

## SECTION IV.—FISH FARMING

### *Report by Fisheries Officer*

#### *Staff*

402. The establishment at the Kajansi Fish Farm remained at one Fisheries Officer, one Fisheries Development Officer, one Fisheries Assistant and eight Fish Guards. One extra Fish Guard was posted to Kajansi from the headquarters strength to help with netting instruction. At the end of the year the vacant post of Engineering Assistant had not been filled.

#### *Kajansi Fish Farm*

403. The year was a busy one at Kajansi, with a heavy programme of building, which was undertaken from Kajansi resources with no outside assistance. By the end of the year the laboratory and office block were completed, but the laboratory fittings had not been installed. This block now comprises two offices, a store and a laboratory. The building is of pleasant contemporary design and overlooks the fish ponds. The lack of storage space at Kajansi was finally cured at the end of the year by the completion of an adequate store. The store is joined to the existing netting shed by a tractor shed and workshop. These fulfil a long felt need as the artisans can now work irrespective of the weather—a state of affairs that is not possible when the workshop is the shade of a large tree.

404. Four Fish Guards' quarters, each comprising a sitting room, a bedroom, a store, a kitchen and an ablution, have been completed. These are now occupied and allow the disposal of the temporary asbestos huts which are in the final stages of decay. These huts were originally bought in 1951 as temporary accommodation for fish-farming staff. Through constant repairing and patching they have been kept in continuous occupation for seven years.

405. The one-eighth and quarter-acre ponds which were completed at the end of last year have now been fitted with filling and draining sluices and are in use. They have proved, as forecast, a great asset and are the size of pond that is likely to be of greatest use for future experimental work.

406. A new grass cutting machine was bought at the end of the year which meant that grass over the whole site could be kept cut short for the first time. The short grass maintained all over the farm immensely improves its appearance. During the year over three hundred trees and flowering shrubs were planted. These were kindly supplied by the Botanic Gardens at Entebbe. Previous plantings are growing well and the site is looking slightly more mellow and mature now that the grass and shrubs have covered the scars left by the tractors.

## *Fry Production*

407. Fry production and distribution continued to be an important part of the work at Kajansi. During the year some 68,000 fry were distributed, at an average rate of some 5,600 fry per month. These were all personally collected by the fish farmers, some of whom travelled long distances in hired transport to reach Kajansi. The number of fry issued during the month reflects the numbers of ponds being built each month by the public; this is roughly a sixtieth of the number of fry distributed. This rate of pond building, about 90 ponds per month, was maintained up to June 1958 when it slowed down.

408. A card index system has been set up to record all the stockings from Kajansi. Details are kept of the owner, location, size, cost and water storage capacity of his pond. These records are particularly useful when subsequent visits are made to these farmers in the field, as an accurate assessment of his progress and production can be made. The previous year's experiment on parent density and fry production were concluded. The results were indeterminate, there seemed little difference between production except where the parent density was very low or where it was so high as to be near the maximum carrying capacity of the water. Where the sexual ratio was balanced there seemed little difference in production above and below a stocking rate of about 4,000 fish per acre. One important factor is that high frequency of fishing depresses yields by destroying nests, by disturbing mated fish and by directly spoiling the habitat of the very young fry. Fry ponds should, therefore, be long and narrow so that they have the greatest possible length of bank in relation to their size, thus allowing fishing to be carried out over the whole length progressively, and affording each portion the maximum rest for recovery. Where continuous high yields are wanted some method of fishing other than seining must be used. An automatic catching device of the pump and trap type would be most suitable. No work has been done in developing a device of this sort at Kajansi, but they are of obvious use in cutting down the rather heavy labour costs of seine netting for fry.

409. It has been supposed that the demand for fry would fall off this year, but this has not been the case. There is still no real indication that the rate of pond-building is significantly slowing down, and it is expected to spend a lot of time on providing fry supplies for some years to come.

410. A start was made during the year on the use of polythene bags for the transport of fish instead of the more traditional fish cans. These operations have been highly successful and culminated in sending fry by bus from Kajansi to Kabale with less than two per cent losses. The great advantage of the bags is that they pack into a relatively small space;

a fish can is a very bulky and heavy container. Plastic bags do not bruise or exhaust the fish and require less water than the cans. It has not been possible to make as much use of the bags as was hoped due to the lack of clean water at Kajansi. The successful transport of fish in plastic bags depends on the use of clean water; dirt in the water leads to rapid loss of oxygen. Tests on the use of plastic bags and tranquilisers show that it will soon be possible to send fish fry around the country with the ease that farm or garden seeds can be handled.

