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# EFFECT OF THE CLIMATIC AMELIORATION OF THE PAST DECADE ON THE AUTUMN CHANGE OF COAT OF THE ARCTIC FOX IN GREENLAND

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WITH 10 TABLES AND 2 PLATES

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The material on which this investigation is based comprises the fox skins sent to Denmark from West Greenland (except the Thule District) in the period from 1919 to 1939[1]; the quantities varied between 1800 and 5700 per annum, and during the latter part of this period a constantly increasing number proved to be of animals with an imperfect winter pelage ("summer skins").

The investigation is founded mainly on a graphic consideration of the material. Preliminarily the curves must be regarded as pictures of an at present unknown process, and the distinct uniformity of these curves permits the drawing of certain conclusions regarding the cause of the chronologically simultaneous (subordinate) oscillations, without our knowing as yet the cause of the main direction of the curves, ascending or descending.

By means of this form of observation and by examining the limited number of possibilities open to us, we have by the process of elimination deduced the probable cause of these oscillations, subordinate as they are but nevertheless confusing to the main picture, in order to proceed to the final discussion of the cause of the main direction of the curves.

The great majority of foxes are trapped in South Greenland and in the Egedesminde District; elsewhere in the country the numbers are of minor importance.

As will be seen from plate 1, fig. 1, which shows the annual number of foxes caught in South Greenland from 1826—1938[2]), the totals are subjected to heavy fluctuations. There were sudden increases in 1831, 1873, 1918 and 1925. In 1929 there was an unusually heavy increase which, after a slight decrease in 1931 and renewed increase in the following year, passed into a steady fall, and in 1938 the totals had once more come down to about the "normal". The volume of this increase is seen from the fact that in 1929 the total was about 5,000 compared with an average of about 2000 in the period from 1875 to

[1]) When the war interruptet the communication.

[2]) F. W. Bræstrup: A study of the Arctic fox in Greenland. M. o. G. Bd. 131. In the present investigation, however, the figures are placed to the calendar vear in which the young foxes have grown up and in which presumably most of the animals were caught.

1914 (the relatively flat part of the curve). The increase was also observed in the Egedesminde District, but not in the rest of North Greenland.

From 1929 there was also an increase in the number of "summer skins", i. e. skins with a thin, more or less brownish coat of hair, so that to some extent they still bear the character of the summer pelage. Whereas in the period from 1918 to 1928[1]) these skins represented only 1.5 to 5.0 per cent. of the total sent to Denmark, the percentage rose continuously from 1929 until 1938, when for South Greenland it amounted to 21 per cent. (Plate 1, fig. 1, table 1). In contrast to the increase in the total numbers caught this increase of "summer skins" applies to the whole of West Greenland.

On the basis of the available material: the 1918—38 totals (received in Denmark 1919—39[2])) of white and blue foxes (Table 2 a, b) and the segregated skins of partially-changed animals, "summer skins", we shall endeavour to show the probable cause of this phenomenon.

The first question to be considered is whether the material is copious enough. For South Greenland and Egedesminde it is, and therefore the investigation must be confined mainly to that part of the country. There is indirect evidence of the reliability of the material from there in figs. 1 and 2, plate 2, showing the catch of white and blue foxes for 1918 to 1938. Here we find a feature which could not have been anticipated, namely that the curves for the different colonial districts of South Greenland are surprisingly uniform in their course, as if they were pictures of the same rocky coast, seen from slightly different angles; this is true of both white and blue foxes. Such a handsome, regular conformity would not appear if the material were numerically insufficient to any marked degree.

The next points for consideration are: What importance may be attached to the numerical material, what does it picture, and is that picture to be relied upon?

Can the catch (the number of skins shipped) be regarded as a reliable expression of the momentary size of the "stock" of foxes in the region, as well as of the rise and fall of the catch, i. e. as an expression of cor-

[1]) "Summer skins" were picked out for the first time at the sale in 1919.

[2]) The quantities shipped may be regarded as practically identical with the totals caught in the previous year, as with the present close season from 1st April to 30th September, such a long time elapses from the opening of the season until the skins traded at the posts can come forward for shipment that as a rule they cannot be sent home until the next year. This is confirmed, by the way, in the circumstance to be referred to later, that sudden increases in the relative number of summer skins (skins of animals caught in early autumn) coincide with a reduced catch; the opposite would be the case if in similar circumstances the shipment comprised any large proportion of the following year's catch.

responding fluctuations in the stock, and is the percentage of "summer skins" a reliable expression of the relation between completely changed and partially changed foxes in the stock at a certain time of the year, and is the increase an expression of a displacement in that relation considered at the same time of the year?

As will appear from the following, these questions must be answered in the affirmative.

