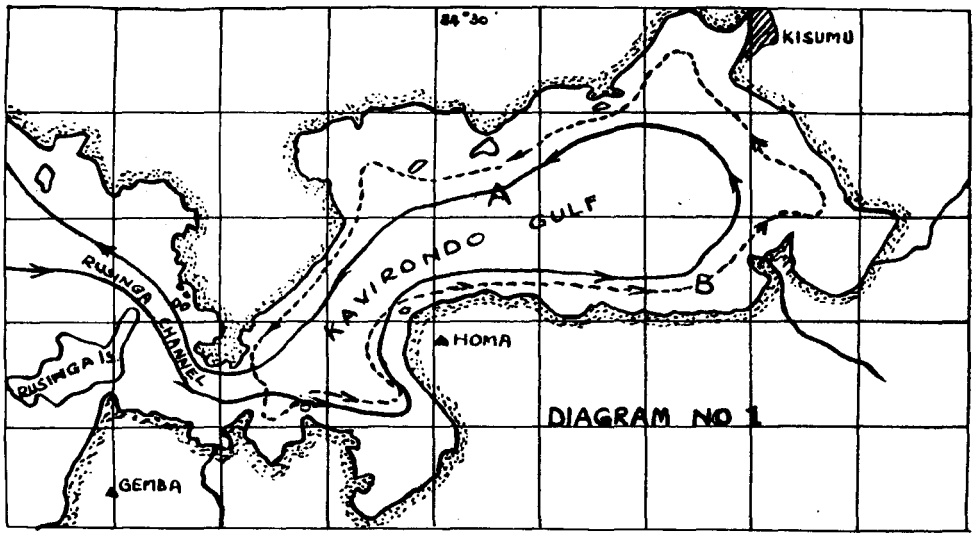
THE TILAPIA FISHERIES OF THE KAVIRONDO GULF.

By Hugh Copley.

The Kavirondo Gulf is an arm of Lake Victoria and is the main producer of lake fish ngege or Tilapia, to Nairobi, which provides us with an excellent fish food. The Kavirondo Gulf is completely within Kenya Colony and the administration of its fisheries together with the other parts of the lake come under the Lake Victoria Fishery Board whose headquarters are based at Kisumu. Before paying particular attention to the gulf let us consider Lake Victoria as a whole. The area of the lake is generally given as 26,000 square miles, nearly the size of Scotland. From north to south it is 250 miles with a greatest breadth of 200 miles and the shore-line is about 3,000 statute miles. The shape of the lake can be compared with that of a soup plate. There is an edge or shelf sloping from the shore gently to the 100 foot mark and then dropping to form the rounded bowl of the soup plate with a maximum depth of 270 feet. The shelf from the shore to the 100 foot line forms the fishing grounds and here all fishing is done.



The Kavirondo Gulf is a depression covered by lake water about 42 miles long by an average width of 12 miles which narrows to 4 miles at the gateway at Rusinga Island. It is very shallow with a maximum depth of 20 feet. The water of this gulf is not stationary by any means for there is a diurnal range as much as 18″ caused by wind pushing water in the main lake through the entrance and into the Gulf. When the wind changes and pushes water in another direction this extra 18″ of gulf water flows back into the lake. This rise and fall in the water level of the gulf goes on all the year round depending on the direction and force of the wind.

There are two species of Tilapia in the gulf; the ngege (*Tilapia esculenta*) and the mbiru (*Tilapia variabilis*). It is the ngege which provides the fish

export from the lakes as it travels and keeps well. The mbiru is not a good traveller or keeper and is consumed locally. Again the gulf is predominantly a ngege fishery whilst other parts of the lake are just the opposite. The general idea that the ngege is found all over the lake is completely without any foundation—in fact the ngege shoals are local.

The ngege is caught by means of a 5″ gill net and this regulation is strictly enforced. Other sized nets are used all over the lake for other fish but this does not interest us. The theory is that by the use of a gill net with a mesh of 5″ no Tilapia will be caught which has not spawned. The nets are 100 yards long when bought, but when mounted are 60 yards long by about 5 feet deep. From 3 to 12 of these nets are joined together and fished as a "fleet". They are set in the evening at dusk and lifted at dawn. Just to show the size of the fishery, there are 500,000 5″ nets; 250,000 2″ nets and 100,000 seine nets in use on Lake Victoria for one year—a value of two million pounds.

To work this fishery there are an estimated 30,000 fishermen, as many as in the whole of the British Isles.

In the Kavirondo Gulf 8,000 5″ gill nets are set every night worth £17,000 and their total length is 272 miles. Each flax net lasts 8 weeks if undamaged or wrecked by hippo or crocodiles. Again 2,200 tons of ngege only are exported from Kisumu a year.

