The Nagupande selective hunting experiment

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These notes together with the accompanying tables and graphs, (which have been drawn on a logarithmic scale), have been prepared in an attempt to provide a succinct and clear-cut picture of the changes in fly numbers which have occurred in the course of the Nagupande Selective Hunting Experiment during the six years which have now elapsed since it was initiated in 1962.

The figures used are “Apparent Densities” of *G. morsitans* (males and females) per 10,000 yards. Those for the Nagupande Experimental Area have been derived from catches of six 3,000 yard long bait-ox flyrounds, while the “control” figures are similarly derived from two 3,000 yard bait-ox rounds in the Lusulu area. (Catches of *G. pallidipes* have also been recorded, particularly in the Lusulu rounds, but these have not been taken into account in the present exercise because they have always been too low in the Nagupande area to show any significant changes in trend). To assist in visualising the changing trends in *G. morsitans* catch over the years, in both the experimental and “control” areas, the relevant 3-monthly (or quarterly) mean levels of catch have been shown on the graphs by means of horizontal lines.

The salient changes in Apparent Density, together with comments thereon, are given below:-

1. *1961 – 1962*

During the period January – September 1962, which immediately preceded the start of selective hunting in the Nagupande area in October 1962, the month-to-month trends in catch in the experimental and control areas were very similar; with the noteworthy exception that the level of catch in the Nagupande area was consistently not much more than half as high as in the Lusulu area – the comparable monthly mean “A.D.s” for this nine-month period being, respectively, 406 and 751.

2. *1962 – 1963*

During the first three months of selective hunting, *i. e.* in October – December 1962, the monthly A.D. rose sharply in the Nagupande area (from 471 in October to 1,009 in December). The corresponding change in the Lusulu Control Area was also an appreciable rise; but there, with monthly A.D. increasing from 471 – 850, the change was not so striking. Disturbance of the food-hosts of the fly in the shooting area, (which included the removal of 44 elephants and 610 warthogs during these first three months of hunting), is considered to be the most likely cause of this disparity. (It seems reasonable to surmise that the consequent greater difficulty of finding regular blood meals in the experimental area would cause the *G. morsitans* population there to become more readily “available” to the flyround catching parties, and hence – irrespective of any normal “seasonal” increase which might be taking place - would result in the observation of higher apparent densities). It is noteworthy, at this point, that the months of November and December 1962 were the only ones in which the experimental area catches actually exceeded the control catches.

During the period January – September 1963 the flyround catches in the Nagupande area decreased very markedly and abruptly, with the result that by September 1963 the monthly A.D. had decreased, from its peak value of 1,009 observed in December 1962, to as low a level as 48. This represents a 95 per cent reduction during this nine-month period. The “fairest” way of assessing the magnitude of the effects of the first 12 months of the Nagupande hunting effort is, however, to compare the mean quarterly A.D. levels prevailing in June – September 1962, (the quarter immediately preceding the start of hunting), and in July - September 1963, (the last quarter of the first “year” of hunting). On this basis (which takes no account of the rise in catch observed during the first three months of hunting) the decrease was from 481 to 73.2, a drop of 85 per cent.

In direct contras to the drastic reductions observed in the experimental area during the first year of hunting, the Lusulu control catches over the same period showed little if any significant change; successive quarterly control A.D.s being 854 in July – September 1962, followed by 634, 688 and 804 in the next three quarters, and 779 in July – September 1963. The change in control A.D. corresponding with the above-mentioned 85 per cent drop in experimental A.D. was accordingly a decrease of only 9 per cent.

3. *1963 - 1964*

During the second year of hunting, from October 1963 to September 1964, the Nagupande experimental area catches of *G. morsitans* continued to decrease very markedly, though not as continuously as in the first year. The observed result was a further 78 per cent drop in the A.D., from the July – September 1963 level of 73.3 to 16.0 in July – September 1964. The overall decrease in quarterly A.D. over the first two years, from 481 in July – September 1962 to 16.0 in July – September 1964, was accordingly a drop of over 96 per cent.