The increase in the number of "summer skins" might be purely an apparent one, caused by a gradually more critical sorting of the skins in Denmark before the sales. This, however, is emphatically denied by the person who does the sorting.

Apart from fluctuations in the size of the stock, differences in the size of the catch might be brought about by weather conditions particularly favourable to hunting and trapping, or by the absence of or early cessation of competing occupations.

As has already been pointed out, the catch curves on figs. 1 and 2, plate 2 exhibit remarkable uniformity. It will be seen how the districts of Frederikshaab, Godthaab, Sukkertoppen, Holsteinsborg, Egedesminde, and even Christianshaab all present a distinct maximum for 1930 and for 1932, a less distinct one for 1927, and a clear fall for 1931 and for 1933. If for instance the weather conditions have been particularly favourable or unfavourable for fox trapping and thereby affected the size of the catch, this must have been the case simultaneously in all these districts, not only in a single year but again and again in all the years enumerated — which is quite improbable.

The same figures show curves representing the percentages of "summer skins" among blue and white foxes respectively. It will be seen how these curves for all the districts from Julianehaab and in fact right up to Umanak begin to rise in 1929, and that this rise continues until 1938 (on account of the numerically defective material for North Greenland—Egedesminde excepted—the curve for that region is very disconnected). If for instance unusually favourable weather or the lack of other occupations had promoted an early commencement of trapping operations and thereby an increase in the number of "summer skins", all fox trappers from Julianehaab to Umanak as if by agreement would have started trapping early in 1929 and thereafter, in the next ten years, year after year, earlier still!

The fluctuations both in the size of the catch and in the percentage of "summer skins" must be assumed to have been due mainly to corresponding changes in the state of the "stock". If this is so, the catch curves present a picture of the changing size of the stock in the localities where trapping proceeds (the coasts), and the curves for the percentage of "summer skins" reflect the proportion of completely changed and

partially changed pelages within the period when the greater part of the foxes are caught.

As the increase in the catch coincides with the increase in the number of "summer skins", it would be tempting to connect the two phenomena with each other; at any rate, having regard to the possibility of their mutual interdependence they should be considered together in the course of the following investigation.

On examining the curves of the catches and the "summer skins" more closely (figs. 1, 2, plate 2), a fact of great importance to the further investigation becomes clear. As already stated, the catch curves for South Greenland and for the Egedesminde District display remarkable uniformity, which becomes still more striking when we gather the districts into smaller groups.

The greater or smaller degree of uniformity between the curves (most conspicuous on fig. 1) gives the following grouping:

Group 1 Julianehaab.
— 2 Frederikshaab, Godthaab, Sukkertoppen.
— 3 Holsteinsborg, Egedesminde,

all groups which also in a geographical and climatological sense form very natural units.

It would be a reasonable assumption that certain conditions, for instance climatic or nutritive, which were the same for the districts within each of these groups, had affected the conditions of life of the foxes, and that one of the effects of this influence was variations in the size of the stock and in the frequency of "summer skins", which again are reflected in the characteristic curve picture for each group.

At this juncture, however, it will be advisable to mention certain factors which occur to us as *apparently* plausible explanations of the phenomenon of the increasing frequency of summer skins.

This phenomenon consists of an incontrovertible *increase* of the percentage from 1929 to 1938; the increase, however, is not entirely regular; it is subjected to a good deal of *fluctuation*, and it is necessary to keep these two things quite separate. For the increase and the fluctuations of that increase need not be due to the same cause.

Whereas the increase comprises the whole of West Greenland, the fluctuations vary from group to group. If it can be shown that the fluctuations are due to local factors within a district group, they may be segregated as a phenomenon unrelated to the steady increase. But if the increase itself and the fluctuations within it are due to one and the same factor, that factor itself must be variable.

Quite a number of variable factors may be picked upon as being the general cause both of the increase and of the fluctuations within that increase.

Epizooties. Apart from the fact that there is no record whatever of any epizooty, their presence might explain certain marked rises in the "summer-skin" curves where they coincide with distinct falls in the catch curves, for example in 1931 at Frederikshaab, Godthaab and Sukkertoppen, even if it is little likely that an epizooty should occur at the same time in these districts, separated as they are by deep complexes of fjords. This explanation becomes still more improbable when it is considered that this fall in the stock is also observable in Julianehaab, Holsteinsborg and Egedesminde Districts but without any corresponding, distinct rise of the "summer-skin" curve (figs. 1, 2, plate 2).

Furthermore, when we see that the first rise of the "summer-skin" curves in 1929 everywhere coincides with the first pronounced rise of the catch curves, we must exclude epizooties as a general factor.