### *Experimental Work*

411. The first controlled trials were carried out at Kajansi during the year. A great deal of experience has been gained and some useful data accumulated. Brief comments on the experiments and the results are given below.

412. *Predator trials.*—One of the problems in *Tilapia* culture is the very high fecundity of the fish, which leads in a short time to fish ponds becoming grossly overcrowded with rapidly succeeding generations. After the initial spawning of the parent generation, the build-up of numbers takes place so rapidly that severe overcrowding and competition for food adversely affects the growth of the older fish. The very heavy yields reported for fish ponds usually refer to the very many generations of mature and immature fish. *Tilapia* in warm water appear to breed at six-weekly intervals so that it is easy to produce heavy weights of fish composed of rapidly succeeding generations of young fish. This build-up usually takes place in four to six months. The removal of the adult fish from ponds as soon as they have bred is not, in itself, any solution to the problems, as the greatest competition for space and food is amongst the younger age groups. Early removal of the older fish does not allow them sufficient time to grow to the desired size of  $\frac{1}{2}$  lb. or over. If ponds that have developed these dense populations of young fish are left on their own two things will happen. Either the population will become so dense that they will use up all the oxygen in the pond and most of them will die, or the rapid reduction of food and space will cause heavy mortality amongst the smallest fish, which are the weakest, and allow the older fish more food and room to grow. In the first case the original situation will soon reassert itself, and in the second case the poor survival of young fish will lead to a small population of large and slow-growing fish. Although the production of large fish is, in itself, desirable the total yield in terms of pounds of fish is very low, and more approximates the yield of the poorer Uganda lakes.

413. A possible method of combating this state of affairs is to introduce a predator into the pond which will feed heavily on the younger age groups and utilise them for its own growth but will not molest the



larger *Tilapias* which can then grow on to a large size. This method has the great advantage of removing the food competition of the unwanted small *Tilapia* and converting them into other large fish.

414. The predator that is under trial at Kajansi is the Nile perch (*Lates*). The experiment will have to be continued over several years before it will be known whether it is a possible solution for the average pond owner, whose ponds are on the whole much smaller than those used for this trial at Kajansi. The Nile perch is a fish from the deep clear water of Lake Albert whereas most fish ponds are shallow and murky. So far the perch have maintained good health and appear to be growing normally. They also appear to be feeding largely on the smaller *Tilapia* and the average size of the individual *Tilapia* is gradually increasing. There is no indication that the perch are exterminating the *Tilapia*. The experiment will only be successful if the perch breed in the fish ponds. If they do not then some other predator must be chosen. Fish farming on a peasant scale could not support the costly special breeding and stocking of Nile perch that would be necessary. This experiment continues.

415. *Heavy Fishing*.—Another approach to the problem of overcrowding in fish ponds has been to fish selectively the various age groups. This has meant the steady removal of the largest fish, (fish growth slows noticeably with age and it becomes uneconomic to maintain stocks of old and very slow-growing fish) and a reduction in the numbers of the youngest stock. This experiment has so far been inconclusive. Some difficulty has been experienced in the catching of the very young fish and the very old fish to make a significant alteration to the population. The experiment is being repeated with new fishing gear. From the point of view of the fish farmer this is not so good a solution as the previous one, demanding as it does more skill and activity on his part. The control exerted by the predator is largely automatic and self maintaining as long as food and predator species are removed from the pond in the same proportion).

416. *Feeding Trials*.—During the year trials have been carried out to determine the effect of feeding different amounts of vegetable material on the final weight of *T. zillii* grown in a pond. Several difficulties were encountered in this trial, mainly due to unforeseen mortalities in the ponds. There is no data available to show at what rate *T. zillii* can convert food (i.e. how many pounds of food it has to increase its own weight by 1 lb.). So an arbitrary figure of 7:1 was chosen for the conversion ratio. The ponds were stocked in pairs with equal numbers of fish and fed at three levels, each feeding level being designed to give twice the production of the previous one. These trials were regarded as being particularly important to the fish farmer, as they will produce accurate information on the amount of food he should feed to his fish and at what time interval. These trials were hindered by a very heavy mortality of the stocked fish

(in one case 75 per cent). This, it is thought, was due to the rather heavy handling that the fish received when they were introduced, each one being weighed and measured. A further confusing factor was the large variations in natural fertility between the ponds. There were not enough ponds available for sufficient replication to be carried out to cancel out this effect. In spite of the defects and difficulties the trials showed that in general terms doubling the food added to the pond doubled the yield of fish. During the course of these experiments it was found that *T. zillii* had strong food preferences, and favours sweet potato tops to either edible canna or Russian comfrey. A considerable body of data on growth has been collected. The experiments have been restarted making use of the lessons learnt and will be the subject of a separate report.

