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1. Gov 311 ——— 31 5 38

To note of progress made on scheme subsequent to 1935 after expenditure of the funds granted from CDF in 1932, asks that it may be funded by CDFC for information.

dupl to c/s.

M. S. W. Smith.

H. J. Mave
16.6

Sir F. Stockdale

to see.

Sean. A copy of this progress report should also be sent to the E. A. C. for the information of the Tsetse Fly Committee.

J. A. Stockdale
7/6.

The report covers progress of the scheme subsequent to the date when the funds provided from the C.D.F. were exhausted. It is interesting to note that there is good reason to believe that, as a result of the measures which have been taken, Sleeping Sickness will be entirely eliminated from the district in question.

On the whole I doubt whether it is

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& when you particularly wish me
to do so. I suggest that no
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last para. of the Gov's despatch.

17/6/38

Then confirm the action
that instructed by Sir
F. Stockdale.

Clutterbuck
17/6

2 To E.A.C. (copy sent to D'ar 4 JUL 1938

3 Kenya. 736 21.12.38 3

Duke copy of report by Mr L.B. Lymes.
on experiments in the eradication of Glossina
palpalis on the shores of Lake Victoria.
Comments generally on progress made.
No addtl copies of the report will follow.

? No action required beyond
sending Colonial E.A.C. the 20 copies
of the Report when they arrive

Cubitt White
29/12

Sir E Stockdale / to see
Dr Smart

H.L. Gray
29/12

an interesting experiment which
has produced a considerable
amount of workable information,
the report is well arranged and
presented, and the photographs
are particularly useful. It
would be interesting to see the
final results of this work.

a/s

F.J. Stockdale
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Plan as proposed by Mr Cubitt White

J.J. Paterson
4/1

30/1/39

necessary to amend this to the effect & unless you particularly wish me to do so I suggest that no action should be taken on the last para. of the Govr's despatch.

Chas Smith
17/6/38

Then confirm the action
taken instructed by Sir
F. Stockdale.

Clutterbuck
17/6

To E.A.C. (with enclosure) 4 JUL 1938

3 Kenya · 736 21.12.38 3

Duplicate copy of report by Mr L.B. Lyons on experiments in the eradication of Glossina palpalis on the shores of Lake Victoria

Commenting generally on progress & stating that 20 additional copies of the report will follow

? No action required beyond sending to the E.A.C. the 20 copies of the Report when they arrive

Clutterbuck
29/12

Sir E. Stockdale / to see
Dr Smart

H.M. Swanzy
29/12

an interesting experiment which has furnished a considerable amount of valuable information. The report is well arranged and presented, and the photographs are particularly helpful. It will be interesting to see the final results of this work.

Dr Smart
2/1

F. Stockdale
2/1

Then as proposed by Mr Clutterbuck White

J.J. Paterson
4/1

30/1/39

action taken when

4. Ch. Sec 3pm 20/12/38

Ref 3. bro twenty copies of Report for transmission to E. A. C.

Action as directed in minute of 4/1 above — ie. send these 20 copies to EAC. LF. ref (2)

Closing minute 14/1 above

5 To: Sec. EA Council (w/20 c. encl 4) Bra. 24.1.39

KENYA
No. 736

GOVERNMENT HOUSE
NAIROBI
KENYA

3/4

21 DECEMBER, 1938.

Sir,

I have the honour to refer to Sir Armigel Wade's despatch No.161 of the 12th March, 1937, and to transmit, for your information copy of a report by Mr.C.B.Symes, Medical Entomologist and Mr.R. Southby, Reclamation Officer, on experiments in the eradication of Glossina palpalis on the shores of Lake Victoria. Twenty additional copies of this report are being forwarded under separate cover for transmission to the Tsetse Fly Committee of the Economic Advisory Council.

2. This report describes the results of the second part of the scheme for the eradication of Tsetse fly, the first part being the subject of a report which was transmitted under cover of the despatch under reference. This scheme has been partly financed from a grant of £6,160 from the Colonial Development Fund towards the cost of experiments in Tsetse fly control, to which approval was given in despatch No.927 of the 22nd December, 1932, from Sir Philip Cunliffe-Lister (now Lord Swinton).

3. You will observe from the report that methods which were successful in eliminating G.palpalis from river areas have not achieved the

THE RIGHT HONOURABLE
MALCOLM MACDONALD, M.P.,
SECRETARY OF STATE FOR THE COLONIES,
DOWNING STREET,
LONDON, S.W.1.

the same measure of success in the Lake shore area, though they did succeed in heavily reducing the infestation. Valuable experience has, however, been gained and there is reason to believe that hand-catching methods can be successfully and economically employed even in areas where the degree of infestation is high.

Funds are being provided for the continuation of the experiment, which it is hoped will succeed in completely eliminating G. palpalis from this area. A full report on these further endeavours will be transmitted in due course.

I have the honour to be,

Sir,

Your most obedient, humble servant,

for

AIR CHIEF MARSHAL

GOVERNOR.

COLONY AND PROTECTORATE OF KENYA

THE REDUCTION OF G. PALPALIS IN A LAKE SHORE AREA BY THE "BLOCK" METHOD

(An experiment facilitated by a Grant from the Colonial Development Fund)

BY

C. B. SYMES
MEDICAL ENTOMOLOGIST

AND

R. SOUTHBY
RECLAMATION OFFICER

1938
PRINTED BY THE GOVERNMENT PRINTER, NAIROBI
KENYA COLONY

CONTENTS

I—INTRODUCTION

In a previous report[1] a detailed account was given of the "Block" method of eliminating *G. palpalis* from river areas. The present report deals with an attempt to apply the same method to an area on the shore of Lake Victoria.

The experiment, which extended over two and a half years, was made an essential part of a scheme drawn up by the District Commissioner, Central Kavirondo, for the economic development of a fertile part of the lake shore that had been unoccupied for many years.

An officer (R.S.) already in the employ of the Administration on reclamation work and with much experience of anti-tsetse (*palpalis*) clearing, was put in charge.

Funds were from two sources—£1,640 from the Colonial Development Fund and £2,400 (in cash or labour) from the Local Native Council.

The latter was used both for the more specific measures against *palpalis* and for general development. For instance, clearings were made initially to isolate blocks of infested bush, but they were made considerably larger than would be necessary for this purpose in order to provide safe land for the early production of crops. The additional clearing for such development was provided by local funds or effort. Two clearings (Nos. 5 and 6) were made entirely from local funds.

Considerable help was provided by the Local Native Council for the wages and food of fly boys and pupa collectors—work specifically connected with the eradication of *G. palpalis* rather than with general development. And for the last six months of the experiment only Local Native Council funds were available for all items.

Actually both funds were expended on all main items of the work except the Sio Road, Port Victoria Pier, and clearings No. 5 and 6. These were paid for from local funds.

The decision to make clearings big enough to provide land for safe and early planting and to allow such planting to proceed before tsetses in neighbouring bush had been reduced, was made for three main reasons:—

(*a*) To maintain the interest of the local population.

(*b*) To ensure adequate occupation of the whole area; and

(*c*) to enlist the aid of the general population in cleaning up the cleared areas.

No cultivation was permitted however within 200 yards of infested bush and low crops only were sanctioned. There was of course a degree of risk: but results have shown that it was negligible. Monthly medical inspection of staff and of immigrants to the area was of course carried out to detect early infection.

There was never any lack of settlers. Such was the enthusiasm that the main difficulty was to prevent planting in the 200 yard safety margins.

We have to admit that such early settlement is not without its disadvantages. For with settlement goes fishing and other lacustrine activities and the many canoes travelling between treated and untreated bush undoubtedly help reinfestation of treated areas and so prolong the work of elimination.

It will be seen that *G. palpalis* has not been eliminated from any of the blocks. One reason for this is that *palpalis* of the lake shore is very different from *palpalis* of river areas. Its densities are extremely high and the short period catches employed for the preliminary measurement of such densities appear to provide little idea of its true population. Our rough estimates of possible numbers to be dealt with were very wrong.

It is now obvious, too, that one man, however efficient and energetic, cannot effectively supervise a fly elimination experiment of this kind and at the same time carry out large schemes of general development.

Weather delayed the clearing work and a lack of trained boys in the early stages delayed fly reduction.

But these explanations are not perhaps an adequate reason for the somewhat disappointing reduction of fly. The main fault lies in the initial decision made by one of us (C.B.S.) to deal with an area so large. Plans were based to some extent on work done in river areas but insufficient allowance was made for the unknown factors in lake shore areas.

However, the experiment has provided useful data on lake shore *palpalis* and the application of this method of eradication. We hope to be able to complete the reduction of fly in the near future.

We wish to record our gratitude to Captain Davenport, District Commissioner, Central Kavirondo, for continuous support and ungrudging help and to succeeding Medical Officers, Central Kavirondo, for carrying out regular medical inspections of staff and of immigrants.

II—AREA CONCERNED

(a) *Description*

The portion of infested lake shore selected for treatment runs southwards from Sio (34° 0' E. longitude, 0° 13' N. latitude) to the most westerly point north of the Nzoia River mouth. The total length of coast line is about fourteen miles (see *map*). It consists generally of fairly sharp and rocky headlands and wide bays. The former are well covered with belts of dense though often narrow bush and large trees, whilst the bays had lighter bush with reeds or papyrus.

About three miles east of Sio a range of scrub-covered hills from 700 to 1,000 feet high, runs south-westwards to the lake at Nzalagobe. A little further south other hills, rather bare except around their bases, run westerly to the two steep and rocky promontories about two miles north of the Nzoia River-mouth. Near the southern end of this coast line is the site of old Port Victoria which was at one time intended to be the terminus of the Uganda Railway. The stones of its old pier were discovered in dense papyrus and have been used for the foundations of the new pier.

A strip of the Nzoia River in the neighbourhood of Nachasionga Hill was included in the operations since it was known to be a source of serious infection.

(b) *Climate*

Temperature, humidity and rainfall figures are given in Appendix 1A and 1B.

The "wet season" appears to begin in December or January and reach its peak in April to June. Wettest months during the period of observations were February to June, 1936, and February to May, 1937. The "dry" seasons started in July, 1936 and June, 1937, though rain occurred every month.

The coolest months were those following the wet season—June, July and August—whilst the hottest period was September to December or January, just before the rains began.

(c) *People*

Before work commenced there were very few people in the area. Small villages existed in Sisenya and Emareng but the extensive slopes between hills and lake, and the hills themselves were for the most part unoccupied and useless. The flat lands along the Nzoia River however supported a fairly dense population which extended into the wide neck between Okani and the Mwita (Sungwa) Hills.

The people are mostly Samia, a tribe cut in two by the Kenya-Uganda border. They are separated from their neighbours, the Manyalla, by the Nzoia River.

Both tribes are active agriculturalists, relatively industrious, progressive and prosperous. They produce large quantities of matama (a tall millet), maize, sweet potatoes and muhogo (cassava) for food, and cotton, sim-sim (sesame) and groundnuts for export. Sugar cane and bananas are grown in large quantities for food or barter along the Nzoia River. Their enthusiasm for occupation of the lake shore is a measure of their desire for more and better crop lands.

Fishing has always been carried on by certain families. Before our work began a few canoes were centred on Port Victoria. Now there are many based upon each clearing.

There are no cattle: *G. pallidipes* infests the hills and spreads into the shore lands.

(d) *Fauna*

Animals most frequently seen are hippopotamus, crocodiles and monitor lizards.

A herd of buffalo is said to inhabit the bush on the Nzalogobe hills and Block E. Leopards are numerous on and around the hills and monkeys in the heavier lake shore bush. Bushbuck, waterbuck, wild cat and mongoose are also present whilst rats, small lizards and snakes are numerous.

Birds, not as numerous as usual on the lake shore, include the magnificent fish-eagle, hawks, duck, geese and the usual varieties of cormorants and egrets. Inland there are guinea-fowl and spur-fowl.

Crocodiles were particularly numerous in Blocks 4, 5 and 6, at the beginning of operations. They have since been frightened off by our activities. These with hippos, monitor lizards and perhaps snakes, were the most obviously accessible hosts of *G. palpalis*. No precipitin tests were carried out on stomach contents however.

(e) *History of Sleeping Sickness*

Little information is available with regard to past infection in this area. Carpenter[3] states that during his investigation in 1924, the Samia people whom he questioned "stoutly affirmed" that the epidemic of 1903–4 had not affected them. But Sumba Island, lying some two miles west of the most southerly point, had apparently become infested from Sigulu, and its population had suffered severely. He states also that many of the people whom he met in this area had definitely come from Sigulu which had been heavily infested and completely evacuated.

There is no doubt that fishing has been carried on in this district for many years and as far as one can ascertain the most favoured fishing grounds are around Sumba and Sigulu islands. Why contact with these infected islands did not lead to infection on the mainland is difficult to explain—for fishermen live for days at a time on their fishing grounds—except by assuming that at the time of the epidemic population was too scanty.

The present chief of the district and his older tribal counsellors maintain that the area was evacuated long ago because of sleeping sickness. Against this is the evidence produced by Carpenter, and also the absence of derelict villages such as one finds in most old stricken areas of Kavirondo.

That a serious degree of infection occurred in later years is shown by McLean[3] who recorded 74 cases during his survey in 1930–1. He states *in litt.* that "about 19 of the cases lived near Nachasionga Hill on the Nzoia and were presumably infected there since they included quite a number of children of the 'goat-herding' stage." The remainder used the lake shore around the present scene of activities (i.e. Port Victoria).

The significant point is that this area was occupied only at the southern end because of human and perhaps cattle trypanosomiasis and that even such occupation produced serious infection.

III—CLEARINGS

In the siting of clearings the chief deciding factors were ease of clearing, suitability of the hinterland for agriculture and settlement, and the size of blocks between such clearings. It has already been pointed out that though clearings were made essentially to cut the continuous infested shore belt into blocks of a convenient size to be dealt with, they were made big enough to provide land for immediate development.

Generally speaking therefore, clearings were sited in bays with their gently shelving shores and lighter vegetation. The densely wooded and heavily infested headlands, too rocky usually for any form of agriculture, though valuable as sources of timber and wood, were therefore conveniently left as fly "blocks" to be treated to measures of fly elimination.

Where papyrus, cane grass or reeds formed part of the vegetation of areas selected for clearings, they were pulled out as completely as possible. This is slow and costly work and though a good deal of it was perhaps not absolutely necessary for purely anti-tsetse reasons, it was desirable for development. The open lake with its clean water, bathing facilities, fishing and fresh air had to be substituted for stifling green walls, stagnation and hordes of mosquitoes.