Nutrition. Obviously, this is a factor of vital importance to the well-being of the stock, one which doubtless affects the fertility of the older animals as well as the development of the young. But as it cannot be assumed that the conditions of nutrition of the mature (breeding) foxes can have much influence on when the breeding season begins and thereby on the development of the cubs and the autumn change of coat, the fluctuations in the frequency of the summer skins would chiefly be dependent on food conditions in the summer season, whereas the fertility of the adult vixens must depend mainly on food conditions in the winter months (as bad food conditions in the winter cannot be counter-balanced by good conditions in the previous summer).

Actually, then, food conditions might explain fluctuations both in the size of the stock and in the frequency of "summer skins"; but if the two things are considered together, it becomes quite unlikely that these conditions can be the general cause of the fluctuations in the size of the stock and also in the percentage of "summer skins" and of the continuous increase of the latter; for the fact that from 1929 to 1938 the "summer-skin" curves rose continuously would presuppose that in every summer season of these ten years the food conditions had been unusually bad, while at the same time the catch curves show that the stock (in South Greenland) in 1929, 1930, 1932 and 1933 at several places was up at from 2 to $2^1/_2$ times the normal size, which would mean that at any rate the winter season in these four years had presented food conditions that were just as unusually good (figs. 1, 2, plate 2).

Precipitation. On fig. 5a and b, plate 1 (Table 6) and fig. 6a and b, plate 1 (Table 7) the mean precipitation in the summer and

winter half-years from 1918 to 1938 for Godthaab and Ivigtut[1]) is shown together with the catch and "summer-skin" curves for Godthaab and Julianehaab. Here again we can see no agreement with the catch and "summer-skin" curves; but on comparing the precipitation curves for Godthaab and Ivigtut we cannot help seeing the enormous difference between the precipitation values at these two places. This, in conjunction with the marked difference between the precipitation values from one year to the next at the latter place, is convincing evidence that the fluctuations in the precipitation for example at Godthaab cannot possibly have much influence on the living conditions of the foxes there, when the tremendous fluctuations at Ivigtut, which must be assumed to correspond more or less to conditions in Julianehaab District, do not prevent the foxes from thriving well at the latter place.

Temperature (direct, or indirect through the influence of conditions of nutrition). The mean temperatures for the summer and winter half-years[2]) for Godthaab and Jakobshavn are shown together with the catch and summer-skin curves for white foxes in these districts on fig. 2a and b, plate 1 (Table 4) and fig. 3a and b, plate 1 (Table 5).

It will be seen that there are great oscillations in the temperature; there are large oscillations in the curves from one year to the next, and it would be natural to seek the cause of the isolated peaks on the summer-skin curves, which are so clearly accompanied by sudden falls in the catch curve, for example in Godthaab in 1926 and 1931, in corresponding sudden oscillations in the temperature curve; but, as will be seen, there is no such agreement.

But if we consider the mean *annual* temperature, and especially the same curve averaged out (triennial average) (fig. 4, plate 1), it will be seen that from 1922 there was a considerable general rise in the temperature, which may explain the general increase in the number of summer skins, but not the aforesaid isolated peaks.

As we may now, after the foregoing, rule out the possibility of a single factor being the general cause of both the continuous, general increase in the number of "summer skins" and of the sudden peaks in that increase, the two things must be due to different factors and therefore are two independent phenomena, each of which must be considered separately.

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[1]) The observations for Ivigtut are used here because of a lack of sufficient observation material from Julianehaab, and because it is unlikely that the meteorological conditions at Ivigtut differ much from conditions in the Julianehaab District.

[2]) All the observations are taken from the Aarbog, 2. Del: Grønland, of the Meteorological Institute. For both temperature and precipitation the winter half-year is formed of consecutive quarters, the fourth quarter being included in the winter half-year of the following year.

As already stated, the colony districts may be gathered into groups, within which the catch curves and the summer-skin curves separately display extraordinarily great uniformity, and where it is presumable that local conditions within the individual groups caused this marked similarity in the shape of the curves, especially the uniform, isolated oscillations in the "summer-skin" curves. We now have a possibility of finding out what are the local factors that brought about these isolated oscillations by a simultaneous consideration of the catch and "summer-skin" curves.

The largest group, and the one most suitable for a detailed investigation, is formed by the districts of Frederikshaab, Godthaab and Sukkertoppen. In order to eliminate possible adventitious elements in the numerical material and to make it more perspicuous the material for the whole of this group has been merged and treated together. Fig. 7a and b, plate 1 (Table 8) shows the catch and "summer-skin" curves for blue and white foxes for the whole group. It will be seen that the "summer-skin" curve for both blue and white foxes has distinct peaks for the years 1926, 1931 and 1934 (A, B and C), and that the catch curves describe correspondingly distinct falls (except in 1934 (C) for white foxes). This means to say that the same factor which brought about the decreases in the stock (catch) in all probability was also the cause of the simultaneous, *isolated* rises in the frequency of the "summer skins".