By contrast again, the Lusulu control area catches during the second year of hunting reached very much higher levels during the middle (January – June) period in the first year. With a peak monthly A.D. figure of 1,645 being attained in March 1964 the average for this second year was 973. But by July – September 1964 the quarterly A.D. figure had dropped, from its highest-ever level of 1,489 observed in January – March 1964, to 772, which was very much the same level as the 779 observed a year earlier, and was only 9 per cent lower than the corresponding level of two years earlier, namely the figure of 854 recorded in July – September 1962.

By the end of the second year of the Nagupande hunting the population of the “selected game species” in the experimental area had been reduced so drastically that it seemed clear that no further significant reductions, in game or fly, would be likely to be achieved without the introduction of some further supplementary measures. It seemed clear, furthermore, that not only would supplementary “mopping up” measures within the experimental area be required, but it would also be necessary to introduce other supplementary measure to reduce “fly-pressure” along the periphery of the area and hence prevent continuous re-infestation from outside.

The best means of “mopping up” the residual fly population within the experimental area would b, it was considered, to “flood” the area with cattle, (sufficient to outnumber the residual population of the selected game species), the coats of which could be kept covered with a residual insecticide which would be lethal to the residual tsetses on brief contact, (but which would not of course be lethal to the bovines themselves). The big difficulty about adopting this line of supplementary attack was the fundamental one that no suitable insecticide for this special purpose was available at the time – and it has regretfully to be recorded that, despite intensive efforts by the Branch research team to find such an insecticide during the past three years, a satisfactory answer is not yet in sight. Nevertheless, in anticipation that we would find an insecticide which would work on the coats of the cattle, we did introduce some 90 head of cattle into the Nagupande area in February 1965 and maintained them there, in nine separate herds, for the following sixteen months, *i. e.* until June 1966, (when a gradual withdrawal commenced).

As a direct consequence of the highly favourable results of the first two years of the Nagupande selective hunting, it had been decided, by mid-1964, that the most effective means of preventing further ingress of fly and game from outside the experimental area – and hence of reducing still further the residual game and fly population within the area – would be to introduce extended selective hunting, on precisely the same “Nagupande lines”, all round the periphery of the area on its fly-infested sides. (Not only was this decision reached in respect of the Nagupande area, but it was further decided that this type of selective hunting would be introduced, generally, as the major method of control in most of the Branch’s operational areas throughout the country).

4. *1964 – 1965*

In October – November 1964 selective hunting was started, accordingly, in all sections of the Sebungwe Operations Area which adjoin the Nagupande area, namely in the Kamezu and Kariangwe sections to the north and west and in the Tivuli section to the east. At the same time, mainly on economic grounds, the intensity of hunting in the Nagupande area itself was reduced, but it was still continued at a level which could be reasonably be expected to maintain a “status quo” (while the search, which it was hoped at the time would not prove to be a very lengthy one, continued for a suitable “mopping up” technique with insecticide).

The graphs for the twelve-month period for October 1964 to September 1965 show that during that time there occurred a limited but definite deterioration in the Nagupande tsetse situation. From the level of 16.0 observed in July – September 1964, the quarterly A.D. figure, having first dropped slightly to 14.9 in October – December 1964, rose to 23.5 in January – March 1965 and to 45.8 in April – June 1965, with a “peak” monthly level of 70.8 occurring in May 1965. Thereafter the quarterly figure dropped again, to 34.9 in July – September 1965, but this was still more than twice as high as the corresponding figure (16.0) of a year earlier.

While these adverse changes were taking place in the experimental area, it will be seen that the Lusulu control catches continued on a more or less “normal” course, albeit at generally lower levels than in the preceding year. With the monthly A.D. levels varying between 462 and 1,287 (475 and 1,645 in 1963 – 1964), and quarterly levels between 544 and 1,014, (613 and 1,489 in 1963 – 1964), the mean level for the year was 797, (compared with 973 in 1963 – 1964).

It is possible to think of several reasons for the Nagupande set-back in 1964 – 1965. In the light of subsequent events – and particularly the unexpectedly long delay in being able to introduce insecticide-treated-cattle - it was perhaps wrong to reduce the intensity of the experimental hunting to only one third of its former level, as was done in October 1964. It nevertheless seems quite likely now, (in the light of more than two further years of observations), that at least in some measure the limited upsurge in Nagupande fly-numbers in 1964 – 1965 can be attributed to the disturbance of the game populations along the periphery of the area by the extended hunting, which was started in October 1964. In other words, we may well have witnessed in mid-1965 the same sort of “disturbance effect” as was observed in the Nagupande area during the first three months of hunting in October – December 1962. It also seems not unlikely that the presence of ninety or more head of cattle in the experimental area from February 1965 onwards may have played some part in the deterioration which occurred in 1964 – 1965.