Bush and trees were felled and burned. Their stumps were eradicated by "stumping" and burning. Ambatch, a straggling thorny tree that grows prolifically actually in the water along the lake edge has to be cut below water level to prevent its re-growth.

Costs given below do not include expenditure on Headquarters camp and staff. This is included in the allocated costs in Table I.

(a) *Clearing No.* 1

(1) *Location.*—Between blocks A and B at the south western end of the area (see map).

(2) *Dimensions.*—Total clearing—68 acres with a lake frontage of 756 yards.

(3) *Costs for labour and food.*—Sh. 1,817/20, of which Sh. 1,373/73 came from the Colonial Development Fund.

(4) *Original bush.*—A wide fringe of tall cane grass, papyrus and ambatch backed by a few trees, dense scrub and creeper growth.

(5) *Progress of clearing.*—The felling of bush and removal of reeds and papyrus began on 25th July, 1935, and was completed on 5th September, 1935. Burning was carried out in August, 1936, and final clearing up in April, 1937.

(6) *Present state.*—A small amount of reed growth is appearing near the water's edge. The stony slopes are grass covered and native gardens occupy most of the land that is suitable for crops of any kind.

(b) *Clearing No.* 2

(1) *Location.*—East of block B.

(2) *Dimensions.*—The original clearing with 800 yards frontage was extended. It is now about 1½ miles long and over 500 yards wide in places. Much of the area required little or no clearing except on its lake edge. Land actually cleared with Colonial Development Funds was 141½ acres and with local funds 182 acres.

(3) *Costs* were Sh. 2,640/33 of which Sh. 2,216/60 was provided from the Colonial Development Fund.

(4) *Original bush.*—Reeds and papyrus occurred along a great part of the shore with dense bush and clumps of trees behind. In most places however the bush was narrow. At Port Victoria the papyrus belt was particularly wide.

(5) *Progress of clearing.*—The original small clearing was started in May, 1935. Felling was completed on June 25th and burning commenced on 13th December, 1935. Extensions have been added at various times and a great deal of clearing done in the region of the new port.

(6) *Present state.*—New growth has re-appeared in some parts. Generally the area has been well maintained. Many gardens have been established, producing cotton, maize and millets. At Port Victoria a new pier constructed for dhow traffic is promoting local trade and serving as a much needed port of call and harbourage for trans-lake dhows.

(c) *Clearing No.* 3

(1) *Location.*—In a small bay just south of Nzalagobe headland. It separates the dense bush of the headland from a strip of infested shore. (Block C south) at Iludacho.

(2) *Dimensions.*—The initial clearing of 85 acres with a frontage of 800 yards has been extended southwards to include a small rocky headland and its hinterland of 16½ acres.

(3) *Costs* were Sh. 3,386/01 of which Sh. 3,089/54 came from the Colonial Development Fund.

(4) *Original bush.*—The lake shore was hidden under a dense and wide belt of tall cane grass, papyrus and ambatch. Behind this was tangled thicket and creeper growth with large trees. On the headland and its vicinity and at the northern end of the area, thorn bush was very dense.

(5) *Progress of clearing.*—Felling began on 25th May and was completed on 10th August, 1935. Burning could not be carried out until January and February, 1936. Cleaning up was done in March, 1936, and again in September, 1937.

(6) *Present state.*—The whole area, with of course the exception of the safety margin and the rocky headland is now under crops; and more land is being obtained by the natives by extending the clearing inland.

(d) *Clearing No.* 4

(1) *Location.*—In a wide bay north of Nzalagobe headland. (Block C, north.)

(2) *Dimensions.*—This area appeared to be particularly suitable for settlement. The initial clearing of 112 acres on a front of 800 yards was therefore extended to include additional 20 acres on the north and 19 on the south. It is still being extended eastwards by the local population. The chief himself has a large holding here.

(3) *Costs* were Sh. 3,269/09 of which Sh. 2,815/92 was provided by the Colonial Development Fund.

(4) *Original bush.*—A very dense and wide belt of cane grass, papyrus and ambatch sealed the lake front. Behind this, particularly at the northern and southern ends, were fairly dense thorn thicket and large trees, close parkland with open areas, merging into more open country with clumps of thicket.

(5) *Progress of work.*—Clearing was begun in September, 1935, and completed in October. Burning was attempted in November, 1935, and repeated in November, 1936. Final cleaning up was carried out in March, 1937.

(6) *Present state.*—Reeds have grown up along some parts of the lake edge. The local chief has established a village; much land is under crops and a number of canoes is engaged in fishing.

(e) Clearings Nos. 5 and 6

(1) *Location.*—In shallow bays between headlands at Ebwanga (Block D) and Ogeni (Block E).

(2) *Dimensions.*—It was originally intended to make two clearings of the usual size, one just above Ebwanga headland to confine fly to the promontory and the second just south of Ogeni point to prevent movement of fly southwards. This was done. But vegetation between these clearings was so light and the land behind so promising that the two clearings were made into one by cutting out all intervening bush. 307 acres were cleared along a lake frontage of about 2¼ miles.

(3) *Costs* were Sh. 4,125, all provided from local funds.

(4) *Original bush.*—A thick fringe of cane grass and papyrus, dense in places, backed by a narrow belt of thicket gave place to scattered thicket and open orchard types.

(5) *Progress of work.*—Clearing commenced on 17th October and was completed in November, 1935. Burning was carried out in November, 1935, and June, 1936, and final cleaning up in January and March, 1937.

(6) *Present state.*—Small patches of cane grass have sprung up but generally the area is clean. Several villages have been established and food crops are extensively planted. Canoe owners make use of certain landing places and fishing has become a main activity.

(f) General Summary

The total area cleared is 713¾ acres with a lake frontage of about 6 1/5 miles. Most of the vegetation dealt with was of course fairly light bush behind a heavier though relatively narrow fringe of cane grass, papyrus, ambatch, tangled thicket and big trees along or very near to the lake edge.

Delay resulted not only in the commencement and completion of work through lack of labour but also in the cleaning up and burning through prolonged rains.

Costs per acre are shown in Table I. The variations in costs are to a great extent due to varying amounts of papyrus and cane grass dealt with. Some 42 acres of this was eradicated by uprooting at a cost, including maintenance and the making of shore watering places, of approximately Sh. 170 per acre.

TABLE I

COSTS OF CLEARINGS (IN SHILLINGS)

LABOUR AT 23·3 CENTS PER DAY

Clearing No.	Man-days	Wages of Labour	Food	Portion of Camp Admin. and Native Supervisors	Total	Provided from C. D. F.	Acreage	Cost per Acre
		Sh. cts.	Sh. cts.	Sh. cts.	Sh. cts.	Sh. cts.		Sh. cts.
1	5,769	1,346 10	471 10	545 27	2,362 47	1,373 73	68	34 73
2	8,383	1,956 03	684 60	792 37	3,433 00	2,216 66	141¼	24 34
3	10,743	2,506 70	877 31	1,015 44	4,399 45	3,089 54	85	51 75
4	10,378	2,421 53	847 56	980 94	4,250 03	2,815 92	112	37 94
5	5,523	1,288 70	451 01	522 03	2,261 74	Nil	92¼	24 45
6	7,566	1,765 40	617 89	715 15	3,098 44	Nil	214¼	14 45
TOTAL	47,362	11,284 46	3,949 47	*4,571 20	19,805 13	9,495 85	713¼	AV. 27 59

*Proportion provided from Colonial Development Fund (not included in C. D. F. Allocation) 3,622 81

TOTAL ... Sh. 13,118 66

Tools valued at Sh. 7·10 were supplied by the Local Native Council.

IV—REDUCTION OF G. PALPALIS

Infested Blocks are shown in map

(a) Technique

Paths were cut near the lake edge through all blocks. Branches and deviations were made where necessary on each side of main paths to provide access to bush that appeared likely to act as resting or breeding haunts for the flies.

Handcatching and pupæ collecting were adopted in all blocks. The boys employed worked from about 8.30 a.m. to 2.30 p.m.—a six-hour day as nearly as possible.

Operations started in Block F in March, 1935, Block B in April, Block C south in September, Blocks D and E in December, 1935, and in Block C north in January, 1936. Delay in some blocks was due to difficulty in obtaining and training boys.

During the wettest months, pupæ collecting was suspended in Blocks D and E, owing to the saturated state of the soil.

The technique of pupæ collecting was improved during May and June, 1936. Until then a certain number of boys trained in this work had been allocated to each block and allowed to do their best in the discovery of pupæ. They soon became well acquainted with all the most frequented breeding grounds. It was then discovered (by R.S.) that recently-searched spots in which the soil had been well turned to a depth of several inches appeared to attract larvipositing females. Pupæ collectors were therefore instructed in the levelling and generally making attractive with a fine tilth, all the most "fruitful" places searched. This developed into the actual creation of attractive breeding places along and near the main paths. Such places are usually in medium or mosaic shade with fine tilth which was kept freshly turned and even surfaced; and they were equipped with sticks or small logs laid flat.

These practices proved useful and were adopted in all blocks.

In order to provide more effective supervision of pupæ collectors, in June, 1936, all boys so employed were organized in large squads each under a senior boy. All blocks were subdivided into sections, each section being just large enough to be searched thoroughly by a large squad in one day. Each section of each block was then dealt with, in rotation, every 15 days. This period might possibly have been extended to 40 days; but we had not then ascertained the pupal period under natural conditions.

At this time too the fly catching was re-organized. Two fly boys were detailed for each section in each block. They moved to a different section daily in their block so that in a block of say six sections, each of the six pairs of boys worked one day in each section every six days. This provided a reasonable method of checking.

Fly boys, like pupa collectors, quickly developed simple means of increasing their catches and reducing labour. Near or on the fly paths they prepared shelters to represent fly "rest" haunts. These were low "caverns" in the bush with shade varying from light to dark, supplied with canes laid loosely and roughly horizontally about 6 inches to 10 inches from the ground. The canes appeared to attract flies. When a fly settled on such a cane the fly boy carefully lifted the cane with its fly and brought it out of the tangle of bush into a position facilitating capture with the hand net.

Similar canes, sometimes two together, were carried by boys in front and at an angle of 45° to 60° from the ground, whilst on patrol. When flies settled on them, as they did frequently, they were brought up slowly to

the net, carried usually in the right hand, for capture. The interesting point is that both in the artificial resting places and in the open paths, flies which settled on canes are not as frequently disturbed by the slow movement of their canes to a stationary net as they are by the movement of the net towards their stationary perch.

The hand nets were initially of white cotton gauze about eight inches across the top. Later they were dyed dark blue or green and gave better results.

Traps were tried only in Blocks C south, C north, D and E. The type used was the Swynnerton Simple Screen 6-foot model, previously tested by us in the Kuja River District[1].

Baits made from extracts of the genital organs of crocodiles and hippos were tried in Block C south. But so many baited traps were smashed by crocodiles that trials were discontinued. Tsetses were not obviously attracted by the bait, crocodiles were.

(b) Descriptions of each block, with details of operations and results

(1) *Block A.*

Description.—A narrow strip of bush about 1,400 yards long running along the rocky northern base of a steep hill which forms the most westerly point of the area treated. The bush, consisting mostly of the usual tangle of thorn thicket and creepers with occasional magnificent fig trees, is about 30 yards wide at most. At the eastern end there is a fairly wide belt of papyrus and cane grass which rapidly decreases in width further west to become a straggling fringe. The hillside above has small scattered clumps of thicket and grass.

Fly reduction (Table 2).—During a rapid survey carried out in February, 1935, a month before these operations began, a density of 10 per boy hour only was recorded in this block. In September, 1935, density was 32 per boy day.

Hand catching and pupæ collecting were the measures adopted.

Reduction between the first four complete months and the last four is about 56 per cent. Little if any reduction appears to have been made until fly boys were increased from 2 to 4 in June, 1936.

Marking experiments (page 24) indicated that a few flies from Hanete Island reached the block. But their numbers were probably too small to interfere with fly reduction.

The predominance of males in the capture is striking.

Collection of pupæ, though helpful was not economic. The average catch of pupæ per boy day over the whole period is about 4, whilst the average catch of adults is 13.

(2) *Block B.*

Description.—A narrow belt of bush about 2,900 yards long running round the base of a steep headland to the north of Block A. Bush consists generally of tangled thorn scrub with many large and beautiful fig trees springing from and overhanging the rocky lake edge. In its widest part this shore vegetation extends over about two-thirds of the hillside and then gives way to grass.

TABLE 2

BLOCK A—MONTHLY CATCHES

Months	Fly-boy Days	Adults					Pupæ			
		Caught by Hand Nets			Total	Average per Fly-boy Day	Boy-days	Number Collected	Average per Boy-day	Total
		Males	Females	Pregnant Females						
1935										
August	10	306	260	24	590	59·0	10	79	7·9	669
Sept.	50	1,171	397	25	1,593	31·9	51	326	6·4	1,919
October	54	909	367	8	1,284	23·7	54	362	6·7	1,646
November	52	1,177	329	6	1,512	29·0	52	198	3·8	1,710
December	52	95	281	10	1,248	24·0	52	276	5·3	1,524
1936										
January	54	874	186	7	1,067	19·7	54	106	2·0	1,173
February	50	1,251	552	40	1,843	36·9	50	234	4·7	2,077
March ..	59	971	369	19	1,359	23·0	46	85	1·8	1,444
April ..	59	1,180	432	31	1,643	27·8	46	32	0·7	1,675
May ..	56	1,088	396	14	1,498	26·7	48	309	6·4	1,807
June ..	107	1,147	492	18	1,657	15·5	44	335	7·6	1,992
July ..	110	1,070	469	10	1,549	14·1	127	1,149	9·0	2,698
August	103	1,150	532	18	1,700	16·5	182	1,102	6·0	2,802
Sept. ..	89	809	456	27	1,292	14·5	139	1,001	7·2	2,293
October	91	1,020	639	14	1,673	18·4	141	985	6·9	2,658
November	117	861	490	29	1,380	11·8	127	788	6·2	2,168
December	128	780	416	25	1,221	9·5	118	678	5·7	1,899
1937										
January	116	676	438	45	1,159	9·9	286	957	3·3	2,116
February	129	587	433	24	1,044	8·1	135	96	0·7	1,140
March ..	119	517	337	17	871	7·3	143	101	0·7	972
April ..	135	339	286	20	645	4·8	53	52	1·0	697
May ..	138	401	234	11	646	4·7	35	10	0·3	656
June ..	110	419	259	19	697	6·3	273	307	1·1	1,004
July ..	115	485	237	27	749	6·5	211	537	2·5	1,286
August	115	266	173	23	462	4·0	158	362	2·3	824
Sept. ..	104	314	191	91	596	5·7	20	96	4·8	692
Total ..	2,322	20,725	9,851	602	30,978		2,655	10,563		41,541

Fly reduction. (Table 3).—In the survey of February, 1935, density varied from 10 to 32 per boy hour. At the beginning of operations it was 68 per boy day.

