorship can be glimpsed at the rear of the building. Photo: D. Tweddle.

on the existence of the separate water layers and the thermocline between them (Beauchamp, 1939). When one thinks of the millions spent on such research today, the tiny investment in his work yielded incalculable dividends.

Beauchamp early suggested that Liebig's Law of the Minimum applied in that the growth of phytoplankton, basis of the food chain in all lakes, is limited by the availability of the least abundant nutrient. Once that nutrient has been taken up, no further proliferation of plankton can occur. He started experimental work to discover what this limiting factor might be. Though he could not know it, this work was prophetic in the light of the disastrous eutrophication of Lake Victoria, which worsened, thanks to unlimited allochthonous nutrients reaching the lake from agricultural fertilisers and indiscriminate tree-felling on adjacent land. At the time, Beauchamp (1953) concluded that the limiting nutrient was sulphate, either as a solute (Fish, 1956) or being fixed in bottom muds (Hesse, 1957). For a while, he advocated introducing sulphate salts to increase productivity and thus fish biomass. This was never done and some doubt was cast on the theory, and soon it all became irrelevant, as the damage to Lake Victoria intensified.

Beauchamp retired in 1960 after thirteen years of meritorious service, during which it is safe to say that he had established the East African Freshwater Fisheries Research Organisation as the premier freshwater research agency on the African continent. At the beginning, it had been his policy to make the Jinja station a sort of branch of the British Freshwater Biological Association. There was even work on algae which were not local. Dr G.E. Fogg of London University supplied the blue-green *Anabaena cylindrica* and the green alga *Chlorella pyrenoides* in bacteria-free cultures, which were used in experiments to determine chemical deficiencies occurring in lake waters (EAFFRO, 1952). The value of this research must be stressed. There is no doubt that this early hydrological work, coupled with Beauchamp's pre-war achievements, contributed enormously to our knowledge of how tropical lakes work.

Another fine officer was Miss R.H. Lowe, who had arrived in November 1948, fresh from her single-handed fisheries survey of Lake Nyasa (1952a). She had immediately begun a survey of the cichlid fish then collectively referred to as the genus *Tilapia* in the various East African waters. This involved a great

deal of expeditionary work of the kind originally envisaged for EAFFRO, where as much information as possible is gathered in the field and the collections made are brought back to the laboratory for study. This work resulted in a number of valuable publications (Lowe, 1955a,b,c; 1956a,b; Lowe-McConnell, 1957, 1958, 1959) on this commercially important taxon. Regrettably, Dr Lowe-McConnell left EAFFRO in 1954 when her husband was transferred, but continued her work, to become one of the most eminent freshwater scientists in Africa and South America, later publishing important general books (Lowe-McConnell, 1975, 1987), amongst a host of other publications.

Even in the early years of EAFFRO, it was not long before the scientific staff realised that Lake Victoria's tilapia stocks were being dangerously overfished. One of its most prominent scientists, D.J. Garrod, began some pioneering fisheries science research on these tilapias (Garrod, 1957a,b; 1959), which was supplemented by an important publication by the visiting scientist, R.J.H. Beverton (1958). Garrod later also published a major review of *Tilapia* (later *Oreochromis*) *esculenta* dynamics in Lake Victoria (Garrod, 1963). As a result, EAFFRO began warning of the decline in stocks as early as 1954 (EAFFRO, 1955), and discussion of it formed a large section of the 1956/57 Annual Report (EAFFRO, 1958). But it was not enough to prevent the Lake Victoria Fisheries Service and the Uganda Fisheries Department from tinkering with Lake Victoria's fish populations, with calamitous results.

Other members of the EAFFRO staff and several well-known visiting scientists also contributed to the Organisation's reputation as a leader in tropical hydrobiological research. Amongst these was the hydrologist, G.R. Fish, who published important studies on the feeding habits of tilapia (Fish, 1951, 1955), which, with those of other researchers (Worthington, 1929; Lowe-McConnell, 1956b), showed that their food consists almost entirely of phytoplankton, of which only the diatoms (mainly *Melosira*) are digested. Fish (1956), and later Talling (1957) and Evans (1962), initiated quantitative estimations of the phytoplankton over prolonged periods.

The entomologist, W.W. MacDonald, was also briefly on the staff, studying the lake fly *Chaoborus*. He published a general article (MacDonald, 1953) and a longer paper which included discussion of their food value (MacDonald, 1956).



## The East African Fisheries Research Organisation: 1947

Dr Taylor was reluctant to leave Northern Rhodesia after eight months there, especially with so many problems unresolved. I was equally reluctant to leave Samfya, where I was learning about fish and fisheries every day, to take on the responsibility, desk-work, frustrations and improvisations that were the lot of the man in charge at Fort Rosebery. But no new director had appeared and the warning in my letter of appointment that I "might be required to take charge of the station" had become a fact. I was granted an allowance of £100 a year while acting Officer in Charge, and drew it for the next five years.