Now what of the Tilapia? The first question for everybody concerned, including the housewife, is "Can this go on for ever?" and secondly "Are we catching too many tilapia and exhausting the stock so that in years to come there will be no fish or very few fish to catch?" This depends on another question "Is the stock of fish in the gulf a closed stock say of 13½ million fish or is the number of fishes caught made up by migrations of fish from the main stock in the lake?" It wil be seen that this is a most important question, for if we have 13½ millions (these figures are purely a guess) of Tilapia in the gulf and catch 4¼ million of mature fish every year can the 9 millions left keep the fishing going? On the other hand if 4½ million fish come in from the main lake every year and keep the stock of 13½ million up to strength and we do not catch more than 4½ million every year the fishery goes on for ever. Into this simplified picture comes a disturbing element. The population of Kenya, all races, is increasing at no mean rate and has a greatly increasing spending power; all can afford to eat more fish, and therefore there are more mouths clamouring to be filled. Whereas 4½ million fish per year may satisfy these mouths this year, as the years pass they will want 6 million fish then 8 million fish and so on. Consequently the pressure for more fish from the gulf will increase, so back we come to our two questions. If the fish population is a closed one, spending its life cycle in the Kavirondo Gulf, a continued increase in the fishing effort will in the long run catch every fish and the fishery is doomed. If however the catch per year is made up from the stock of fish in the main lake the fishery will continue for many more year, but again if the number of fish caught goes on increasing there will come a point when the

fishery is doomed, for there will not be enough increase in the main lake tilapia each year to make up for the number of fish caught by the fishermen in the Kavirondo Gulf and other fishing grounds.

I have endeavoured to show these two different schools of ideas in a simple diagram. The full line A shows shoals entering the gulf, spawning and then returning to the main lake. The dotted line B shows the presumed migration of closed shoals which spend all their life in the Kavirondo Gulf. Now the first thing to do is to follow a fish or a few fishes and find out what it or they do in a year, two years or better still in three years. "Simple my dear Watson" until you look at the Kavirondo Gulf, then go to Rusinga Island and have a look at the lake, and there seems a lot of water. Again think that we are trying to visualise what 13½ million fish are doing in that vast amount of liquid. This can only be done by marking fish and then catching them again to find out their migrations. A good start has been made by Commander Cole and his men of the Lake Victoria Fishery Service who are catching and marking a number of tilapia, which they let go with a fervent prayer that they will be caught again by some native fisherman who will bring them back to them with a correct story of where he caught them and the exact date. It is heartening to know that marks are coming in.

In time we shall know if the tilapia spends its life in the closed gulf or migrates and circulates in the main lake. The marking experiments have started in the gulf but in time will be moved to the entrance. Somebody will say that's all right with marking and getting back the few but they are a tiny proportion of the whole population. They are, but as the tilapia is a shoal fish with very few stragglers we can consider the few caught as representative of the movements of the whole. So far our reckoning has been on a very simple basis but many complications set in which make a fishery officer go bald long before his time.

If we go to other great fisheries we find that certain fish, cod and herring for instance, show natural fluctuations in abundance and these fluctuations are in cycles of 10 and often 25 years. It has been proved with cod and herring and is believed to be true for other fish like menhadden, sardines, tunny etc.

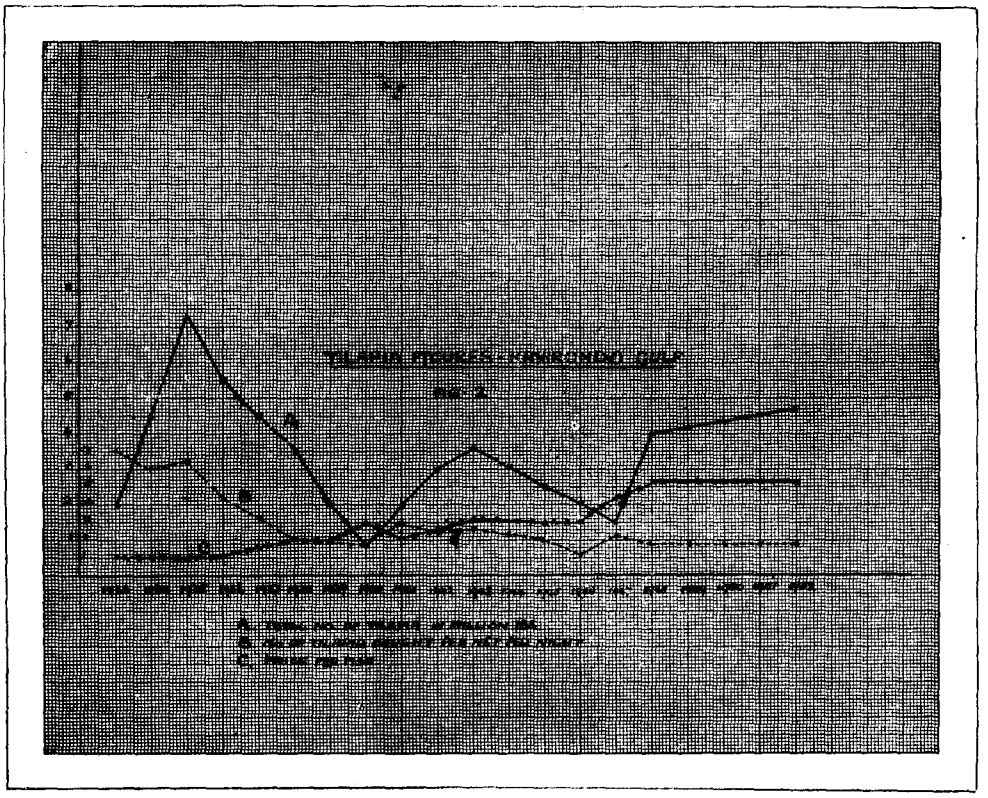
Among the natural causes producing these fluctuations are the influence of favourable or unfavourable hydrological or physical conditions such as temperature, light intensity, currents, storms by surface agitation of the water, variation in food supply, variation in natural enemies, variation in the number of eggs spawned, variation in migrations of young and old fish, variation in population pressure and others.