Work started in April, 1935, with hand-catching and pupæ collecting. Most of the training of boys was carried out in this block.

An apparent reduction of 88 per cent has been achieved in two years and five months. The more rapid reduction after September, 1935, resulted from the completion in that month of clearing No. 1. This cut off a considerable movement of flies from Block A.

Marking experiments (page 24) indicated that an appreciable number of flies entered this block from Hanete Island. The probable influx between May and September, 1937, was 1,200 flies so that for the whole period of operations additions to the population would appear to have been sufficient to prolong quite appreciably the work of elimination. The sharp drop in numbers captured after July, 1937, when flies on Hanete had been seriously reduced, confirms this.

The high proportion of males captured is again worthy of note. Only during the last ten months did the sexes approach equality in numbers. This is probably an indication, not only that flies were well fed but that female rest haunts were not being dealt with and that therefore the fly paths were not well sited.

Pupæ collections were considerable but much more costly than the capture of adults. It was in this block that large numbers of pupæ were first discovered in humus beneath large fig leaves, with no support for pregnant females except the leaves themselves.

TABLE 3
BLOCK B—MONTHLY CATCHES

Months	Fly-boy Days	Adults: Caught by Hand Nets: Male	Females	Pregnant Females	Total	Average per Fly-boy Day	Pupæ: Boy-days	Number Collected	Average per Boy-day	Total
April 1935	44	2,571	405	15	2,991	68·0	44	72	1·6	3,063
May	155	6,575	684	34	7,293	47·0	58	51	0·9	7,344
June	118	4,376	794	25	5,195	44·0	112	73	0·7	5,268
July	127	4,527	1,072	24	5,623	44·2	127	192	1·5	5,815
August	118	4,046	1,190	59	5,295	44·8	102	1,470	14·4	6,765
Sept.	65	2,058	549	11	2,618	40·2	99	657	6·6	3,275
October	97	2,473	746	24	3,243	33·4	124	816	6·5	4,059
November	85	1,904	471	15	2,390	28·1	149	687	4·6	3,077
December	85	1,786	567	22	2,375	27·9	124	587	4·7	2,962
1936										
January	112	1,935	464	25	2,424	21·6	103	232	2·3	2,656
February	91	1,791	791	41	2,623	28·8	112	354	3·2	2,977
March	114	1,792	625	15	2,432	21·3	115	171	1·5	2,603
April	110	2,078	852	57	2,987	27·1	100	195	1·9	3,182
May	107	1,984	859	31	2,874	26·8	95	528	5·5	3,402
June	185	2,148	954	40	3,142	17·0	85	642	7·5	3,784
July	161	1,741	760	53	2,554	15·8	191	1,300	8·0	3,854
August	143	1,661	930	55	2,646	18·5	181	1,094	6·0	3,740
Sept.	179	1,216	751	40	2,007	11·2	209	1,233	5·9	3,240
October	147	1,240	823	39	2,102	14·3	142	569	4·0	2,671
November	159	775	588	22	1,385	8·7	198	1,050	5·3	2,435
December	172	719	595	29	1,373	7·9	139	461	3·3	1,834
1937										
January	164	668	568	50	1,276	7·8	294	485	1·6	1,761
February	166	566	408	49	1,023	6·1				1,023
March	170	638	539	60	1,257	7·4	135	59	0·4	1,316
April	190	509	512	39	1,060	5·6	201	56	0·3	1,116
May	166	537	546	41	1,124	6·7	35	13	0·4	1,137
June	184	339	450	82	871	5·6	190	180	0·9	1,051
July	164	509	543	40	1,092	6·6	230	338	1·4	1,430
August	160	272	239	25	536	3·3	195	318	1·6	854
Sept.	105	184	124	43	351	3·3	24	246	10·2	597
Total	4,012	53,638	49,419	1,105	74,162		3,883	14,129	—	88,291

(3) *Block C south.*

Description.—A small belt of bush about 1,700 yards long separated from Block B by some 1¼ miles of cleared area. Vegetation consisting of dense bush with a few big trees runs along the base of a low escarpment. At the eastern end there is a wide fringe of papyrus and cane grass.

Fly reduction. (Table 4). In the survey of February, 1935, densities varied from 6 to 34 per boy hour whilst during the first day of operations in September, 1935, catches were at the rate of about 50 per boy hour falling in October to about 40 per boy day.

Hand-catching, pupæ collecting and trapping were all employed. From the averages of the first four and the last four months there appears to have been a reduction of about 20 per cent. But from June, 1936, when staff were increased, a more rapid reduction seems to have been accomplished—about 37 per cent in actual numbers and 46 per cent in catches per boy day. Females were again much fewer than males.

One fly marked on Hanete Island was captured in this block. This does not indicate anything in the nature of a serious re-infestation from that source.

Trapping was not very helpful in spite of a fairly high initial density, though the high proportion of females attracted to the traps is of interest. Eighteen traps were used. They were sited under various conditions in the hope that influence on efficacy might be noted. Results are discussed on page 11.

Pupæ were collected in good numbers but they were again expensively obtained as compared with the cost of hand-catching.

TABLE 4
BLOCK C SOUTH—MONTHLY CATCHES

Months	Fly-boy Days	Adults: Caught by Hand Nets: Male	Females	Pregnant Females	Total	Average per Fly-boy Day	Caught in Traps (18): Males	Females	Total	Average per Trap (Approx.)	Pupæ: Boy-days	Number Collected	Average per Boy-day	Total
1935														1,997
September	4	1,014	208		1,222	305·5	241	534	775	43	8			1,997
October	32	1,038	220		1,258	39·3	152	373	525	29	60	208	3·5	1,991
November	34	972	190		1,162	34·2	214	493	707	39	100	195	1·9	2,064
December	36	1,262	186		1,448	40·2	280	730	1,010	56	81	265	3·3	2,723
1936														
January	36	1,177	167		1,344	37·3	175	576	751	42	92	114	1·2	2,209
February	64	1,927	426		2,353	36·7	222	380	602	33	105	389	3·7	3,343
March	62	1,802	386		2,188	35·3	71	447	518	29	88	83	0·9	2,789
April	143	1,956	389	35	2,380	16·6	68	423	484	32	83	496	6·0	3,456
May	60	1,522	310	22	1,854	30·9	79	443	522	29	82	89	1·1	2,427
June	112	2,497	509	41	3,047	27·2	114	546	660	37	64	226	3·5	3,795
July	109	2,000	664	32	2,696	24·7	82	315	397	22	64	226	3·5	3,944
August	119	2,363	518	42	2,923	24·6	24	100	124	7	140	558	3·9	4,089
September	134	1,915	892	45	2,852	21·3	24	54	65	3·6	187	769	4·1	3,851
October	108	1,945	1,200	69	3,214	29·8	11	54	65	3·3	177	772	4·4	4,051
November	123	1,677	1,069	52	2,798	22·7	10	50	60	1·7	126	954	5·5	3,812
December	135	1,536	839	49	2,424	18·0	6	24	30		177	880	4·8	3,254
1937														
January	111	1,303	892	67	2,262	20·4	8	24	26	1·4	141	412	2·9	2,700
February	119	1,064	724	53	1,821	15·3	1	19	20	1·1	136	210	1·5	2,031
March	139	1,077	782	52	1,911	13·7	1	12	13	0·7	244	214	0·9	2,138
April	156	974	691	54	1,719	11·0	1	1	2	—	157	109	0·7	1,830
May	147	821	596	68	1,485	10·1	—	—	—	—	—	27	0·4	1,512
June	109	728	471	56	1,255	11·6	—	—	—	—	129	153	1·2	1,408
July	141	637	350	35	1,022	9·2	—	—	—	—	110	302	2·7	1,324
August	107	479	239	25	743	7·8	—	—	—	—	116	289	2·5	1,122
September	102	467	263	23	753	7·4	—	—	—	—	28	373	13·3	1,126
	2,412	34,153	13,270	800	48,223		1,879	5,992	7,871	—	2,868	8,882	—	64,976

(4) *Block C north.*

Description.—This block, some 5,200 yards long, runs round the steep shore slopes at the western end of Nzalagobe Hill. Bush is very dense with many large trees. There are one or two patches of cane grass and papyrus and at the northern end, there is a wide belt of papyrus of considerable length.

TABLE 5
BLOCK C NORTH—MONTHLY CATCHES

Months	Fly-boy Days	Adults: Caught by Hand Nets: Males	Females	Pregnant Females	Total	Average per Fly-boy Day	Caught in Traps (42): Males	Females	Total	Average per Trap (Approx.)	Pupæ: Boy-days	Number Collected	Average per Boy-day	Total
1936														
January	75	3,206	476		3,682	49·1	3,002	5,227	6,229	148	201	2,205	11·0	12,116
February	107	10,823	1,726	—	12,549	117·1	2,039	2,973	5,012	119	223	3,522	15·8	21,083
March	131	13,743	2,025	—	15,768	120·4	1,275	2,799	4,074	97	165	1,005	6·1	20,847
April	182	16,837	4,034	148	21,019	115·5	1,653	3,804	5,457	134	166	496	2·9	27,172
May	225	15,293	3,728	145	19,166	85·2	1,224	2,520	3,754	89	188	871	4·6	23,791
June	459	15,297	4,825	274	20,396	44·4	793	1,963	2,756	65	282	1,715	6·1	24,867
July	393	12,310	4,586	358	17,254	43·9	561	1,775	2,336	55	671	6,897	10·3	26,487
August	348	14,519	5,235	312	20,066	57·7	777	1,848	2,625	62	614	7,934	12·9	30,625
September	263	9,909	4,373	287	14,569	55·4	359	1,396	1,755	41	507	6,552	12·9	22,876
October	358	7,947	3,910	118	11,975	33·4	208	1,155	1,363	32	615	4,474	7·3	17,812
November	439	8,382	4,151	164	12,697	28·9	106	546	652	15	434	4,407	10·2	17,756
December	559	7,572	3,715	84	11,371	20·3	83	460	543	13	654	4,850	7·4	16,764
1937														
January	424	5,698	3,187	101	8,986	21·2	45	190	235	5	570	3,679	6·5	12,900
February	520	5,981	2,651	101	8,733	16·8	52	190	243	6	526	1,185	2·3	10,161
March	510	6,872	3,572	112	10,556	20·7	36	128	164	4	871	1,538	1·8	12,258
April	633	5,959	3,575	206	9,740	15·4	46	469	515	12	267	123	0·5	10,378
May	581	5,997	3,676	142	9,815	16·0	52	333	385	9	390	112	0·3	10,312
June	539	5,135	2,909	110	8,154	15·1	20	105	125	3	695	1,160	1·6	9,439
July	565	4,752	2,554	85	7,391	13·1	11	30	45	1	678	3,425	5·1	10,861
August	509	3,431	1,828	62	5,321	10·5	—	—	—	—	583	2,986	5·1	8,307
September	396	3,699	1,991	99	5,789	14·6	—	—	—	—	114	1,489	13·1	7,278
Total	8,216	183,362	68,727	2,908	254,997	—	12,557	25,911	38,468	—	9,414	60,625	—	354,090

Fly reduction. (Table 5).—In February, 1935, density varied between 6 and 42 per boy hour. For the first two months of operations it was about 120 per boy day. There appears to have been a reasonably steady reduction from about April, 1936, to the end of the period. Female catches were as usual relatively low.

A certain number of flies reached the block from Block D. They may have crossed clearing No. 4 by taking advantage of the regrowth of reed and papyrus fringe or they may have been carried by canoe. Their numbers would appear to be too low to influence fly reduction.

Traps were useful for some months but they failed about half way through the period. Details are given on pages 21 and 22.

Pupæ collecting contributed usefully to the general reduction but again it was more costly than adult catching.

TABLE 6
BLOCK D—MONTHLY CATCHES

Months	Fly-boy Days	Adults: Caught by Hand Nets: Males	Females	Pregnant Females	Total	Average per Fly-boy Day	Caught in Traps (21): Males	Females	Total	Average per Trap (Approx.)	Pupæ: Boy-days	Number Collected	Average per Boy-day	Total
1935														
December	21	916	240		1,156	55·0	779	642	1,421	65	50	268	5·4	2,845
1936														
January	42	1,068	220	—	1,288	31·0	310	385	695	33	132	294	2·2	2,277
February	50	2,428	550	—	2,978	59·6	197	441	638	30	80	344	4·3	3,960
March	52	2,766	830	—	3,596	69·2	94	376	470	22	—	—	—	4,066
April	70	2,653	785	48	3,486	49·8	178	628	806	38	—	—	—	4,292
May	98	2,626	1,093	76	3,795	38·7	131	508	639	30	—	—	—	4,434
June	107	2,417	1,079	109	3,605	33·7	119	471	590	28	—	—	—	4,195
July	117	1,819	1,127	138	3,084	26·5	75	376	451	21	67	670	10·0	4,205
August	116	2,130	986	102	3,218	27·7	83	226	309	15	244	1,719	7·0	5,246
September	111	1,491	927	96	2,514	22·6	41	184	225	11	153	923	6·0	3,662
October	118	1,469	778	54	2,301	19·5	36	170	206	10	141	971	6·9	3,478
November	122	1,910	824	39	2,773	22·7	17	101	118	5	57	495	8·7	3,386
December	171	1,824	848	31	2,703	15·8	20	112	132	6	82	762	9·3	3,597
1937														
January	112	1,651	795	24	2,470	21·9	12	61	73	3	177	1,086	6·1	3,629
February	199	2,064	1,029	68	3,161	15·9	17	52	69	3	109	265	2·4	3,495
March	169	2,292	1,478	122	3,892	23·0	27	59	86	4	197	312	1·6	4,290
April	191	2,190	1,669	168	4,027	21·1	28	119	147	7	—	—	—	4,174
May	54	748	560	52	1,330	24·6	49	58	107	5	—	—	—	1,437
June	—	—	—	—	—	—	68	19	87	4	—	—	—	87
Total	1,921	34,432	15,818	1,127	51,377	—	2,281	4,987	7,268	—	1,489	8,109	—	66,754

(5) *Block D.*

Description.—Dense bush with large trees running round a low escarpment on the prominent but low headland at Ebwanga and continuous with the thicket covering the headland. There are a few patches of cane grass fringe and a wide papyrus belt at the northern end. The block is about 1,250 yards long.