417. *Kisizi Ponds*.—Observations were maintained during the year on two populations of *T. leucosticta* and one of *T. zillii*. In these ponds at over 5,000 feet accurate records of temperature and growth rate are kept. The trial showed that the growth rate of *Tilapia* is slower at this altitude and that the onset of sexual maturity is delayed. This is, in itself, not a bad thing as the fish continue growing more slowly over a longer period than normal, so that fish in the Kigezi ponds ultimately are generally larger than those from ponds at a lower altitude. Yields are not, however, so high. This can probably be overcome by higher stocking rates. The Kigezi fish differ from others by a very highly developed fat ribbon. It is not known whether this is a method of keeping out the cold.

### *Instruction*

418. An average of 210 visitors were received at the Kajansi Fish Farm per month, and a total of 2,539 for the year. Many of them visited Kajansi to collect fry for their ponds; all of these received instruction in feeding and managing their ponds. A great many clubs, school classes and other groups visited the fish farm during the year. These included the Makerere degree courses in Zoology and Agriculture and the World Health Organisation study group on malnutrition, as well as many school and Community Development courses. Instruction was given in net making to departmental staff, to community development assistants and to private persons. The Fisheries Officer and his staff gave many lectures and demonstrations both at Kajansi and at other places.

### *Extension Work*

419. Once again a large number of fish ponds were built during the year. Kigezi and Buganda led the other districts in the number of ponds built. The total number of fish ponds is now some 4,500 which compares with a total of 1,500 at the end of last year. The table below shows the number of ponds per district and compares the rate of increase in pond building during the last three years.



*Number of fish ponds*

Districts	1955-56	1956-57	1957-58
Kigezi ..	170	310	750
Mengo ..	114	741	1,998
Masaka ..	8	29	380
Mubende ..	80	400	400
Bugisu ..	10	29	109
Bukedi ..	4	39	240
Ankole ..	2	2	33
Toro ..	6	6	15
Bunyoro ..	20	20	30
Acholi ..	5	9	300
West Nile ..	3	3	300
Busoga ..	0	2	10
Teso ..	0	1	3
Karamoja ..	1	1	1
Lango ..	2	2	1
TOTAL ..	425	1,594	4,570

420. This threefold increase in the building of fish ponds should be slightly offset by the fact that in Buganda some of the earliest fish ponds have been temporarily abandoned due to the difficulty experienced by the owners in catching their fish. Many of the ponds in Buganda were built by porters. Most of the porters are Banyaruanda who have no fishing skill. Many Baganda are not willing to learn to fish themselves and when they find that their porters cannot fish they lose interest in their ponds. Some pond owners have informed the Department that as they built the ponds on our advice, we should fish them for them. A further difficulty is that most nets suitable for pond fishing are traditionally sold unmounted, that is without corks or leads attached. The mounting of a net ready for fishing is always done by the fishermen himself, and by so doing he saves a considerable amount of money on the cost. To overcome the difficulties experienced in Uganda direct contact has been made with representatives of the net makers who are preparing a specially mounted seine net for sale to fish farmers. A consignment of 140 ready-made cast nets at £7 each found a ready market around Kampala. Another line of approach has been to set up professional pond fishermen who would travel around their area and fish either for wages or for a percentage of their catch. Progress has been very slow, the first fisherman reporting that few farmers are willing to pay him for fishing their ponds which they feel should be a Government service. If their attitude is extended to coffee and cotton, Uganda can look forward to a lean economic future.

421. A frequent complaint from fish farmers who do not feed their fish as advised is that they have been given an inferior species compared to their neighbour, who feeds his fish well and gets good results. It is very difficult to put over the idea that the differences in size and weights of fish between two ponds is directly the result of good or bad management.

422. There is, however, slowly emerging a core of successful and competent fish farmers who are getting good results and profits. One such man from Mubende has sold, within three months of starting to fish

his pond, some 1,500 fish worth Shs. 800. Another farmer in South Buganda sold over Shs. 200 worth of fish in his first month's fishing. Many pond owners have recovered the capital outlay on their fish ponds several times over by selling fry to their neighbours. Often the price for one small fish of  $1\frac{1}{2}$  inches long is Shs. 1/50. As one female can lay up to several thousand eggs every six weeks and needs relatively little attention, this is a most profitable branch of fish farming.