5. *1965 – 1966*

In respect of the next twelve-month period, from October 1965 to September 1966, it has to be recorded, with regret, that the extended hunting procedure which had been in force throughout 1964 – 1965 had to be brought to an abrupt conclusion, for security reasons in early November 1965. It was not until February 1966 that it was deemed prudent by the Security Authorities to allow a resumption of hunting by African hunters, and this only on a considerably modified and restricted basis. (The revised technique consists, in essence, f the replacement of the former system of widespread distribution of some 75 hunters, operating the control of a Tsetse Field Officer and covering the whole of a “hunting area” each month from some 25 static camps, by a single mobile team of 25 hunters, operating under the much more rigid control of one Tsetse Field Officer and covering, more intensively, only selected parts of the hunting area each month). Thus during 1965 – 1966, systematic selective hunting took place in the Nagupande area for only three of the twelve months, namely October 1965, March 1966 and September 1966.

Despite the suspension of all African hunting for all but the three months mentioned above, an appreciable further improvement in the Nagupande tsetse situation occurred in the course of the 1965 – 1966 year.

Thus by the final quarter of this period, July – September 1966, the 3-monthly A.D. figure had decreased to 4.4 which was its lowest level ever recorded up to that time. This level of 4.4 represents an 87 per cent reduction on the comparable level (34.9) of a year earlier, and a 99 per cent reduction on the immediate “pre treatment” level of 481 recorded (four years earlier) in July – September 1962.

In 1965 – 1966 the Lusulu Control flyround catches continued, in general, at only slightly lower levels than in the preceding year, (with monthly A.D levels varying between 428 and 1,017 and quarterly levels between 585 and 879, resulting in a mean level for the year of 726).

6. *1966 – 1967*

In 1966 – 1967, selective hunting in the Nagupande area was carried out by a single mobile team, which operated for nine of the twelve months, (the months of no hunting being November and December 1966 and September 1967). It will be seen from the graph that during this fifth year of the selective hunting still further reductions in the level of the Nagupande ox round catches occurred. With monthly A.Ds ranging between the peak figure (for the year) of 6.9, observed in November 1966, and the trough value of 1.1 observed in the preceding month, October 1966, the mean value for the year was 4.1, as compared with the corresponding figure of 8.8 for the preceding (1965 – 1966) year. In the course of the year the overall drop in quarterly A.D. level, from 4.4 in July – September 1966 to 3.2 in July – September 1967, indicated a further decrease of the order of 27 per cent.

This continued improvement in the Nagupande area in 1966 – 1967could well be, it is considered, a result of the reduction in “pressure” of fly from the north-west, north and east, following the extension of hunting to the Kariangwe, Kamezeu and Tivuli areas in late 1964.

At the same time, *i. e.* during 1966 – 1967, very considerable fluctuations were observed in the levels of catches on the Lusulu control rounds. From the quarterly A.D. level of 716 observed in July – September 1966, this quantity dropped markedly in October – December 1966, to give the lowest value recorded to date, of 262. Thereafter, however, the numbers rose again to give successive quarterly values of 617, 695 and 824, with the last figure (July – September 1967) being somewhat higher than the corresponding July – September 1966 figure of 716. The late 1966 – 1967 annual mean figure of 599 was 17 per cent lower than the 726 observed in 1965 – 1966.

7. *1967 – 1968*

At the time of writing these notes the sixth year of the Nagupande hunting, 1967 – 1968, has been in progress for only three months. But it is of interest to note that during this 3 month period, (October – December 1967), a further drop in mean quarterly A.D. has been observed in the Nagupande area, from the level of 3.2 recorded in July - September 1967, to 1.7 which is the lowest value ever yet recorded for this quantity. At the same time a significant decrease from the level of the preceding quart was also observed in the Lusulu control catches: there, the July - September 1967 figure of 824 was followed by a figure of 313 in October – December 1967.