Fly reduction. (Table 6).—Density varied from 16 to 42 per boy hour in February, 1935. During the first four months of operations catches were at the rate of 41 per boy day and this was reduced slowly to 21 for the last four months—not very satisfactory.

TABLE 7

BLOCK E—MONTHLY CATCHES

Months	Fly-boy Days	Adults								Pupæ			
		Caught by Hand Nets				Average per Fly-boy Day	Caught in Traps (18)			Average per Trap (Approx.)	Boy-days	Number Collected	Average per Boy-day	Total
		Males	Females	Pregnant Females	Total		Males	Females	Total					
1935 December	41	2,494	816	73	3,383	81·6	—	—	—	—	49	157	3·2	3,540
1936 January	54	3,131	1,525	364	5,020	92·9	—	—	—	—	110	148	1·3	5,168
February	46	1,972	1,013	90	3,075	66·8	—	—	—	—	76	235	3·1	3,310
April	49	3,038	1,024	122	4,184	85·4	—	—	—	—	—	—	—	4,184
August	36	1,593	566	60	2,219	61·6	266	317	583	32	100	1,248	1·2	4,090
September	161	2,738	1,472	108	4,318	26·8	46	211	257	14	167	1,171	7·0	5,748
October	100	2,504	1,378	88	3,970	39·7	30	143	173	19	172	1,022	6·1	5,195
November	126	2,742	1,587	100	4,429	35·6	3	45	49	3	138	912	6·8	5,390
December	103	1,880	1,251	86	3,217	31·2	6	37	43	2	78	469	6·3	3,749
1937 January	104	1,805	710	44	2,559	24·6	13	43	56	3	184	583	3·2	3,198
February	157	1,570	1,438	130	3,138	21·9	7	59	66	4	110	291	2·6	3,795
March	166	1,860	1,301	47	3,208	19·3	10	65	75	4	247	322	1·3	3,605
April	89	973	555	31	1,559	17·5	11	63	74	4	37	42	1·1	1,675
Total	1,342	28,590	14,636	1,343	44,569		302	984	1,376		1,463	6,060	—	52,605

Traps again contributed during the first few months but lost their efficacy within the year.

Pupæ collecting was about four times as costly as hand-catching. Work ceased in May, 1937, owing to shortage of funds.

(6) *Block E.*

Description.—A belt of dense bush and large trees some 3,200 yards long around the outer edge of a broad flat promontory. At the northern end there is a wide papyrus belt, continuous with the large swamp in front of Sio port.

Fly reduction (*Table 7*).—Density at the tip of the promontory was 18 per boy hour in February, 1935. At the beginning of operations it was 81 per boy day. This was reduced to 17 per boy day in 13 months.

There is again a preponderance of males in the adult captures though not so marked as in other blocks.

Work was interrupted in March and again in May, June and July and part of August, 1936, owing to shortage of funds.

Traps were introduced after four months hand-catching had reduced the fly population very considerably. They were therefore not very effective.

Pupæ collections made during the twelve months work were equivalent to about two months of hand-catching.

TABLE 8

BLOCK F—MONTHLY CATCHES

Months	Fly-boy Days	Adults					Pupæ			
		Caught by Hand Nets			Total	Average per Fly-boy Day	Boy-days	Number Collected	Average per Boy-day	Total
		Males	Females	Pregnant Females						
1935 March	31	471	99	21	591	19·1	57	19	0·3	610
April	39	347	265	25	637	10·8	66	44	0·7	681
May	142	396	102	6	504	3·5	45	11	0·2	515
June	109	255	53	2	310	2·8	96	12	0·1	322
July	82	327	99	5	431	5·3	98	49	0·5	480
August	76	423	96	7	526	6·9	83	44	0·5	570
Sept.	56	337	55	10	402	7·2	67	34	0·5	436
October	54	515	89	6	610	11·2	98	101	1·0	711
November	84	524	146	20	690	8·2	155	96	0·6	786
December	77	488	151	11	650	8·4	150	85	0·5	735
1936 January	81	501	163	15	679	8·4	128	14	0·1	693
February	74	694	227	10	931	12·6	81	74	0·9	1,005
March	80	480	179	4	703	8·8	60	23	0·4	726
April	68	413	62	2	477	7·0	64	26	0·4	503
May	86	330	100	4	434	5·0	67	21	0·3	455
June	84	371	174	11	556	6·6	36	28	0·8	584
July	83	403	148	10	561	6·8	68	89	1·3	650
August	83	271	117	2	390	4·7	65	63	0·9	453
Sept.	85	204	97	6	307	3·6	65	55	0·8	362
October	86	194	103	5	302	3·5	71	41	0·6	343
November	113	177	104	5	286	2·5	68	26	0·4	312
December	127	219	97	2	318	2·5	46	17	0·4	335
1937 January	105	195	112	6	313	2·9	92	19	0·2	332
February	172	197	93	7	297	1·8	46	7	0·2	304
March	169	187	119	10	316	1·8	44	9	0·2	325
April	101	141	48	2	191	1·9	—	—	—	191
May	92	104	30	8	142	1·5	—	—	—	142
June	52	106	25	1	132	2·5	60	16	0·3	148
July	56	106	40	6	152	2·7	56	16	0·3	168
August	44	66	38	6	110	2·5	28	24	0·9	134
Sept.	26	52	19	1	72	2·8	4	6	1·5	78
Total	2,637	9,593	3,190	237	13,020	—	2,064	1,069	—	14,089

(7) *Block F.*

Description.—This is a scattered area on the north side of the Nzoia River below Nachasionga Hill. There is a fairly dense patch of bush with big trees on the slopes at the eastern end of Nachasionga which extends in light thicket form up to the native bridge. The land between hill and river is mostly flat and subject to swamping when the river overflows its banks, as it frequently does. The river banks and large areas adjoining are covered with tall reeds and cane grass. Fly reduction was attempted here because the area, with its (then) much used bridge, had been shown by McLean[3] to be a serious source of infection.

Fly reduction. (Table 8).—Though most of the flies were found in the heavy bush at the base of Nachasionga, appreciable numbers were captured at scattered clumps of trees or bush on both sides of the river.

Densities were never high. In February, 1935, they varied between 4 and 12 per boy hour in the Nachasionga bush.

Reduction from 19 to about 3 per boy day was very slow, principally because of the scattered nature of the infestation and the difficulty of ascertaining its limits.

No traps were used: initial density was too low.

Pupæ collections were not very helpful in the actual reduction of fly but they disclosed many unusual breeding places and indicated how a small and very scattered population of *palpalis* can persist under what appear to be very adverse conditions.

(8) *Sungwa (Camp) Hill.*

This is not strictly a recognized block.

Description.—The hill rises immediately behind the control camp at Port Victoria, reaching 4,200 feet in altitude. The lower slopes are clothed in very dense and continuous thicket which thins out slowly with altitude to an almost bare top.

Fly reduction.—*G. palpalis* was discovered on the lower northern and eastern slopes in the early days of operations and catches were organized to try to minimize their probable interference with reduction in neighbouring blocks. That the flies were not merely wanderers from Block B with which the hill was connected by continuous thicket before clearing No. 2 was made, was made obvious by the discovery of seven live pupæ and 60 empty pupæcases in thicket on the lower lakeside slopes at 250 yards from the shore.

Between March, 1935, and September, 1937, nearly 11,000 flies were captured.

(9) *Nzoia River.*

This area too is not strictly a block but is rather an extension of Block F. It embraces an indefinite area of flat river lands with villages, gardens, banana plantations and a few indigenous trees. Hand-catching was extended to this in February, 1936, as an aid to the reduction of fly in Block F. Some 2,190 flies were captured.

(10) *Hanete (Mitafubu) Island.*

Elimination was done here to protect Block B from reinfestation (*see* page 24). Table 9 shows numbers of marked and unmarked flies captured on the island. The rapid reduction is interesting.

An estimate of the island's tsetse population in the third week of May, based upon 5 days marking and 5 days catching, would have given:—

$$\frac{1580}{1} \times \frac{3446}{601} = \text{population} = 9059.$$

The total catch at the end of five months was 12,927 and there were a few flies left. The estimate is almost certainly much below the actual

population for the time. An obvious error in this method of estimation is that in high densities, fly boys, however well drilled, do not catch, mark and release flies as quickly as they merely catch them.

Movement of flies from island to mainland would probably be balanced by a movement in the opposite direction: though we did not ascertain that flies did leave the mainland.

Sexes were about equal in the unmarked flies.

TABLE 9.

HANETE ISLAND—MONTHLY CATCHES HAND-CATCHING AND PUPÆ COLLECTIONS

Date, 1937	Boy-days	Unmarked			Marked			Total	Pupæ Collected
		Males	Females	Pregnant Females	Males	Females	Pregnant Females		
7th–13th May		*1,111	*413	*56	—	—	—	*1,580	—
14th–31st May	90	2,837	1,911	136	592	103	4	5,583	1,279
1st–30th June	142	2,401	3,032	168	2	34	1	5,638	801
1st–31st July	164	751	695	59		3		1,508	321
1st–31st Aug.	90	111	67	8		Nil		186	25
1st–4th Sept.	5	7	3	2		Nil		12	—
Total	491	6,107	—	—	—	—	—	12,927	2,426

*These were all marked at the beginning of the work for observations on movement between island and mainland.

(11) *Degree of reduction*

To those of us who are acquainted with the initial densities of *G. palpalis* the reduction in numbers resulting from our operations, though not as complete as we had hoped, is strikingly obvious. An examination of figures in the tables, with their varying numbers of boy days, may not convey this however.

Mr. A. Walter, Director of Meteorological Services, has very kindly examined all the tables and provided the accompanying graphs illustrating reductions in Blocks A, B, C south and C north. Graphs for the other blocks show the same general picture. In explanation Mr. Walter writes:—

". . . In the first place it is quite evident that the curve of average per boy day follows an exponential curve. In other words, it is the well known compound interest curve. I have had some of these figures plotted on a diagram and you will see at once that the natural figures give a distinct and definite curve of the nature to which I have just referred. The same figures have been plotted as a logarithmic curve and they lie on a straight line confirming what I have already stated.

I approached the problem on the basis of the theory of gases in which the molecules of a gas may be considered to take the place of your flies. If we consider that a gas is contained in a chamber and that there is a small interior chamber connected with an air pump, the strokes of the air pump can be considered analogous to the nets of your boys, so that the mathematics become similar to that of the gas problem and the air pump.

It follows from a consideration of the problem on these lines that the number of flies in the area after each successive catch is represented by the terms of the series $Y - N(1-K)^t$, in which N is the total number of flies, K is the average per boy day, and t is a function of the time or may be considered to represent the number of boy days.

On these assumptions it seems clear that K, or the average per boy day, must decrease as the work progresses unless there are sources of large additional supplies which, from your figures, does not appear to

be the case. This is also shown by differentiating the expression which I have given above for the series representing the total number of flies after each catch.

. . . the essential point is that the curve is of the exponential form and, as you will see from the equations, K must decrease with time.

I have plotted your results and find that the expressions given on the attached graphs represent values of K on the basis of the exponential formula.

The ordinates of these graphs have been determined by statistical computation from the actual values plotted and not by eye estimation."

TABLE 10

COSTS OF FLY REDUCTION

Fly Boys—Average cost for wages and food—39 cents a day (including Sundays).
Pupæ Boys—Average cost for wages and food—27 cents a day (including Sundays).
Food per boy—7 cents a day.

Block	Hand Catching		Pupæ Collecting		Traps at say Sh. 15 each Nominal Cost	*Fly Paths		Total
	Boy days	Wages and Food	Boy days	Wages and Food		Length in Yards	Costs (Labour and Food)	
		Sh. cts		Sh. cts	No. Sh.	Yards	Sh. cts	Sh. cts
A	2,327	885 58	2,655	716 86	None	1,404	69 30	1,671 73
B	4,092	1,584 68	3,883	1,048 41	None	2,988	134 50	2,747 59
C (South)	2,412	940 68	2,868	722 36	18 270	1,728	147 67	2,130 71
C (North)	8,216	3,204 24	9,414	2,541 78	42 630	5,256	575 19	6,951 21
D	1,921	749 19	1,489	402 03	21 315	1,260	152 46	1,618 68
E	1,242	484 78	1,463	395 01	18 270	3,240	387 75	1,537 14
F	2,637	1,028 43	2,964	557 28	None		106 52	1,691 23
Henrietta Island, Camp Hill and Nzoia	491	191 49	542	146 34	None			337 83
	912	355 68	—	—				355 68
TOTAL	24,165	19,404 34	21,378	†6,580 06	99 1,485		†1,572 39	19,041 80
Allocated portion of Headquarters Camp and Staff		1,908 66		1,312 44			341 31	

*Including paths for pupæ collectors, trap sites and corridors, greeting traps, etc.
†Local Native Council provided Sh. 4,177 06.

(12) *Costs of Fly Reduction.*

(*a*) Expenditure on measures specifically connected with *palpalis* reduction is shown in Table 10. The sums actually paid for food and wages is Sh. 17,560/10. The difference of Sh. 3/30 between this and the figures given in Table 10 results from the use of an average figure in separating the various allocations.

The Local Native Council provided Sh. 4,146/21 for wages of fly and pupæ boys and Sh. 30/85 towards the cost of fly paths.

Traps were taken over from Kaniadoto where they had been used in our first field trial and their cost already debited to Colonial Development Fund.

Hand nets for fly boys cost an additional Sh. 178/47. This is included in sundry vouchers.

Total expenditure from the Fund was therefore Sh. 13,561/51 (£678 approximately).

(*b*) *Handcatching versus pupæ collecting.*—541,514 flies were captured by hand at a cost of Sh. 9,404/35 or approximately 1.7 cents a fly.

Pupæ collections totalled 102,463 at a cost of Sh. 6,580/06 or approximately 6.4 cents each.