423. The training of staff reached a sufficiently advanced stage during the year to allow two of them to be posted to counties in Buganda. Buggangazi and Kyaggwe were the first counties to receive such staff. These postings have proved most successful and have led to a much closer relationship with the farmers. These fish guards can advise the pond owners on siting, building, feeding and cropping their fish ponds. They also provide a focal point for meetings and discussions amongst fish farmers. More staff for postings away from Kajansi are being trained.

424. The Fisheries Officer and the Fisheries Assistant visited as many areas as possible. The Fisheries Assistant developed a new technique for demonstrating fish farming while on safari. He starts on one pond with a few listeners and gives a lecture there, then takes them all on to the next pond where he gathers a few more, points out any differences, and then takes them on to the third pond. By snowballing his audience in this way he estimates that he can address some 400 to 500 people during the day.

### *General*

425. The year has been a most successful one from the point of view of development at Kajansi and in extension work. Much more extension work could have been done with more transport, the junior staff having only bicycles. Motor transport has had to be used most sparingly during the year.

Many farmers are asking about fish other than *Tilapia* for their ponds. We can only investigate other species slowly due to the small number of ponds available at Kajansi, which are not adequate for properly replicated experiments. This means that the programme has to proceed slowly and on *ad hoc* lines.



## FISH FARMING KIGEZI REGION

*Report by Fisheries Development Officer*

### *General Review*

426. Progress in the construction of ponds throughout Kigezi District continued to be good and by June 1958 over 700 ponds had been completed and stocked with *Tilapia*. Demands for assistance were received from every part of the district and the small available staff had considerable difficulty in meeting these demands, particularly in the second half of 1957 when no transport was available due to the Fisheries Development Officer's absence on leave. Credit must be given to the attached Local Government Fisheries Assistant who despite this difficulty managed to stock 186 ponds during this period. It is fairly certain that the actual number of ponds in operation is well in excess of 700 for it is known that many people, particularly in the remoter areas are building ponds without our assistance and stocking them with fry purchased from neighbours.

### *Pond Construction and Management*

427. On the whole the standard of pond construction has improved considerably and a recommendation that pond owners should endeavour to standardise their ponds to a size of 60 feet by 60 feet has been fairly widely adopted. This size of pond has proved to be quite adequate to give a sustained production of fish; it is easily maintained and easily fed and is big enough to give the fish some protection from predatory birds which can be a problem. Some enterprising owners have constructed ponds measuring up to 100 feet by 200 feet and if properly managed these ponds will provide very large yields.

428. Feeding has been generally satisfactory, but it is quite evident that fish obtained from the Department's own breeding and experimental ponds at Kisizi are in much better condition than those caught in private ponds; this is a direct result of the heavy and continuous feeding which the Kisizi ponds receive. Some owners are, however, feeding their ponds heavily and are learning that the yield of fish they can expect will be in proportion to the food they give, and it is hoped that by continued and persevering instruction others will follow suit. Wherever feeding has been good some very large fish have been caught weighing up to 1½ lb. which is satisfactory by any standards.

429. It has proved extremely difficult to persuade pond owners in Kigezi to fish their ponds as soon as breeding has started. It is essential that they do so otherwise the ponds will become over-stocked and the fish population will deteriorate. Demonstrations of net, trap and hook-and-line fishing have been carried out at many ponds throughout the district over a long period and whilst some pond owners are fishing their ponds, others are content to watch their fish grow to a large size, whereupon they



434. *T. leucosticta* has not been used to any great extent for stocking ponds. It has been found that this species seems to breed very rapidly, and in view of the difficulty experienced in persuading people to fish their ponds heavily at the onset of breeding, it seems inadvisable to use it. At the same time there are indications that this fish is able to tolerate acid conditions which prove fatal to *T. zillii*. This suggests that it may be a suitable species for stocking in ponds built in the vicinity of papyrus swamps where the water is usually of a very low pH.

### *Acknowledgments*

435. Acknowledgments must be given to the District Commissioner, the Resettlement Officer, and to the Agricultural Field Officers in Kigezi, who have on many occasions assisted the Fisheries Development Officer in transporting fry to remote areas and in advising pond owners on management.

ENTEBBE,

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