7. Summary: *1962 – 1967*

To summarise the foregoing year-by-year account of the trends in the Nagupande tsetse catches it can be said that, as at January 1968,there is good evidence that the residual *G. morsitans* population of the Nagupande experimental area – following 5 ¼ years of selective hunting – has reached the lowest level yet recorded; and that this level is less than one per cent of that which originally prevailed when the selective hunting was started in October 1962.

Over the same period there appears to have been relatively very little long-term change in *G. morsitans* numbers prevailing in the Lusulu “control” area, as evidenced by the fact that the recorded mean control A.D. figure for the last quarter of 1966 – 1967, namely 824, was only slightly lower than the corresponding value of 854, observed five years earlier, in July – September 1962.

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Table 1. Mean monthly [and quarterly] catches of *G. morsitans* (males and females) per 10,000 yards.

A. Nagupande experimental area

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1962 | | 1963 | | 1964 | | 1965 | | 1966 | | 1967 | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| January | 306.0 |  | 513.0 |  | 43.3 |  | 32.8 |  | 4.2 |  | 1.9 |  |
| February | 247.0 | 343 | 580.0 | 478 | 38.9 | 37 | 24.4 | 24 | 4.4 | 5 | 6.4 | 4 |
| March | 477.0 |  | 342.0 |  | 28.9 |  | 13.3 |  | 5.3 |  | 5.0 |  |
| April | 492.0 |  | 324.0 |  | 41.7 |  | 28.9 |  | 5.8 |  | 6.1 |  |
| May | 304.0 | 393 | 211.0 | 218 | 47.2 | 35 | 70.8 | 46 | 4.7 | 5 | 3.1 | 5 |
| June | 382.0 |  | 118.0 |  | 16.7 |  | 37.8 |  | 3.1 |  | 6.7 |  |
| July | 297.0 |  | 76.1 |  | 11.1 |  | 23.6 |  | 2.5 |  | 1.4 |  |
| August | 627.0 | 481 | 95.6 | 73 | 20.0 | 16 | 50.3 | 35 | 6.7 | 4 | 4.4 | 3 |
| September | 520.0\* |  | 47.8 |  | 16.7 |  | 30.8 |  | 3.9 |  | 3.9 |  |
| October | 422.0 |  | 43.3 |  | 12.8 |  | 22.2 |  | 1.1 |  | 1.4 |  |
| November | 766.0 | 732 | 51.7 | 48 | 8.0 | 15 | 26.9 | 22 | 6.9 | 4 | 2.8 | 2 |
| December | 1009.0 |  | 48.3 |  | 23.9 |  | 15.8 |  | 2.8 |  | 1.1 |  |

\* Estimated value

B. Lusulu control area

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| January | 551.0 |  | 711.0 |  | 1408.0 |  | 879.0 |  | 1018.0 |  | 576.0 |  |
| February | 459.0 | 564 | 720.0 | 688 | 1413.0 | 1489 | 880.0 | 977 | 1007.0 | 879 | 636.0 | 617 |
| March | 681.0 |  | 633.0 |  | 1645.0 |  | 1172.0 |  | 612.0 |  | 638.0 |  |
| April | 998.0 |  | 718.0 |  | 1124.0 |  | 1287.0 |  | 479.0 |  | 529.0 |  |
| May | 663.0 | 836 | 698.0 | 804 | 1036.0 | 1020 | 1260.0 | 1014 | 847.0 | 585 | 970.0 | 695 |
| June | 847.0 |  | 997.0 |  | 901.0 |  | 494.0 |  | 428.0 |  | 585.0 |  |
| July | 757.0 |  | 830.0 |  | 565.0 |  | 598.0 |  | 628.0 |  | 983.0 |  |
| August | 943.0 | 854 | 973.0 | 779 | 1028.0 | 772 | 808.0 | 654 | 946.0 | 715 | 859.0 | 824 |
| September | 862.0 |  | 533.0 |  | 722.0 |  | 557.0 |  | 572.0 |  | 630.0 |  |
| October | 471.0 |  | 475.0 |  | 462.0 |  | 615.0 |  | 258.0 |  | 336.0 |  |
| November | 581.0 | 634 | 582.0 | 613 | 521.0 | 544 | 812.0 | 725 | 352.0 | 262 | 416.0 | 313 |
| December | 850.0 |  | 782.0 |  | 649.0 |  | 749.0 |  | 175.0 |  | 187.0 |  |