(c) *Trapping.*—The traps used are valued at Sh. 1,495 or Sh. 15 each. They had cost Sh. 23 each to make in Kaniadoto[1].

During their service in Port Victoria they caught 54,984 flies for an expenditure at the rate of 2.7 cents per fly. To this must be added a proportion of the wages of 10 boys who tended traps on two days a week. But further details are unnecessary: traps in their present state of development and used as they are, are totally ineffective after a relatively short time.

(*d*) *Fly paths.*—The exact cost of these cannot be given since the item included the cutting of sites and corridors for traps, carriage repair and erection of traps.

V—POINTS OF INTEREST

(*a*) G. palpalis *and vegetation*

Around the headland blocks much of the vegetation is dense thicket of the "impenetrable" type—tangled masses of thorn and the semi-recumbent bush and creeper. Clumps of big trees provide a type of massive wooding.

In the bays chosen for clearings, with their generally lighter bush and long belts of papyrus and cane grass, densities were on the average lower than on the headlands. Though where heavy vegetation did occur as in Blocks C south, C north and D, flies were numerous.

Main fly paths were cut within a few yards of the lake shore and on the shore itself where topography permitted. Short branch paths were then made at intervals to cut into possible rest or breeding haunts or to make contact with the lake edge for food hunting flies where the main paths failed to do this. No specific study of these haunts was made before planning the paths: and though as far as could be ascertained most of the probable resting and breeding haunts were tapped, and the staff supplemented these with artificial constructions with considerable success, it is very probable that greater numbers of females would have been captured if more of the lake edge itself had been served by paths. There is little doubt that though almost any path through infested bush will attract active *palpalis* to it, the siting of paths to reach all possible conditions of fly must be given greater attention in future work of this kind.

The heavier bush, as usual, harboured the biggest fly populations. Block C north contains the densest and heaviest vegetation in the area. Its tangled thicket, undergrowth and big trees run from the lake edge for 40 or 50 yards up the not too steep foot slopes of Nzalagobe Hill and merges gradually into fairly dense stunted thicket on the hill itself. The *palpalis* population here was very dense. Breeding grounds under light shade at the foot of rocks and trees were numerous and offered excellent conditions over a fairly big area of suitable soil.

In Block B, too, vegetation and soil appeared to be excellent but the area was limited to a very narrow strip by the steep gradient of the hillside. In this block, as in A, conditions at least approaching the optimum appeared to exist beneath the very large overhanging fig trees.

(*b*) *Breeding grounds*

(1) The most attractive breeding grounds appear to have been in light well-drained humus at the base of large or medium trees or rocks and beneath shade cast by high to medium foliage.

But pupæ were also scattered. Very large numbers were found in small lots in light humus beneath dead foliage and high shade; at the bases of small trees and thicket in medium to fairly heavy shade; and under dead sticks and small logs lying criss-crossed in shade of the mosaic type provided by leafy canopies four to five feet above ground. It is this last type of breeding ground that the collectors imitated successfully (page 7) though their reconditioning of the more orthodox grounds beneath big trees and rocks was equally successful.

Still more scattered but prolific breeding went on in unexpected places. During the cutting of clearing 2, pupæ were found 250 yards from the lake edge in the thicket of the hillside—on one occasion four live pupæ and 18 empty cases were collected and on another three pupæ and 44 empties. Two pupæ and 13 adults were also found on the hillside at 580 yards from the shore.

Block F, the river area, provides useful evidence of the rather disconcerting adaptability of *palpalis*. The only portion of this block that appeared to offer reasonable breeding facilities was the patch of bush on the south-eastern slopes of Nachasionga Hill. Though considerable numbers of pupæ were found in this bush, the majority were obtained under dense thicket on the middle slopes of the hillside up to about 200 feet and at some 350 yards from the river bank. The swamp conditions on the flat lands near the river and the repellant nature of their dense cane grass and reed growth would appear to explain the attraction of the hill foot and its vegetation but it does not provide a reason for the choice of altitude.

These flat and fertile river lands support a dense population of people. Where possible, gardens have been established for the cultivation of bananas, sugar cane, cotton and other crops. And *G. palpalis* appears to have found them useful. In July, 1935, eight live pupæ were found at the base of banana plants whilst a big tree nearby produced none. Four searches of several days each during August and October, 1935, yielded 10 pupæ, 4 pupæ and 96 empty cases, 5 pupæ and 13 empties, 24 pupæ and 181 empties respectively in banana plantations. No pupæ were found at the bases of three big trees included in the second search.

Three searches in sugar cane gave 10 pupæ and 36 cases in an old plantation, 6 pupæ and 23 cases, 22 pupæ and 263 cases with 9 adults respectively in two young plantations. A small palm growing beneath a big tree harboured 1 pupæ and 8 cases.

Breeding such as this of course produces only a scanty *palpalis* population - enough however, to maintain a considerable degree of infection (page 16).

There is no doubt that *G. palpalis* can make use of a considerable variety of soil and shade conditions for breeding. In this area alone we seem to have encountered nearly all stages between an optimum as existing in, say, Block C north and the barely tolerable on the Nzoia flats. The latter are unlike any river conditions previously investigated in Kenya and, as far as we know, elsewhere.

Along most infested rivers investigated by one of us (C.B.S.) in Kenya and elsewhere, there is the usual belt of bush varying in width and density from the mere broken fringe of thicket or swamp growth, to heavy forest or dense reedy swamp a mile or so wide. Pupæ have been found scattered only in the heavier bush on soil conditions not unlike those of the heavily infested lake shore: light loam with abundant vegetable debris in all stages of decay but never in similar concentrations. And generally there were no people and no cultivation within a mile or two of such rivers.

The Nzoia area differs from all these in that except for a few scattered and widely separated small clumps of bush or trees, often far from the river, natural vegetation consists mostly of dense cane grass or papyrus which, as we know, offer no attractions as breeding grounds. Moreover, collections of huts and extensive crop lands are established close to the river on all land that is not liable to complete and prolonged inundation during flood periods. And on the fine alluvial tilth of these crop lands, as has been shown, scattered but fairly prolific breeding goes on beneath bananas and sugar cane.

(2) It might be of interest to include here a record made by one of us (R.S.) of the behaviour of a pregnant female, at one of the prepared "natural" breeding traps described on page 7.

"On the 7-12-36 I went to look at one of the nature traps made by a pupæ collector in Block D No. 5. From this nature trap the collector had gathered 34 pupæ. I took this opportunity to watch for female flies

settling on the ground to deposit their larvæ, after having placed collectors at various other traps to warn me should they see a pregnant fly settle on the prepared ground. Shortly I was called by one of the pupæ collectors stating that a pregnant female had settled near him. I found a pregnant tsetse (*G. palpalis*) settled on the prepared ground. This trap was on a slope and the fly faced up the hill with the thorax raised at an angle. The distended abdomen appeared to be resting along the ground, the wings folded. I watched it for a second and observed that the tumid black lips of the larvæ were slightly in evidence. It then flew away settling near by on some ground that was covered with little twigs and forest refuse. I was smoking a cigarette at the time and it struck me that the smoke from my cigarette which was carried over the fly had disturbed it, so I threw my cigarette away. It moved nearer to me and again settled on dirty ground. It then made another move, returning to the original clean tilth where it had originally been but closer to me, and resumed its original position facing up hill. It was so close to me that I took my observations with my reading spectacles on. It remained absolutely motionless for a few seconds. I then saw a contraction of the abdomen, a tremor, which passed away at once, but I noticed that the tumid lips were now more in evidence. It then made a little dart forward as though to fly away. But it only moved a fraction and again was motionless. Shortly continuous tremors of the abdomen started and the larva was slowly extruded. It looked preposterously large and was the shape of a pupa except for a slight elongation at the end finally evacuated.

At this period the fly assumed the natural horizontal position, otherwise making no movement whatsoever, the wings throughout as far as I saw remaining closed and motionless. I watched the larva. It did not appear to move from the spot where it fell but just to fade into the ground. The last I saw of it was the two tumid lips being drawn into the ground and disappearing in an apparently perpendicular direction leaving a slight round depression.

The nature trap had been carefully prepared, with suitable branches, the size of my forearm, placed in such a way that various portions were about an inch from the ground. I do not think that 5 minutes had passed from the time I started watching to the finish."

(c) Trapping

Traps of the Swynnerton 6 foot simple screen type were installed in Blocks C south, C north, D and F. Catches of individual traps are given in appendix II.

(1) *Block C south.*– Sites with a variety of conditions were chosen. Some traps were placed just overhanging the lake edge. Nos. 1, 6, 11, 12 and 17, some a yard or two from the edge in corridors cut through the papyrus from the main fly path to the lake. Nos. 2, 3, 4, 9, 10 and 14, others at various distances from the lake along the corridors, and the remainder on or near the main fly path and in fairly open areas behind the papyrus and ambatch of the shore.

The two best traps, Nos. 1 and 11, were both situated near the base of rising ground with heavy bush, and both were overhanging the water of the lake, No. 1 on poles and No. 11 on ambatch trees. Nos. 3 and 4 with fair catches were a few feet back from the water and both near heavily bushed rising ground. No. 14 was on the main fly path at the end of a corridor cut through about 70 yards of papyrus to the lake edge and No. 15, another giving fairly good results, was further along the main fly path where it joined the lake edge.

Of the least effective, No. 7 was situated about 30 yards from the lake in a corridor through the papyrus and No. 12 was overhanging the lake under conditions very similar to those of No. 11. It may be that the stream of flies patrolling the water's edge was essentially "one-way" so that they reached No. 11 trap first. Evidence suggesting similar behaviour was obtained during trap tests on the Kuja River[1].

There is little to be got however from an analysis of results other than a suggestion that traps prominently overhanging the lake edge with well bushed rising ground behind were more effective than those placed in long corridors of papyrus or on the main fly paths themselves.

(2) *Block C north.*—There were 42 traps in this block. Numbers 1 to 8 were placed in small cuttings in the light cane grass fringe along the lake edge. Nos. 9 to 23 were in a small bay at the foot of a steep rocky and well-wooded escarpment. The bay was the resort of crocodiles and hippos. Nos. 38 and 39 were behind a fringe of ambatch trees and backed by large trees with little undergrowth, and the remainder were behind a dense papyrus and cane grass shore belt with no opening to the lake.

The most effective group of traps was that situated along the hippo and crocodile basking ground. The presence of these animals made the area into a favoured feeding ground and the well-wooded escarpment behind probably provided the essential facilities for resting and breeding. Of the traps in the cane grass fringe No. 3 was most effective, but unfortunately there is no obvious reason for it. Those behind papyrus and cane grass with no opening to the lake were least effective but the two behind ambatch and backed by forest trees were relatively good. The heavy shade produced by big trees may have influenced numbers but in Block C south at least one trap placed in ambatch caught well. This growth is usually the nesting place or rendezvous of numerous lake birds and it has been noticed previously, especially on Moboko Island, that flies are often more abundant in the vicinity of bird colonies.

(3) *Block D.*—Most effective traps were Nos. 2, 3, 6, 17 and 18. The first three of these with all traps up to No. 15 were in small openings in the shore fringe of cane grass. Nos. 17 and 18 were in a sheltered bay backed by heavy forest trees.

(4) *General.*—It seems that most of the traps that gave fairly good results did so because they were situated in or near much used rest haunts or feeding grounds, particularly if these were closely backed by well wooded rising ground. It seems probable that a sharp and steep escarpment, if only a few yards high, rising close to the lake edge, concentrates not only resting flies but also creates a narrow channel for patrolling flies so that catches by hand or trap at the base of such an escarpment are higher than in flatter areas.

Traps slung behind dense and wide papyrus were useful only if they were in the vicinity of good shade providing facilities for resting or breeding or both. Those placed in the middle of long corridors through papyrus were not generally effective.

A few traps situated prominently on the outside of the papyrus or cane grass fringe caught well. But many others similarly placed did not. We cannot suggest a reason for this. One very promising feature of the trap catches is the high percentage of females.

It must be emphasised again that not enough attention could be given to this part of the work to make it productive of more definite conclusions.

The type of trap used is not sufficiently attractive. The little attraction it begins with is lost after a few months: flies treat it as a familiar and permanent part of the landscape. If it could be changed frequently both in appearance and in position its attraction would probably be maintained.

Results again indicate the need for exhaustive investigation of both traps and baits.

(d) *Pupal period*

(1) During October and November, 1935, certain crude observations were made on emergences of adults from pupæ collected in the field and kept in gauze-covered tins. In 890 emergences, the maximum period between collection and emergence was 44 days. This indicates little except that the true pupal period is probably not less than 44 days.

(2) On April 28th, 1935, one of the fly boys had a larva deposited in his hand by a newly caught female. The larva was kept in a small box with soil and the adult emerged after 40 days.

(3) More reliable figures were obtained actually in the field. Whilst visiting their prepared breeding places described on page 7, fly boys occasionally watched females alight and deposit larvæ. Certain senior boys were supplied with cylinders made from cigarette tins from which top and bottom had been removed. When a female was seen to produce a larva a cylinder was carefully pressed into the soil over the spot penetrated by the larva. A covering of gauze was then fixed on the cylinder and the date recorded. Cylinders were examined daily by senior boys during their patrols. Results were as follows:—

Larva	Deposited	Adult Emerged	Pupal Period
			Days
1	3-11-36	18-1-37	50-51
2	1-12-36	18-1-37	48-49
3	2-12-36	18-1-37	47-48
4	4-12-36	19-1-37	46-47
5	1-1-37	17-2-37	47-48
6	1-1-37	17-2-37	47-48
7	28-1-37	13-3-37	44-45
8	18-6-37	9-8-37	52-53
9	10-7-37	22-8-37	43-44
10	12-7-37	29-8-37	48-49

Rainfall and average day temperatures during the months concerned were:—

December, 1936	4·25 in.	76·6°F.
January, 1937	3·95 in.	78·0°F.
February, 1937	7·26 in.	76·5°F.
March, 1937	2·79 in.	77·3°F.
June, 1937	1·99 in.	75·0°F.
July, 1937	1·09 in.	74·9°F.
August, 1937	0·72 in.	76·3°F.

The pupal period appears to be roughly the same in the wet as in the dry season, varying between 43 and 53 days; but our observations are too few to be conclusive.

Six other pupæ deposited under observation in June and July did not produce adults. One was destroyed by a bush pig, two contained fully developed but dead adults and three were damaged by predators or parasites.