This factor may for example be found in the conditions of nutrition. If so, these conditions must have been particularly bad in the years 1926, 1931 and 1934, and the simultaneous oscillations in the catch and "summer-skin" curves show that they must have prevailed in both the summer and the winter half-year (cf. page 7). Another explanation may be that for some reason or other (food migration) the foxes left the coast early in the winter, which would also explain both the reduced catch and the increased percentage of "summer skins" (cf. page 5).

If now we consider the three isolated peaks on the "summer-skin" curves as a separate phenomenon, explained simply as having been caused directly or indirectly by food conditions in those years, and experimentally disregard (cut away) the peaks at A, B and C (the hatched areas), we shall see that the remainder of the curves forms a steadily rising (almost straight) line. Thus this steady rise in the "summer-skin" curves must have been caused by a factor that had nothing to do with food conditions (cf. p. 7), and it would be natural to look for it in the general amelioration of the climate in Greenland[1]).

[1]) Ad. S. Jensen: Concerning a change of climate during recent decades in the arctic and subarctic regions, from Greenland in the west to Eurasia in the east, and contemporary biological and geophysical changes. Kgl. Dansk Vidensk. Selsk. Biol. Med. XIV, 8.

From fig. 4, plate 1, we see that after having begun to rise in 1922 the mean temperature became positive for the first time in 1928, at the same time as the rise in the "summer-skin" curves began, and since then, until 1937, has oscillated about Zero.

The above detailed investigation of conditions on this part of the west coast makes it probable that this assumption is correct, and that there may be full reason to assume that the general increase in the number of skins of animals with only partly changed winter pelages, an increase that was proved to have set in throughout West Greenland as far north as Melville Bay in 1929 and since continued, is due to the milder climate.

Thus this relatively slight rise in the mean temperature (in Godthaab about 2°) in the short period during which it has existed has had a very perceptible influence on the phenotypic character of the Arctic fox, manifested in the displacement of the time when the winter colouration of its fur is complete. We may reckon that the temperature began to rise about the year 1922, and the number of partially changed skins about 1929, so that the biological effect appears about seven years after the commencement of the temperature rise; or, if we reckon from the preliminary temperature optimum which set in about 1929 together with the initial increase in the number of incompletely changed skins, the mean temperature in the course of about seven years with an increase of 2° brought about a constantly more pronounced displacement of the date of the autumn change of coat.

This displacement must be a purely phenotypical one, not immediately comparable with the very similar phenomenon that was observed when the Arctic hare was transplanted from Norway to the Faeroe Islands about the year 1854, where, as stated by M. Degerbøl[1]), as a consequence of the very small initial stock (three individuals), the changes were no doubt chiefly genotypical.

[1]) Zoology of the Faeroes LXV, 1940.

Table 1. Total fox catch in South Greenland and percentage of "summer skins" 1918—38 (shipment 1919—39).

| | Total | "Summer skins" | % |
|---|---|---|---|
| 1918 | 4550 | 121 | 2.7 |
| 19 | 3005 | 138 | 4.5 |
| 20 | 2499 | 70 | 2.8 |
| 21 | 2329 | 61 | 2.6 |
| 22 | 2144 | 34 | 1.6 |
| 23 | 1918 | 41 | 2.1 |
| 24 | 1772 | 26 | 1.5 |
| 25 | 2668 | 91 | 3.4 |
| 26 | 1825 | 95 | 5.2 |
| 27 | 2729 | 105 | 3.8 |
| 28 | 2607 | 58 | 2.2 |
| 29 | 5533 | 328 | 5.9 |
| 30 | 5518 | 436 | 7.9 |
| 31 | 3165 | 363 | 11.5 |
| 32 | 5745 | 489 | 8.5 |
| 33 | 4699 | 486 | 10.3 |
| 34 | 3036 | 336 | 11.1 |
| 35 | 3062 | 482 | 15.7 |
| 36 | 3002 | 629 | 20.0 |
| 37 | 2764 | 413 | 14.9 |
| 38 | 2146 | 453 | 21.1 |

Table 2a. Catch of white foxes in the years 1918—38 (shipment 1919—39).