By mid-November the rains had arrived, and, as I returned from Lusaka, the roads, so recently chokingly dusty, were swamped with sheets of water, concealing the potholes into which the vehicle crunched with chassis-shattering force. I ploughed soggily back to Fort Rosebery, there to await events with what turned out to be entirely justified trepidation.

Taylor's efforts to complete the Lupuma dam, at a cost about four times the original estimate of £715, were manifestly insufficient to prevent the swollen river from breaking it, even though a little grey Ferguson tractor with scoop, ordered months previously, had just arrived. However, fortune favoured me, for a brand new D4 bulldozer, a desperately scarce item then, arrived for the PWD roads section. I was allowed to use it for two precious days, during which, working from dawn to dusk, the two tractors moved almost as much earth as Taylor's hand labour had done in three months, thus adding an extra metre to the wall. I slept more restfully, but the Lupuma had one last bolt to shoot.

There was a cloudburst over the deceptively small catchment area, and, at dawn on New Year's day 1952, I found the water within 30 cm of the wall's crest and a flood rushing through a spillway obviously too small. I clamoured for help and the DC, Ewen Thomson, rose to the occasion. Every labourer was called out, every prisoner brought from the gaol. Grain bags due for return to the mills were filled with earth and passed along a muddy human chain. We stood hip-deep in the spillway, hacking at its steep laterite sides, with the current snatching away the spoil, to widen it by two metres. The floods receded a little, the Lupuma Dam was saved, and remains there, so far as I know, to this day. But at the time I was sure that my first task in charge of the Organisation would be to report the loss of the only tangible asset it had produced in its first year of existence.

In March, the Colonial Office fisheries adviser, Dr Hickling, arranged for me to visit the East African Freshwater Fisheries Research Organisation, to broaden my experience and meet colleagues. EAFFRO had been one of the first research organisations founded by Dr Worthington with a slice of the original CDW research grant in 1947 when Scientific Secretary of the East African High Commission. This was a semi-federal body set up to administer services common to the territories of Kenya, Uganda and Tanganyika, such as posts, telegraphs, customs and excise, the railways and research. EAFFRO's ambitious brief was to examine, with a view to their further development, the lake fisheries of the three countries, from the Great Lakes Tanganyika and Victoria in the south and centre to the Nilotic and

Rift Valley lakes in the north. All had very large fisheries and a good infrastructure of road and lake communication – except Lake Rudolf, now Turkana, which had a virtually untouched fish population, until the ill-advised 1970s Norwegian Aid project tried to turn the Turkana tribesmen into fishermen.

The task allotted to it was far too great for EAFFRO, with its six permanent staff. The original intention had been to establish substations, especially one on Lake Tanganyika (EAFFRO, 1949), but this had never happened. In practice, with some exceptions such as the work of Lowe-McConnell and, later, Mann, much of the work, a good deal of it academic in nature, was done either in the laboratory or, because of the limited range of their research vessels, on the waters of Lake Victoria close to the laboratory. In the end the younger sister, JFRO, was to do far more research on Lake Tanganyika than EAFFRO ever did.

The EAFFRO laboratory, with its architect's trademark pagoda-like Far Eastern look, is situated at Jinja at the end of the Napoleon Gulf at the lake's outflow. This is the famous source of the Nile, which excited so much 19th-century interest before being discovered at last by Speke in 1864. Rzoska (1976) described the earlier history of this ancient river and its associated lake and headwaters. The construction of the laboratory and staff housing started in 1947, and was relatively rapidly completed, EAFFRO being far more fortunate than JFRO in being located in a town with many skilled artisans, with locally made bricks and with cement from nearby Tororo. The many fine hardwood timber species of the Uganda forests, *sapele* mahogany, *mvule* (*Chlorophora excelsa*) teak, yellowwood (*Podocarpus*) and Mount Elgon olive were all used lavishly, and certainly wastefully, in the building. There was absolutely no comparison between the artistic merit of the Jinja laboratory and that of the stark brick and iron of Samfya.

While the laboratory was being built, some of the staff lived at Kisumu on Lake Victoria in Kenya, and some preliminary gill-netting experiments were done there under the supervision of S.H. Deathe, the first technical officer. At the time of my first visit, EAFFRO had been going for nearly four years.

As the Director, R.S.A. (Bobby) Beauchamp, introduced me to his staff and visiting scientists, I felt my position keenly, for they had already achieved impressive research results, while all JFRO had to its credit was the discovery of a previously unrecorded, and as yet unidentified, small cyprinid from Lake Bangweulu.

Beauchamp, Director from 1947 to 1960, was another of the "Cambridge School" of African limnological research. Before World War II he had laid the foundations of our knowledge of the water stratification of the Rift Lakes Tanganyika and Nyasa. This included making a truly epic voyage down the length of Lake Tanganyika in a four-metre boat, sleeping under trees near the beaches and equipped only with a hand-operated winch and three quarters of a kilometre of hydrographic wire and a reversing thermometer. Lowering and hauling this took half an hour or more to get a single temperature reading, yet, with this simple equipment, Beauchamp accurately obtained the first-ever data