(e) *Proportion of the sexes*

In our hand catches, excluding those on Hanete Island, female percentage is approximately 30. The highest is in Block E with 36 per cent and the lowest in F with 22 per cent. During the last few months of operations numbers of captured males and females were approaching equality.

Trap catches on the other hand, as in previous work, show about 70 per cent females. But the numbers caught were too small to balance the excess of males in the handcatching.

The Hanete Island work indicates an equality of sexes in nature as did our records for the Kuja River area[1].

There remains a big population of females to be dealt with in all blocks. With more attention to fly paths in relation to resting, breeding and feeding haunts this should be accomplished in a relatively short time.

(f) *Breeding season of* G. palpalis

Catches of pregnant females, shown in the Tables, provide a certain amount of evidence that the rate of reproduction was highest in the period April to September—that is from the middle of the rains to about three months after the rains—in both years, and lowest from October to January. This agrees approximately with our findings for the river areas in S. Kavirondo[1].

(*g*) *Seasonal increased adult activity of* G. palpalis

Trap captures in Blocks C south, C north, and D indicate fairly definitely an increased adult and particularly female activity during the period April to June or July of both 1936 and 1937. This agrees roughly with the suggested period of increased reproduction above and with records made in the Kuja River area of South Kavirondo.

(*h*) *Movement and spread of* G. palpalis

In order to observe any possible influence on mainland fly freed areas of infested islands lying at various distances off shore, flies were marked on the three neighbouring islands of Hanete (Mitafubu), Waduma and Sumba.

(1) Hanete is a small rocky island about 500 yards long and 80 yards wide, covered with dense scrub, situated some 400 yards due north of Block B.

From 7-5-37 to 13-5-37, 1,580 flies (1,111 males and 469 females), were marked. From then until 4-9-37 fly boys caught flies every day (Table 9). Of the marked flies 746 were recaptured on Hanete, 144 (78 males) were caught on the mainland in Block B, one in Block A, one in Block C south, one on Sumba Island on 9-7-37, and a last one in Block C north on 18-12-37, 221 days after the last marking.

(2) Waduma Island is about 2,000 yards due north of Hanete. It is about 500 yards long and 250 wide, and well covered with stunted bush and creeper. Of 2,007 flies marked here (1,483 males) two were captured on Hanete. No attempt was made to eradicate *palpalis*.

(3) Sumba Island is a conical hill about a mile long and half a mile wide, with heavy bush around the base. It is situated some 2½ miles from Block B and about 1¼ miles from Waduma. 413 flies were marked here on 10-6-37 and 2,753 on 6-9-7-37. Of these one male was caught in Block B on 20-7-37, four females on Hanete Island on 21-7-37 and 31-8-37 and one in Block D on 23-6-37.

(4) In June, 1937, 1,168 flies were marked in Block D. Seven of these were captured in Block C north within a month of the date of marking.

(5) Of 137 flies marked on the north side of Sungwa (Camp) Hill several were captured on the south side about a mile away, and in Block B, and one in Block C south.

The large number of Hanete flies found in Block B suggests that there is a deliberate crossing of the 400 yards of intervening water. It is probable that the mainland is easily seen by flies at this distance. Whether or not the mainland flies can see and visit Hanete, which is small and low, has not been ascertained.

Canoes engaged in fishing or travelling to and from the Sumba and Sigula fishing grounds often go very near to Hanete Island and probably help in the transference of flies from place to place. But it is extremely unlikely that they could account for the large numbers of migrants caught in Block B.

The other catches of marked flies suggest little if anything more than a spread of flies in small numbers by canoe or foot traffic. There is a possibility that a few flies may wander a mile or two through thin bush or scrub from say the shore at Block C to the Nachasionga bush in F. But they are unlikely to do so without some attraction in the form of animals or man for at least part of the journey.

One of the most obvious results of our operations is the development of fishing and general canoe traffic. There is frequent movement up and down shore and between neighbouring islands. This probably explains the capture of the Sumba and Waduma flies so far from their base. One fly had contrived to travel either about six miles across the lake in a straight line or twice that distance round by the mainland shore.

The two flies from Block D, captured in Block C north, were either carried there or they travelled along shore across the big clearing No. 4 between blocks. The latter might well have happened since at the time of the marking experiment a regrowth of cane grass provided a useful fringing shelter for patrolling flies.

The important points indicated by these tests appear to be—

(*a*) an infested island up to about 400 yards distance is a source of re-infestation to fly-free areas on the mainland; and

(*b*) uncontrolled canoe traffic helps appreciably in the spread of *G. palpalis*. It may therefore not only prolong the effort to eliminate "residual" flies but would promote a slow re-infestation of areas made fly-free. Any plans for elimination of *palpalis* must therefore include measures for the control of canoe traffic.

(*k*) *Recovery of* G. palpalis *populations after reduction by adult and pupæ collections*

At the termination of work in September, 1937, a skeleton staff of 15 fly boys was retained to patrol blocks A to C north and F in an attempt to prevent a recovery in number of *palpalis* before full scale operations could be resumed. Their monthly captures indicated a slow increase of flies in all blocks.

In March, 1938, sample catches were made in five blocks and Hanete Island to ascertain roughly the degree of recovery reached. Figures are given in Table 11.

In Blocks B, C south and C north densities had apparently doubled themselves in six months. There was apparently a smaller increase in A and a decrease in F.

Of particular interest is the recovery on Hanete Island where catches during four days in September, 1937, had produced only 12 flies. It seems probable that recovery here had been aided by the arrival of flies from elsewhere.

It may be that the figures for March, 1938, are not strictly comparable since more boys were employed in all blocks than were used for the catches in September, 1937. The increases are probably greater than indicated therefore.

Reinfestation, as distinct from re-growth of population, may have come from Sumba, Sigulu or Waduma islands and Blocks D and E. Marking experiments indicated an appreciable, though, except in the case of Hanete and Block B, not a gross movement of flies between islands and blocks. It would seem then that increases in fly populations were natural and not influenced to any appreciable extent by additions from outside. This would apply to the populations of Hanete and Block B together, since they appear to have been concerned essentially with an interchange of flies and not with foreign additions.

The slight decrease, or at least the failure to increase in Block F is interesting.

A very definite decrease appears to have occurred on Namenya Hill. (Not shown in Table 11.) In February, 1937, the catches per boy day over 20 days on the north and south side respectively were 20 and 8. From April, 1937, work ceased until March, 1938, when catches over 20 days by the same number of boys (2) were on the north side 2 and the south side 3. Is it possible that in these areas of low densities and very scattered breeding a relatively slight reduction of numbers may have serious consequences for tsetse communities? Observations in the future will decide this.

TABLE 11

RECOVERY OF *G. PALPALIS* POPULATIONS

(*a*) Six days' catch at the end of operations.

(*b*) Catches by skeleton staff—October, 1937 to January, 1938.

(*c*) Six days' sample catches to ascertain extent of recovery in populations.

Date	Block F		Block A		Block B		Block C South		Block C North		Hanete Island	
	Total	Per Boy day	Total	Per Boy day	Total	Per Boy day	Total	Per Boy day	Total	Per Boy day	Total	Per Boy day
(*a*) Sept., 1937 ...	25	4	138	6	88	3·7	151	6	1,505	13	*186	2
(*b*) Oct., 1937 ...	71	2·7	394	7·6	236	4·5	596	11·5	3,030	23·3	—	—
Nov., 1937 ...	82	3·1	311	6·0	206	4·0	688	13·2	6,194	29·7		
Dec., 1937 ...	79	2·9	271	5·4	242	4·5	902	18·0	6,009	40·0		
Jan., 1938 ...	100	3·7	405	8·0	374	7·5	1,084	21·7	7,510	50·0	—	—
(*c*) March, 1938 ...	104	2·0	324	9·0	330	6·0	656	11·0	286	26·0	318	9·0

*August, 1937.

(d) Other species

(1) *G. pallidipes*. This species infests practically the whole of the scrub-covered hinterland. It is particularly numerous on and around Nzalagobe Hill. Number of adults and pupæ collected during the search for *palpalis* are shown in Appendix III. The majority were obtained in Blocks C south and north in the neighbourhood of Nzalagobe. Pupæ were relatively few.

This species apparently makes good use of the lake shore bush for feeding but breeds further inland in the higher and dryer areas. Since our operations against *palpalis* are unlikely to have disorganized *pallidipes* to a serious degree, such data as we have of the latter species (Appendix III) may well indicate true seasonal changes in adult activity. In Block F the increase of adults caught during the periods March to June, 1936, and April to June, 1937, are not due to augmented catching staff. The same applies to the increase in Block C north during June to August, 1936, and March to June, 1937. In other blocks however apparent increases during the periods March to June are at least partly the result of additions to fly-boys.

Seven specimens of *G. pallidipes* were found in a "swarm" of 218 *G. palpalis* on a crocodile shot by R.S.

(2) *G. brevipalpis*. As usual this species was found with *G. palpalis* in all blocks. No attempt was made to study it in any way.

Collections of adults and pupæ made during operations are shown in Appendix III.

Block C north with its dense bush yielded a relative abundance of both adults and pupæ. There is evidence from this block that adults were most active during the periods June to August, 1936, and March to June, 1937, and that the rate of reproduction was highest during July to August, 1937.

Both species therefore appear to behave much in the same way as *G. palpalis*. Activity is greatest during the latter half of the rainy season and for a month or two following, and breeding is at its maximum rate during the dryer months following the rains, that is, during or immediately after maximum adult activity.

(m) Human trypanosomiasis

Cases of sleeping sickness diagnosed at the Port Victoria dispensary during the past few years are as follows:—

	Cases
1930–31	74 (Dr. N. McLean)
1932	37
1933	33
1934	6
1935	1
1936	3
1937	4

It is considered that the majority of cases during the period 1935–1937 contracted infection on Sumba Island, which is much used by fishing parties from the mainland of Uganda as well as Kenya.

From the beginning of operations in March, 1935, a monthly medical inspection has been made of all staff employed and of the general population admitted to the various clearings. No infection has been found among them.

VI—OCCUPATION AND DEVELOPMENT

(*a*) One hundred and twenty-five families (625 persons) have built huts and definitely settled in clearings. In addition a new population of same 2,000 people make use of the clearings for water supplies, bathing, cultivation and fishing. Canoes are numerous and every morning on the return of fishermen, fish markets are held in each clearing.

Maize, millets and cotton are the main crops produced on the new lands.

(*b*) At Port Victoria a new pier has been constructed of local materials at a cost of Sh. 1,632 (Local funds). It is used almost daily by dhows.

(*c*) A road from Port Victoria to Sio, its northern portion running on the west side of the Ligulu Hills, was made to facilitate access to clearings 4, 5, and 6, and Blocks D and E, at a cost of Sh. 6,256 (Local funds).

TABLE 12

SUMMARY OF EXPENDITURE (In Shillings)

	Colonial Development Fund	Local Funds
	Sh. cts.	*Sh. cts.*
Fly and Pupæ Collectors (Wages and Food)	11,840 50	4,146 21
Fly Paths (Labour, Wages and Food)	1,542 54	30 85
Clearings (Labour, Wages and Food)	9,495 85	5,738 08
Headquarters Camp and Staff	3,622 81	9,248 31
Salary (European in Charge)	2,466 60	14,085 79
Travelling (European in Charge)	2,468 45	1,479 53
Sundry Vouchers	1,191 20	753 78
Bicycle	250 00	—
Sh.	32,877 95	*35,482 55

*In addition the Local Native Council provided large sums for clearings No. 5 and 6, the Sio Road, Port Victoria Pier and surboundings and extensions to all clearings.

VII—SUMMARY AND CONCLUSION

(1) A field trial of the "block" method of *palpalis* elimination has been carried out in a lake shore area with high densities of fly. The work was made to form an essential part of a scheme for the reclamation, settlement and economic development of a derelict area.

(2) Five large clearings were made at a cost of approximately £990 of which £656 was provided from the Colonial Development Fund grant.

The total area cleared is 713 acres. This is about twice as much as would have been necessary purely for isolating the *palpalis* blocks. The additional clearing was done to facilitate early settlement and agricultural production.

(3) Reduction of flies in seven blocks and Hanete Island was accomplished by hand catching and pupæ collecting; trapping was tried in four of these blocks and hand catching alone was adopted in two other areas.

Decrease in numbers of *G. palpalis* in the mainland blocks varies between about 50 per cent and 90 per cent. The small population on Hanete Island was practically eliminated in 3½ months.

Total cost of fly reduction measures was approximately £878 (excluding the nominal value of traps) of which £678 was provided from the Colonial Development Fund.

(4) Handcatching was the most economical method. Pupæ collecting was much more costly and trapping was ineffective.

(5) Data are presented to indicate that:—

(a) *G. palpalis* can maintain a low density by breeding in sugar and banana plantations.

(b) Its pupal period in this area is between 43 and 53 days.

(c) Maximum activity occurs during the period April to June and maximum reproduction from April to September.

(d) Considerable movement of fly occurs along shore and between mainland and islands. Though much of this is aided by foot and canoe traffic large numbers of flies can and do cross as much as 400 yards of open water between Hanete Island and the mainland.

(e) Maximum adult activity and reproduction of *G. pallidipes* and *G. brevipalpis* occurs at the same time as that of *G. palpalis*.

(6) Settlement and development have progressed satisfactorily.

(7) *Conclusion.* The experiment was conducted to ascertain the possibility of eliminating *G. palpalis* from a lake shore area by a method already adopted successfully on infested rivers. Elimination was not achieved for reasons given, but the reduction accomplished and the experience gained indicate that even with such high densities as occur handcatching can be employed successfully and economically.

A lake shore area of about 16 square miles, previously unoccupied, has been partially settled and developed. Crops of maize, millets, and cotton are being produced in and around cleared areas and more land is being reclaimed by the local population. Fishing has developed and lacustrine activity is considerable.

It is hoped to complete the elimination of *G. palpalis* in the near future and so to make full and unrestricted settlement possible.