| Locality | Jhb. | Fhb. | Ghb. | Skt. | Hbg. | Egm. | Chb. | Jhv. | Rtb. | Ghv. | Umk. | Upv. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918..... | 996 | 242 | 363 | 76 | 186 | 130 | 87 | 19 | 19 | 23 | 20 | 17 |
| 19..... | 669 | 119 | 230 | 65 | 166 | 118 | 69 | 20 | 21 | 20 | 22 | 58 |
| 20..... | 468 | 128 | 200 | 49 | 155 | 85 | 51 | 24 | 16 | 9 | 3 | 3 |
| 21..... | 488 | 66 | 152 | 70 | 174 | 140 | 38 | 21 | 15 | 19 | 5 | 26 |
| 22..... | 392 | 69 | 208 | 76 | 178 | 217 | 103 | 26 | 31 | 18 | 28 | 204 |
| 23..... | 295 | 71 | 158 | 78 | 178 | 112 | 73 | 35 | 36 | 17 | 8 | 15 |
| 24..... | 282 | 50 | 125 | 72 | 205 | 152 | 84 | 59 | 39 | 25 | 22 | 19 |
| 25..... | 496 | 96 | 169 | 76 | 195 | 158 | 50 | 36 | 29 | 9 | 23 | 22 |
| 26..... | 280 | 42 | 99 | 49 | 231 | 112 | 90 | 52 | 63 | 22 | 29 | 456 |
| 27..... | 298 | 69 | 214 | 122 | 336 | 194 | 91 | 66 | 45 | 17 | 24 | 20 |
| 28..... | 347 | 81 | 138 | 134 | 291 | 181 | 74 | 55 | 40 | 26 | 24 | 20 |
| 29..... | 800 | 235 | 363 | 270 | 362 | 190 | 87 | 76 | 65 | 27 | 47 | 36 |
| 30..... | 698 | 254 | 400 | 263 | 371 | 263 | 138 | 83 | 88 | 50 | 74 | 437 |
| 31..... | 404 | 51 | 312 | 132 | 269 | 228 | 104 | 57 | 64 | 34 | 42 | 151 |
| 32..... | 561 | 227 | 427 | 277 | 494 | 402 | 134 | 86 | 57 | 34 | 42 | 10 |
| 33..... | 678 | 143 | 339 | 160 | 292 | 248 | 66 | 31 | 44 | 28 | 36 | 67 |
| 34..... | 412 | 125 | 251 | 132 | 235 | 252 | 64 | 33 | 50 | 46 | 98 | 198 |
| 35..... | 401 | 93 | 221 | 126 | 228 | 259 | 78 | 37 | 31 | 34 | 48 | 24 |
| 36..... | 294 | 70 | 190 | 120 | 215 | 223 | 53 | 35 | 14 | 28 | 20 | 14 |
| 37..... | 407 | 85 | 199 | 84 | 236 | 210 | 85 | 37 | 13 | 29 | 21 | 91 |
| 38..... | 324 | 82 | 173 | 72 | 190 | 224 | 63 | 45 | 28 | 55 | 47 | 64 |

Table 2b. Catch of blue foxes in the years 1918—38 (shipment 1919—39).

| Locality | Jhb. | Fhb. | Ghb. | Skt. | Hbg. | Egm. | Chb. | Jhv. | Rtb. | Ghv. | Umk. | Upv. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918..... | 1122 | 457 | 785 | 185 | 138 | 138 | 24 | 2 | 8 | 12 | 32 | 15 |
| 19..... | 719 | 244 | 576 | 149 | 128 | 149 | 20 | 3 | 12 | 18 | 32 | 38 |
| 20..... | 509 | 256 | 478 | 149 | 107 | 139 | 37 | 7 | 17 | 13 | 29 | 11 |
| 21..... | 637 | 62 | 413 | 133 | 100 | 163 | 39 | 11 | 21 | 15 | 27 | 40 |
| 22..... | 391 | 123 | 434 | 191 | 82 | 101 | 9 | 6 | 4 | 4 | 14 | 30 |
| 23..... | 276 | 130 | 371 | 230 | 131 | 139 | 25 | 5 | 18 | 9 | 17 | 1 |
| 24..... | 293 | 93 | 341 | 153 | 158 | 181 | 56 | 11 | 22 | 42 | 61 | 9 |
| 25..... | 576 | 281 | 418 | 182 | 179 | 193 | 49 | 6 | 11 | 9 | 44 | 11 |
| 26..... | 319 | 139 | 331 | 177 | 158 | 144 | 34 | 4 | 19 | 46 | 49 | 37 |
| 27..... | 310 | 238 | 612 | 213 | 317 | 309 | 53 | 8 | 24 | 38 | 66 | 7 |
| 28..... | 366 | 263 | 408 | 294 | 285 | 336 | 71 | 10 | 20 | 30 | 77 | 12 |
| 29..... | 948 | 738 | 980 | 496 | 341 | 336 | 75 | 18 | 43 | 68 | 72 | 14 |
| 30..... | 901 | 779 | 1023 | 469 | 360 | 368 | 48 | 17 | 7 | 62 | 32 | 15 |
| 31..... | 454 | 216 | 814 | 291 | 222 | 339 | 36 | 20 | 17 | 26 | 26 | 14 |
| 32..... | 746 | 772 | 1267 | 471 | 503 | 609 | 83 | 29 | 21 | 54 | 48 | 4 |
| 33..... | 885 | 461 | 1078 | 387 | 276 | 454 | 63 | 13 | 34 | 51 | 40 | 15 |
| 34..... | 562 | 305 | 492 | 315 | 207 | 333 | 43 | 5 | 21 | 55 | 16 | 14 |
| 35..... | 480 | 351 | 616 | 379 | 167 | 399 | 93 | 15 | 28 | 37 | 47 | 6 |
| 36..... | 371 | 298 | 677 | 318 | 211 | 433 | 45 | 13 | 14 | 44 | 37 | 11 |
| 37..... | 449 | 286 | 706 | 315 | 235 | 366 | 70 | 8 | 18 | 62 | 24 | 19 |
| 38..... | 280 | 164 | 513 | 176 | 172 | 358 | 32 | 19 | 19 | 44 | 30 | 5 |