Table \*. Total kills of the “selected game species” in the Nagupande selective hunting area 1962-67

(Including kills on the Nagupande game fence).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1962 | Elephant | 35 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| to 1963 | Buffalo | 0 | 2 | 1 | 1 | 6 | 5 | 1 | 2 | 3 | 0 | 0 | 0 |
|  | Kudu | 20 | 29 | 16 | 16 | 10 | 6 | 6 | 16 | 13 | 16 | 6 | 5 |
|  | Bushbuck | 9 | 6 | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 3 |
|  | Warthog | 218 | 302 | 90 | 123 | 89 | 52 | 78 | 102 | 85 | 81 | 41 | 28 |
|  | Bushpig | 18 | 13 | 1 | 7 | 5 | 7 | 1 | 9 | 10 | 3 | 2 | 3 |
|  | Totals | 300 | 361 | 112 | 147 | 110 | 70 | 87 | 130 | 113 | 101 | 50 | 39 |
|  | Cumulative | 300 | 661 | 773 | 920 | 1030 | 1100 | 1187 | 1317 | 1430 | 1531 | 1581 | 1620 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1963 | Elephant | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| to 1964 | Buffalo | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Kudu | 10 | 12 | 8 | 9 | 4 | 4 | 8 | 5 | 9 | 9 | 7 | 6 |
|  | Bushbuck | 6 | 5 | 1 | 2 | 0 | 1 | 3 | 0 | 3 | 2 | 4 | 4 |
|  | Warthog | 59 | 54 | 39 | 60 | 22 | 22 | 23 | 31 | 28 | 24 | 14 | 23 |
|  | Bushpig | 6 | 10 | 4 | 3 | 7 | 4 | 2 | 1 | 5 | 2 | 5 | 0 |
|  | Totals | 82 | 81 | 52 | 75 | 34 | 32 | 36 | 38 | 45 | 37 | 30 | 33 |
|  | Cumulative | 1702 | 1783 | 1835 | 1910 | 1944 | 1976 | 2012 | 2050 | 2095 | 2132 | 2162 | 2195 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1964 | Elephant | 0 | 1 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 1 | 0 |
| to 1965 | Buffalo | 0 | 0 | 9 | 2 | 6 | 6 | 0 | 2 | 0 | 0 | 5 | 0 |
|  | Kudu | 3 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
|  | Bushbuck | 3 | 3 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 2 | 1 | 1 |
|  | Warthog | 7 | 19 | 12 | 8 | 10 | 10 | 4 | 7 | 5 | 6 | 13 | 13 |
|  | Bushpig | 3 | 4 | 4 | 0 | 4 | 2 | 1 | 1 | 1 | 0 | 2 | 1 |
|  | Totals | 16 | 29 | 25 | 13 | 26 | 21 | 7 | 11 | 6 | 9 | 23 | 16 |
|  | Cumulative | 2211 | 2240 | 2265 | 2278 | 2304 | 2325 | 2332 | 2343 | 2349 | 2358 | 2381 | 2397 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1965 | Elephant | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| to 1966 | Buffalo | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Kudu | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 4 |
|  | Bushbuck | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Warthog | 11 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 5 |
|  | Bushpig | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Totals | 13 | 1 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 9 |
|  | Cumulative | 2410 | 2411 | 2411 | 2411 | 2411 | 2447 | 2447 | 2447 | 2447 | 2447 | 2447 | 2456 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1966 | Elephant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| to 1967 | Buffalo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Kudu | 3 | 0 | 0 | 0 | 8 | 4 | 0 | 2 | 2 | 0 | 0 | 0 |
|  | Bushbuck | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 |
|  | Warthog | 4 | 0 | 0 | 16 | 12 | 7 | 7 | 3 | 10 | 12 | 11 | 0 |
|  | Bushpig | 1 | 0 | 0 | 8 | 4 | 0 | 3 | 1 | 1 | 0 | 1 | 0 |
|  | Totals | 8 | 0 | 0 | 24 | 24 | 11 | 10 | 6 | 14 | 12 | 16 | 0 |
|  | Cumulative | 2464 | 2464 | 2464 | 2488 | 2512 | 2523 | 2533 | 2539 | 2553 | 2565 | 2581 | 2581 |