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APPENDIX Ia

RAINFALL

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1936	3·70	6·52	8·52	6·97	2·31	8·53	1·92	1·28	2·61	1·27	1·40	4·25
1937	3·95	7·26	2·79	7·74	7·01	1·09	1·09	0·72	1·99			

APPENDIX Ib

AVERAGE TEMPERATURES AND RELATIVE HUMIDITIES

Date	9 a.m.		12 noon		3 p.m.	
	Average Temperature	Relative Humidity	Average Temperature	Relative Humidity	Average Temperature	Relative Humidity
1935						
August	72·0	64·1	79·9	51·1	78·7	55·8
September	74·5	67·2	79·9	59·8	79·9	58·9
September	74·5	67·2	79·9	59·8	79·9	58·9
October	74·5	74·6	79·9	68·6	79·9	69·4
November	75·7	67·0	80·4	63·4	79·9	72·9
December	74·9	63·6	81·7	54·5	80·4	65·2
1936						
January	76·0	72·9	77·0	64·4	76·0	64·4
February	73·0	74·0	77·0	64·7	76·0	70·2
March	75·0	68·4	79·3	62·7	78·0	66·2
April	73·0	75·2	77·0	67·2	76·0	69·4
May	74·0	72·6	77·6	65·1	78·0	65·0
June	74·0	75·0	76·0	63·0	75·0	64·0
July	70·3	75·0	75·0	60·0	75·0	63·0
August	71·4	69·6	77·3	57·7	77·5	57·9
September	72·4	69·5	78·1	57·9	78·4	59·6
October	75·1	63·2	80·6	53·5	79·4	57·3
November	76·2	62·8	82·2	50·8	84·0	57·1
December	74·0	67·3	78·6	59·6	77·4	64·5
1937						
January	75·0	65·4	80·0	57·2	79·5	60·6
February	73·9	74·7	78·3	66·0	77·4	68·0
March	75·0	74·0	79·0	63·6	78·0	66·2
April	73·8	79·4	77·2	70·2	77·1	70·4
May	72·8	82·7	77·0	71·1	77·3	70·7
June	71·4	77·5	76·9	67·2	76·9	63·5
July	71·4	72·5	76·8	61·3	76·4	61·4
August	72·0	70·6	79·0	60·6	78·0	61·3
September	74·0	64·5	82·0	54·8	81·5	59·3

APPENDIX II
TRAP CATCHES

(a) Block C South Sept., 1935 to March, 1937		(b) Block C North Feb., 1936 to July, 1937		(c) Block D Dec., 1935 to June, 1937	
Trap	Flies Caught	Trap	Flies Caught	Trap	Flies Caught
1	1,033	1	601	1	**350**
2	263	2	231	2	657
3	584	3	1,859	3	696
4	522	4	494	4	429
5	283	5	1,105	5	157
6	371	6	334	6	653
7	134	7	617	7	308
8	245	8	543	8	256
9	304	9	1,785	9	108
10	232	10	971	10	**153**
11	1,285	11	493	11	**239**
12	162	12	606	12	**259**
13	267	13	1,679	13	**390**
14	516	14	1,630	14	**259**
15	613	15	999	15	**388**
16	201	16	1,658	16	**356**
17	303	17	2,336	17	**588**
18	339	18	1,797	18	**491**
		19	2,304	19	130
		20	599	20	**100**
		21	1,057	21	**213**
		22	1,038		
		23	2,824		
		24	767	(d) Block E	
		25	260	Aug., 1936 to April, 1937	
		26	587		
		27	568	1	**31**
		28	328	2	8
		29	140	3	**37**
		30	872	4	30
		31	252	5	172
		32	505	6	120
		33	205	7	101
		34	430	8	178
		35	388	9	82
		36	557	10	18
		37	283	11	189
		38	1,148	12	**31**
		39	1,220	13	78
		40	648	14	20
		41	629	15	86
		42	312	16	**46**
				17	44
				18	17

APPENDIX III
CATCHES OF *G. PALLIDIPES* AND *G. BREVIPALIS*
(Block A Omitted)

Date	Block F						Block B					
	G. pallidipes			*G. brevipalpis*			*G. pallidipes*			*G. brevipalpis*		
	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ
1935												
March	13	3					1	2		1	1	**9**
April	99	19					19	2				
May	206	7					12	7				**2**
June	86	4					6	4				**8**
July	44	13		3			1			3	1	**22**
August	27	9		3	1			2			1	**15**
September	10	1		7								**30**
October	3	1		9								**8**
November	19	3					1					**7**
December	23	5										
1936												
January	33	6		1			2	1				**2**
February	106	26			1			3		1	4	
March	184	17				2	7					**1**
April	147	13			2		15	1			3	
May	88	6					7	1				
June	179	6					32	1			4	
July	79	8					17	1				
August	50	5						1				1
September	24	6					1					
October	35	3						1				
November	27	3										
December	38	3										
1937												
January	37	4										1
February	47	3					1	2				
March	47	8										
April	90	6					4	3				
May	55	10					5	5				
June	80	22					7	1				
July	42	7					2	2	3			
August	14	2	1				2	1				
September	1	1							1			

APPENDIX III—(*Contd.*)

CATCHES OF *G. PALLIDIPES* AND *G. BREVIPALIS*

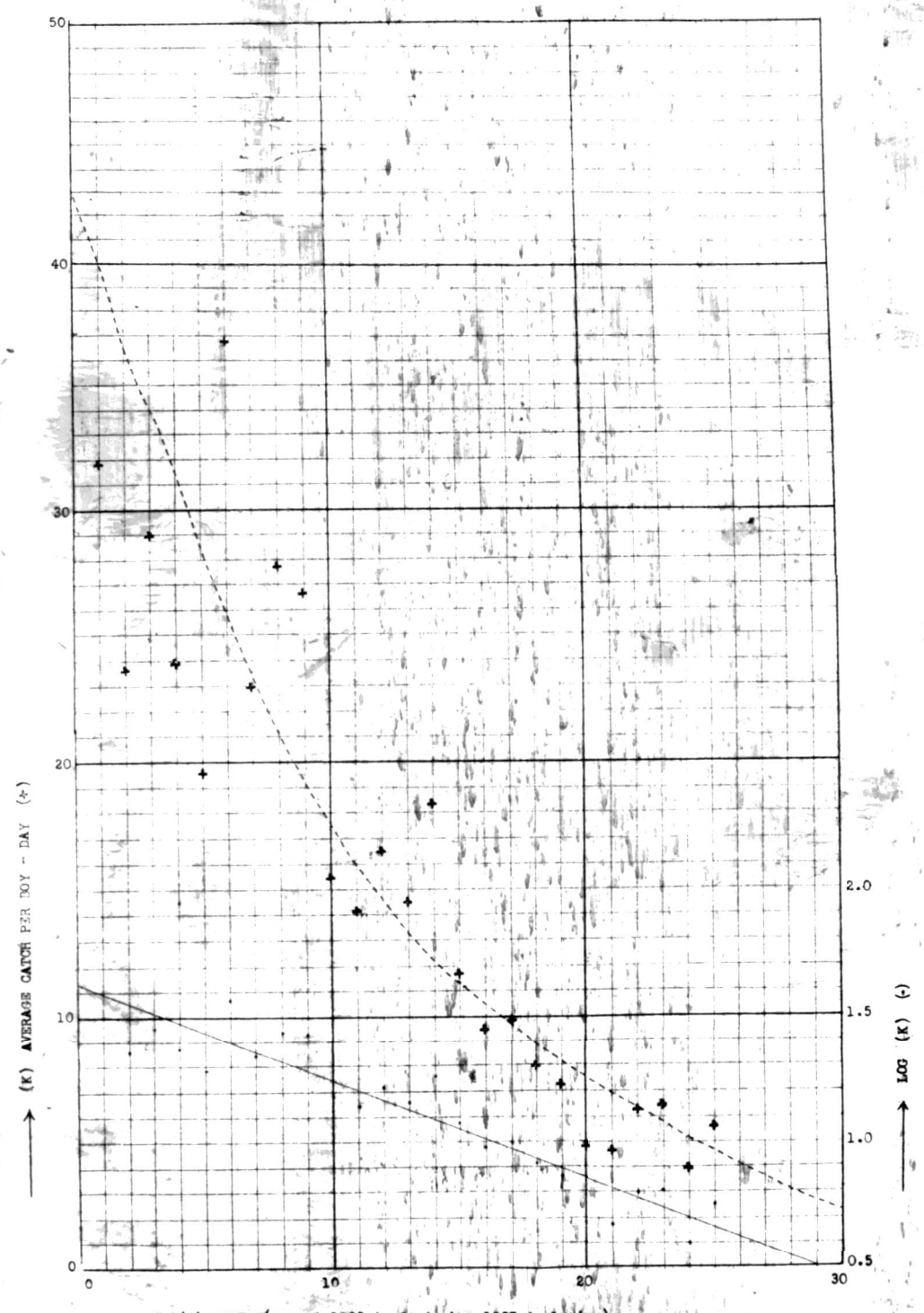
(BLOCK A OMITTED)

DATE	BLOCK C SOUTH						BLOCK C NORTH					
	G. pallidipes			*G. brevipalpis*			*G. pallidipes*			*G. brevipalpis*		
	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ
1935—												
October	—	—	—	—	—	14	—	—	—	—	—	—
November	—	—	—	—	—	29	—	—	—	—	—	—
December	—	—	—	—	—	11	—	—	—	—	—	—
1936—												
January	—	—	10	—	—	31	—	—	—	—	—	78
February	—	—	10	—	—	60	—	—	—	—	—	178
March	—	—	—	—	—	20	—	—	—	—	—	74
April	56	11	—	2	2	13	2,412	769	—	94	20	35
May	200	7	—	4	3	3	2,059	474	—	66	30	68
June	216	33	—	—	—	11	2,247	830	—	45	7	77
July	324	42	—	—	—	25	3,175	684	—	299	171	349
August	442	37	—	18	10	43	3,586	658	—	475	257	158
September	283	25	—	—	—	71	630	123	—	138	48	506
October	259	14	4	—	—	62	631	69	2	18	7	305
November	254	15	—	—	—	23	632	67	—	—	—	203
December	166	11	11	—	—	28	378	32	—	—	—	266
1937—												
January	268	28	—	—	—	29	945	87	8	9	14	311
February	578	48	10	—	—	35	1,712	159	6	20	5	140
March	902	81	3	—	—	32	1,917	301	—	173	41	228
April	1,131	89	2	—	—	20	3,088	411	—	782	99	26
May	1,206	111	—	—	—	8	4,258	568	3	1,301	190	25
June	1,065	190	21	—	—	30	2,297	457	10	627	99	153
July	868	80	23	—	—	34	1,094	298	72	469	136	513
August	364	42	24	—	—	31	656	174	199	452	146	348
September	155	11	40	—	—	—	414	72	34	—	—	220

DATE	BLOCK D						BLOCK E					
	G. pallidipes			*G. brevipalpis*			*G. pallidipes*			*G. brevipalpis*		
	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ	Males	Females	Pupæ
1935—												
December	—	—	—	—	—	39	4	4	—	—	—	40
1936—												
January	—	—	—	—	—	80	18	3	—	—	—	55
February	—	—	—	—	—	40	7	4	—	—	2	85
March	—	—	—	—	—	—	—	—	—	—	—	—
April	75	16	—	2	3	—	22	5	—	—	—	—
May	194	37	—	10	3	—	132	35	—	13	—	—
June	129	73	—	9	3	—	—	—	—	—	—	—
July	135	60	—	16	4	103	—	—	—	—	—	—
August	162	91	—	91	13	175	96	107	—	44	46	70
September	55	27	—	107	35	173	30	13	—	27	12	117
October	11	2	—	20	6	138	71	17	—	18	4	152
November	25	3	—	26	5	40	175	25	—	32	12	126
December	8	1	—	—	—	62	79	11	—	18	4	45
1937—												
January	12	2	—	—	—	90	64	7	—	—	—	100
February	63	7	—	—	—	31	247	25	—	—	—	—
March	400	23	—	—	—	—	321	21	—	—	—	—
April	452	19	—	—	—	—	132	23	—	—	—	—
May	69	10	—	—	—	—	—	—	—	—	—	—

BLOCK A.

DIAGRAM ILLUSTRATING VARIATION WITH TIME OF AVERAGE NUMBER OF FLIES PER BOY - DAY.



EQUATION of Curve is $K = e^{-(0.090t - 3.76)}$

EQUATION of Straight Line is $\log_{10} K = -0.039t + 1.63$

BLOCK C (NORTH).

DIAGRAM ILLUSTRATING VARIATION WITH TIME OF AVERAGE NUMBER OF FLIES CAUGHT PER BOY - DAY.