Table 3a. Percentage of "summer skins" of white fox in years 1918—38 (shipment 1919—39).

| Locality | Jhb. | Fhb. | Ghb. | Skt. | Hbg. | Egm. | Chb. | Jhv. | Rtb. | Ghv. | Umk. | Upv. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918..... | 2.0 | 2.1 | 1.9 | 2.6 | 1.6 | 3.1 | 0 | 0 | 0 | 4.3 | 0 | 0 |
| 19..... | 4.0 | 1.7 | 0.4 | 3.1 | 1.2 | 2.5 | 1.4 | 0 | 0 | 0 | 0 | 0 |
| 20..... | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21..... | 0.8 | 0 | 2.0 | 0 | 0.6 | 0.7 | 0 | 0 | 0 | 0 | 7.4 | 0 |
| 22..... | 0.8 | 0 | 1.9 | 1.3 | 0 | 0.5 | 0 | 0 | 3.2 | 0 | 0 | 2.9 |
| 23..... | 0 | 1.4 | 1.3 | 5.1 | 1.7 | 8.9 | 1.4 | 0 | 2.8 | 0 | 0 | 0 |
| 24..... | 1.1 | 4.0 | 3.2 | 0 | 0 | 2.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25..... | 1.2 | 2.1 | 1.8 | 0 | 3.1 | 3.2 | 0 | 0 | 0 | 0 | 0 | 12.5 |
| 26..... | 1.1 | 4.8 | 6.0 | 6.1 | 8.7 | 2.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27..... | 4.0 | 1.4 | 3.7 | 0.8 | 2.4 | 5.2 | 5.5 | 6.1 | 0 | 5.9 | 0 | 0 |
| 28..... | 0.3 | 0 | 0.7 | 0.7 | 0.3 | 3.9 | 4.1 | 0 | 0 | 0 | 4.2 | 0 |
| 29..... | 9.0 | 13.2 | 2.2 | 8.9 | 4.4 | 6.8 | 2.3 | 7.9 | 4.6 | 11.1 | 10.6 | 5.6 |
| 30..... | 10.7 | 8.3 | 4.5 | 11.4 | 16.2 | 14.1 | 0.7 | 12.0 | 28.4 | 12.0 | 4.1 | 1.8 |
| 31..... | 8.7 | 23.5 | 20.2 | 29.5 | 16.7 | 10.0 | 6.7 | 7.0 | 7.8 | 2.9 | 11.9 | 2.0 |
| 32..... | 10.2 | 10.0 | 13.1 | 10.5 | 12.1 | 8.5 | 7.5 | 17.4 | 17.5 | 23.5 | 0 | 0 |
| 33..... | 15.9 | 17.5 | 14.1 | 11.9 | 23.6 | 18.5 | 7.6 | 22.6 | 22.7 | 21.4 | 16.7 | 6.0 |
| 34..... | 23.3 | 28.8 | 15.1 | 23.5 | 17.9 | 17.5 | 12.5 | 12.1 | 24.0 | 6.5 | 11.2 | 5.6 |
| 35..... | 21.4 | 26.9 | 16.7 | 16.7 | 30.3 | 30.8 | 32.1 | 59.4 | 32.3 | 17.6 | 29.2 | 8.3 |
| 36..... | 31.4 | 12.9 | 30.0 | 30.8 | 16.7 | 33.6 | 11.3 | 50.0 | 14.3 | 21.4 | 5.0 | 30.8 |
| 37..... | 29.5 | 35.5 | 28.1 | 51.2 | 28.8 | 29.5 | 31.8 | 57.1 | 38.5 | 3.5 | 33.3 | 4.9 |
| 38..... | 22.8 | 30.5 | 37.6 | 20.8 | 26.8 | 34.4 | 22.2 | 37.8 | 25.0 | 20.0 | 23.6 | 15.6 |