The most important environmental factor for the survival of the larval fish and hence the future of the brood of the year is the presence of the proper food in proper quantities at the stage of development when the newly hatched larval fish has used up its yolk sac and must feed on phytoplankton or microscopic food. If that food is not there just when all the

millions of tiny tilapia want it, mass death will occur affecting the fishing adversely two or three years hence. It is gradually being realised that this may be the predominant factor in the whole history of the tilapia and we know nothing about it.

The only way we can find out how the fishery is working is to study the catch of fish made from the gulf every year, for the catch should follow the up and downs of the fish shoal. This is the only way we can do it as we cannot know the number in the shoal every year or the number born —I wish we could.

The curve of total catches (Fig. 2) shows two peaks of abundance, one in 1935 and another in 1943, but it also shows that the peak in 1943 was much lower than that in 1935. The curve also shows a cycle of 8 years, up to 1947. After 1947 the fishery gradually stabilises itself to a total catch of



5 million fish and a catch rate of 1.9 fish per net per night. In other words the fishery is in equilibrium; but any increase in the number of fish caught should affect the catch rate per night, and the fishery would progressively decline until it did not pay the fishermen to catch a fish. The gradual decline in the curve (Fig. 2A) from 1937 to 1940 was due to the low price received for fish with an upward increase in the price of nets. Supposing one converted all the nets set in the gulf every night to nets which would catch twice as many fish i.e. 3.8 fish per net per night and still keep the

fishing in equilibrium then half the number of nets only could be allowed to fish each night. The number of fishermen does not matter. This fishing effort, as it is called, also depends on the cost of each net together with working costs, which shall be below the price the fisherman gets for his fish. If the working costs go up and the price received for the catch remains stationary, then the number of fish caught will decrease as the fisherman will look for another job. The fishery benefits as it gets a rest, but the general economy of the Colony suffers.

It seems therefore that the fishery is in equilibrium, but we want more fish to feed the increasing population as the years go by—what shall we do? The ngege is not the only fish in the Kavirondo Gulf or in the lake. Other fish must be exported, like bagrus, butter fish, lungfish which are good wholesome food, and the sooner this is done the better.

I hope I have convinced any reader that firstly the fisheries of Lake Victoria are very large, for a yield of 80,000 tons of fish a year by 30,000 fishermen is no small fishery. Secondly various environmental factors for the spawning stock are of vital importance to the successful continuation of the fishery. Thirdly to hold the present position other species of fish have got to be exploited.

Finally how is the fishery controlled and how much does control cost? The lake fisheries are controlled by the Lake Victoria Fisheries Service under the leadership of Commander G. Cole who has 3 ships and 6 Fishery Officers for a lake the size of Scotland. The total amount of money available for the service in 1953 is £20,128 equally divided between Kenya, Tanganyika and Uganda. In other words the people of Kenya pay £7,000 a year towards a service which regulates the use of 850,000 nets; producing 80,000 tons of fish, keeping 30,000 fishermen at work and providing 800,000 people with fish. Such is dirt cheap at the price.

WHAT FUTURE JOURNALS WILL CONTAIN

The Editor wishes to inform readers that every effort is being made to improve the standard of the Journal and to render it of greater use to members. With this end in view two series of articles will commence shortly, "The Identification of Birds of Prey in Flight" and "The Identification of East African Marine Shells". Mr. B. Verdcourt introduces the latter series with a fully illustrated account of the Cowries. A number of species of these attractive shells are not represented in the Coryndon Museum's collection and an appeal for specimens is made to anyone who may be at the coast. Any contributions from your own Cowrie collection would be most acceptable. Thank you.

John G. Williams,

Hon. Editor.