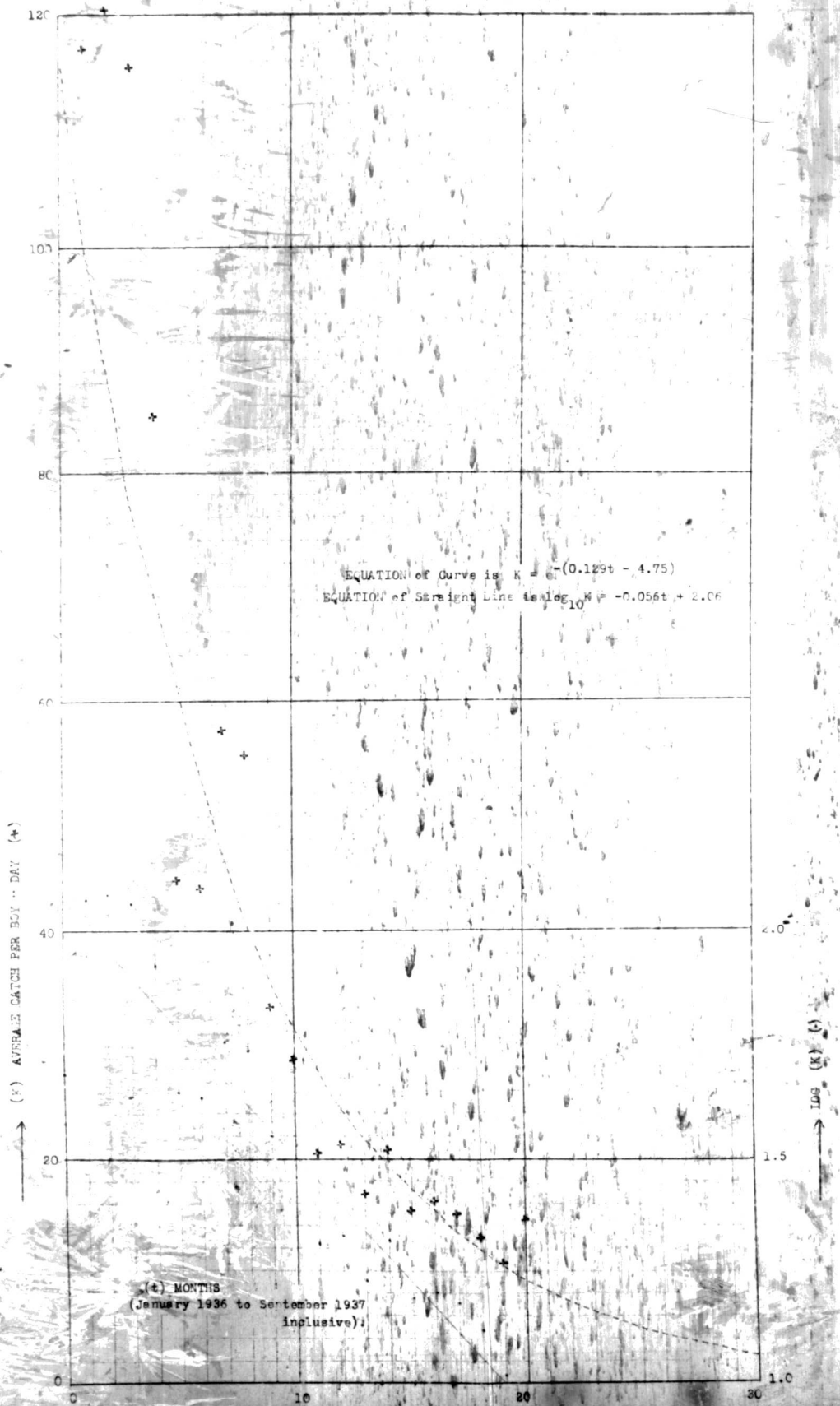
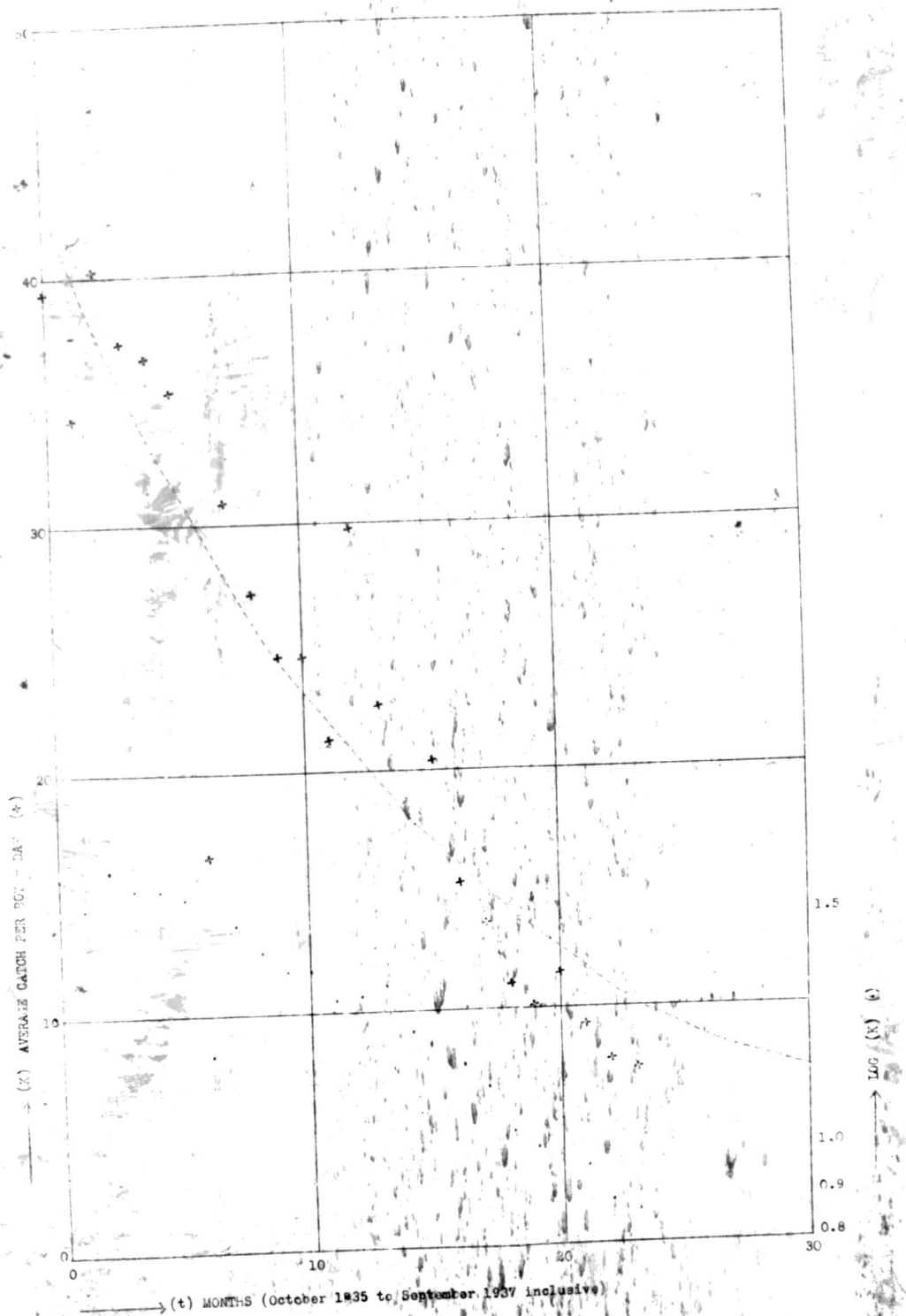


DIAGRAM ILLUSTRATING VARIATION WITH TIME OF AVERAGE

NUMBER OF FLIES CAUGHT PER BOY-DAY.



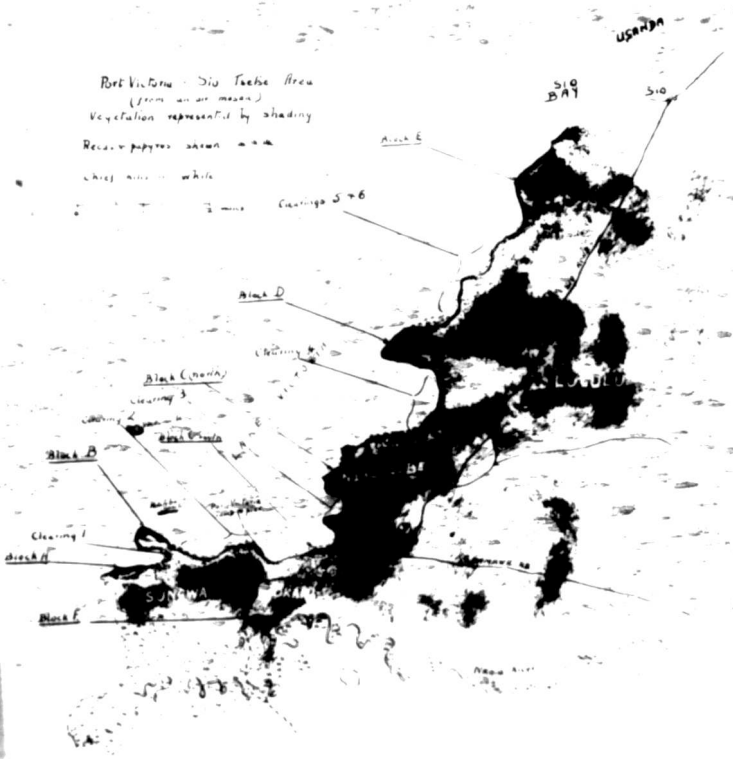
EQUATION of Curve is $x = e^{-(0.061t - 3.79)}$

EQUATION of Straight Line is $\log_{10} x = -0.030t + 1.64$

PHOTOGRAPHIC REPRODUCTION OF MAP

OF THE AREA SURVEYED

(TRACED FROM THE ORIGINAL MAP)



PHOTOGRAPHS :

No.19	by [illegible]
Nos. 1,2,16,17,18,20 and 22	by [illegible]
Nos. 3,6,7,8,9,10 and 11	by [illegible]
Remainder	by [illegible]

10
[illegible] on a
Hill: Supra
[illegible] and
at the upper
limit of
bush

11
[illegible]
[illegible]
[illegible]

[illegible]
[illegible]
[illegible]

1
[illegible]
[illegible]
Book
3

13
[illegible] view
of [illegible]
seen in
Book 3:
Upper of
[illegible]
[illegible]
hill [illegible]
leaves

14. The beginning of one of the bi trees in Block B.

15. Artificial rest haunt constructed by fly boys to attract C.palpalis

16. Fly boys carrying canes to attract C. palpalis

17. Native manipulating by fly boys.

18. Native bridge over Nawia River

20. Young cotton and maize in one of the cleared areas

19. Canoe launch in one of the clearings

21. Natives gathered in clearing for a canoe regatta

22. Dhow approaching Port Victoria's new pier

KENYA
No. 311

GOVERNMENT HOUSE
NAIROBI
KENYA

31 May, 1938.

1/36

Sir,

18307/32 With reference to a despatch No.927 of the 22nd December, 1932, from Sir Philip Cunliffe-Lister (now Lord Swinton) on the subject of a grant from the Colonial Development Fund to cover the cost of experiments in tsetse-fly control in certain districts of the Colony, I have the honour to transmit the accompanying copy of a note on the progress of the scheme subsequent to 1935, by which time the funds made available from the Colonial Development Fund were expended.

The scheme was continued with the aid of funds provided by the Local Native Council.

2. I request that, provided you see no objection, the note may be forwarded to the Colonial Development Advisory Committee for their information.

I have the honour to be,

Sir,

Your most obedient, humble servant,

R Brooke-Popham
AIR CHIEF MARSHAL
G O V E R N O R.

THE RT. HON.
MALCOLM MACDONALD, M.P.,
SECRETARY OF STATE FOR THE COLONIES,
DOWNING STREET, LONDON, S.W.1.

The field experiment in this area undertaken with the aid of a grant provided by the Colonial Development Fund was completed in 1955 and a report submitted. The scheme has been continued with funds provided by the Local Native Council and the following notes on recent progress made have been prepared for the information of the Colonial Development Advisory Committee.

2. The infested area being dealt with is that portion of the Kuja River between its junction with the Riana River, southwards, to Wadharia clearing. (See map 1. in report of 1957), including the Odielo and Wanjowe bush and the Sari, Akijo and Kibugu streams - in all, more than 18 miles of river bush. The streams north of Wadhasaa clearing were the site of the first field trial.

Clearings had been made during the 1955-56 experiment. Of these one - Wadhatego - was enlarged. The area was then organised in 3 Blocks - the old Block VI between Wadharia and Wadhagulu, Block V from Wadhagulu to Wadhatego and Block IV, including all bush up river from Wadhatego.

Elimination of Glossina palpalis by handcatching began in June and July, 1956. An idea of the reduction so far obtained may be seen from the following figures :-

		Flies caught.	Average per boy day.
(a) BLOCK VI.	July 1956	1910	18
	" 1957	271	2.5
	March 1958	265	2.4
	(Staff of 4 boys only).		
(b) BLOCK V.	July 1956	36702	
	" 1957	2501	56
	March 1958	486	5
	(Staff of 24 boys).		0.8
(c) BLOCK IV.	Sept. 1956.	42350	
	Oct. 1957.	5070	58
	March 1958.	3080	6.7
	(Staff of 28 boys).		4
(d) CONTROL (below Wadharia clearing).			
	January 1957. Av. of 4 days catch id.		165 - 82.5
	December 1957		383 - 191.5
	(Staff of 2 boys).		

5. The area concerned in the 1953-55 experiment has been patrolled periodically to watch for a possible reinfestation or 'regeneration' of Glossina palpalis. No flies have been captured in the Nthiwa River Blocks I and II but during the first 9 months of 1957 twelve flies were caught in Block III and Lower Pala and two in the Upper Pala and Mirogi Block. It is thought that the movements of a large herd of elephants between the Lambwe Valley and the Kuja River, which caused the withdrawal of the fly-boys during the wet months, might have been responsible for the presence of these flies.

4. Settlement is gradually developing. In the Nthiwa Pala area which was opened for occupation at the end of 1955, there are 65 new houses and 99 new plots under cultivation. Simsim is being produced in large quantities.

For settlement in the area now being dealt with, 95 families have applied for holdings in the Kaniadoto location and the Chiefs of Kaniamwa and Kabwoch State that approximately similar numbers are waiting for permission to occupy their portions of land now being rendered safe.

5. A statement prepared by the Medical Officer, Kisii, showing the extent of the reduction of infection, is reproduced in paragraph 6 below :-

6. "The first accurate investigation into the incidence of human Trypanosomiasis in the Kaniadoto area was carried out in 1927, when an incidence of 10% was discovered. These cases occurred amongst a sub-division of the location numbering about 1000 people, who for the most part frequented the tributaries of the Kuja River for obtaining water, building poles, firewood, etc.

The removal of several villages which were in dangerous proximity to tsetse was recommended. Beyond this and treatment of infected people nothing further was done.

In January 1929, a European Forest Officer and his wife contracted Sleeping Sickness during a safari in the

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END

Kaniadoto area.

In 1929, 176 cases of Sleeping Sickness were found among the native population in the Kuja River area.

In January 1930 it was decided to carry out an investigation into the incidence of Sleeping Sickness in the Kavirondo endemic zones with a view to recommending measures for the control of the infection. Altogether about nine months were spent in the Kuja River area, during which time the sources of the infection were accurately determined by closely questioning all infected people in regard to their movements and mode of life.

Between February and October 1930, 156 new cases of Sleeping Sickness were found in Kaniadoto - the sub-division, Kaniakela, producing the majority of cases. Five months afterwards, in March 1931, a re-examination of the population produced 78 fresh cases. From these figures it would appear that about 16 fresh infections were occurring monthly.

In 1932 a trained African Laboratory Assistant was posted to Kaniadoto in order to deal with fresh cases of Sleeping Sickness. The subsequent findings are as follows:-

1933	.....	55 cases.
1934	.....	46 "
1935	.....	35 "
1936	.....	30 "
1937	.....	10 "

In July 1937, the total population of Kaniakela was examined and only two new cases were found. These two cases are included in the total for 1937. The reduction in the incidence of Sleeping Sickness in the Kaniadoto area is undoubtedly due to anti-tsetse measures which have been conducted since 1933. There is good reason to believe that at the present rate of progress Sleeping Sickness will be entirely eliminated from the district in question in the very near future."