Table 3b. Percentage of "summer skins" of blue fox in years 1918—38 (shipment 1919—39).

| Locality | Jhb. | Fhb. | Ghb. | Skt. | Hbg. | Egm. | Chb. | Jhv. | Rtb. | Ghv. | Umk. | Upv. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1918..... | 3.0 | 1.3 | 4.6 | 4.3 | 0 | 4.3 | 0 | 0 | 0 | 0 | 31.3 | 0 |
| 19..... | 1.9 | 0.8 | 13.9 | 3.4 | 2.3 | 5.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20..... | 5.7 | 2.3 | 4.4 | 4.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21..... | 5.0 | 0 | 1.9 | 9.0 | 1.0 | 3.1 | 5.1 | 0 | 0 | 0 | 0 | 0 |
| 22..... | 1.0 | 2.4 | 1.8 | 4.4 | 2.4 | 2.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23..... | 2.9 | 1.5 | 1.3 | 5.6 | 2.3 | 10.0 | 0 | 0 | 0 | 33.3 | 0 | 0 |
| 24..... | 1.0 | 5.4 | 2.1 | 1.3 | 0 | 8.8 | 0 | 0 | 0 | 0 | 4.9 | 0 |
| 25..... | 5.2 | 2.5 | 6.7 | 3.3 | 1.7 | 7.3 | 0 | 0 | 0 | 11.1 | 0 | 9.1 |
| 26..... | 2.5 | 5.8 | 7.3 | 6.8 | 5.7 | 7.6 | 0 | 0 | 0 | 0 | 2.0 | 0 |
| 27..... | 3.9 | 4.6 | 3.8 | 1.9 | 7.9 | 12.9 | 0 | 0 | 4.2 | 0 | 6.1 | 0 |
| 28..... | 4.4 | 4.2 | 3.2 | 2.7 | 2.1 | 6.0 | 1.4 | 0 | 0 | 0 | 0 | 0 |
| 29..... | 4.6 | 7.2 | 3.1 | 6.7 | 5.0 | 4.8 | 0 | 0 | 2.3 | 5.9 | 5.6 | 14.3 |
| 30..... | 10.0 | 6.8 | 4.1 | 6.4 | 4.7 | 5.4 | 4.2 | 0 | 0 | 6.4 | 12.5 | 0 |
| 31..... | 5.3 | 10.0 | 9.2 | 12.4 | 5.4 | 7.4 | 0 | 10.0 | 0 | 0 | 7.7 | 14.3 |
| 32..... | 10.3 | 6.9 | 7.1 | 4.7 | 4.4 | 1.8 | 0 | 13.8 | 0 | 3.7 | 27.1 | 0 |
| 33..... | 7.3 | 6.5 | 5.7 | 6.7 | 12.7 | 9.3 | 3.2 | 0 | 11.8 | 7.8 | 25.0 | 13.3 |
| 34..... | 15.7 | 20.3 | 15.9 | 13.3 | 11.1 | 9.0 | 11.6 | 0 | 0 | 14.5 | 12.5 | 0 |
| 35..... | 14.8 | 10.8 | 11.4 | 10.3 | 15.5 | 12.5 | 14.0 | 20.0 | 32.2 | 27.0 | 14.9 | 16.7 |
| 36..... | 8.4 | 10.1 | 9.5 | 14.5 | 4.7 | 12.7 | 8.9 | 30.8 | 0 | 9.1 | 10.8 | 0 |
| 37..... | 16.3 | 17.5 | 12.0 | 15.6 | 23.4 | 16.9 | 11.4 | 0 | 33.3 | 11.3 | 16.7 | 11.1 |
| 38..... | 8.6 | 18.9 | 19.7 | 21.6 | 16.9 | 28.4 | 15.6 | 15.8 | 10.5 | 22.7 | 23.3 | 0 |

Table 4. Mean quarterly temperatures in Godthaab District together with winter and summer and annual temperatures.[1])

(On the basis of the Meteorological Institute's Aarbog 2. Del).

| | 1st qr. | 2nd qr. | 3rd qr. | 4th qr. | Winter half-year | Summer half-year | per annum |
|---|---|---|---|---|---|---|---|
| 1918 | — 9.6 | — 2.1 | 5.2 | — 5.4 | .. | 1.5 | — 3.0 |
| 19 | — 7.1 | — 0.4 | 5.4 | — 2.5 | — 6.2 | 2.5 | — 1.2 |
| 20 | — 10.2 | 1.3 | 4.5 | — 5.3 | — 6.3 | 2.9 | — 2.4 |
| 21 | — 11.9 | — 0.3 | 5.2 | — 4.2 | — 8.4 | 2.4 | — 2.7 |
| 22 | — 10.9 | 0.6 | 4.8 | — 3.0 | — 7.6 | 2.7 | — 2.1 |
| 23 | — 7.4 | 2.2 | 5.5 | — 2.5 | — 5.2 | 3.8 | — 0.5 |
| 24 | — 5.7 | 3.0 | 5.8 | — 5.3 | — 4.1 | 4.4 | — 0.5 |
| 25 | — 9.5 | — 0.4 | 5.5 | — 1.1 | — 7.4 | 2.5 | — 1.4 |
| 26 | — 6.5 | 2.6 | 6.1 | — 2.3 | — 3.8 | 4.3 | — 0.1 |
| 27 | — 7.9 | 2.0 | 6.4 | — 2.3 | — 5.1 | 4.2 | — 3.0 |
| 28 | — 6.9 | 3.1 | 7.5 | — 2.1 | — 4.6 | 5.3 | 0.4 |
| 29 | — 3.2 | 3.6 | 6.6 | — 4.5 | — 2.7 | 5.1 | 0.6 |
| 30 | — 7.1 | 3.1 | 6.8 | — 3.5 | — 5.8 | 4.9 | — 0.4 |
| 31 | — 7.1 | 1.9 | 7.8 | — 4.8 | — 5.3 | 4.8 | — 0.6 |
| 32 | — 5.0 | 3.3 | 7.0 | — 4.1 | — 4.9 | 5.1 | 0.3 |
| 33 | — 7.4 | 1.8 | 6.8 | — 2.9 | — 5.7 | 4.3 | — 0.4 |
| 34 | — 8.8 | 1.6 | 6.7 | — 2.3 | — 5.8 | 4.2 | — 0.7 |
| 35 | — 8.2 | 3.8 | 7.4 | — 3.4 | — 5.2 | 5.6 | — 0.1 |
| 36 | — 3.8 | 2.8 | 7.3 | — 4.0 | — 3.6 | 5.0 | 0.4 |
| 37 | — 7.7 | — 0.1 | 5.8 | — 2.9 | — 5.8 | 2.8 | — 1.2 |
| 38 | — 9.4 | 0.2 | 5.2 | — 5.5 | — 6.1 | 2.7 | — 2.4 |

[1]) In this and the following tables the winter half-year consists of continuous quarters, the 4th quarter being included in the subsequent winter half-year.

Table 5. Mean temperatures at Jacobshavn in the quarters and in the winter and summer half-years 1918—38.

(On the basis of the Meteorological Institute's Aarbog 2. Del).

| | 1st qr. | 2nd qr. | 3rd qr. | 4th qr. | Winter half-year | Summer half-year |
|---|---|---|---|---|---|---|
| 1918 | — 20.7 | — 4.0 | 5.2 | — 11.0 | .. | 0.6 |
| 19 | — 17.6 | — 4.1 | 4.4 | — 5.2 | — 14.0 | 0.1 |
| 20 | — 19.2 | 0.3 | 4.8 | — 10.0 | — 12.2 | 2.6 |
| 21 | .. | — 2.3 | .. | — 7.5 | .. | .. |
| 22 | — 19.9 | — 2.1 | 4.6 | — 5.9 | — 13.7 | 1.2 |
| 23 | — 16.1 | 0.6 | 5.3 | — 6.4 | — 11.0 | 2,9 |
| 24 | — 12.2 | 1.4 | 4.6 | — 9.9 | — 9.3 | 3.0 |
| 25 | — 17.1 | — 1.8 | 4.9 | — 4.9 | — 13.5 | 1.5 |
| 26 | — 13.3 | 0.3 | 6.1 | — 6.7 | — 9.1 | 3.2 |
| 27 | — 14.7 | — 0.5 | 6.5 | — 5.9 | — 10.7 | 3.0 |
| 28 | — 10.4 | 1.5 | 7.6 | — 5.1 | — 8.2 | 4.5 |
| 29 | — 4.9 | 0.7 | .. | — 8.1 | — 5.0 | .. |
| 30 | — 11.2 | 0.6 | 7.0 | — 7.7 | — 9.6 | 3.8 |
| 31 | — 13.2 | 0.2 | 8.3 | — 8.3 | — 10.4 | 4.2 |
| 32 | — 8.6 | 1.6 | .. | — 8.1 | — 8.4 | .. |
| 33 | .. | .. | .. | .. | .. | .. |
| 34 | — 14.6 | — 0.7 | 6.1 | — 5.2 | .. | 2.7 |
| 35 | — 13.8 | 1.3 | 6.9 | — 6.0 | — 9.5 | 4.1 |
| 36 | — 9.2 | 1.2 | 6.6 | .. | — 7.9 | 3.9 |
| 37 | — 14.0 | — 2.9 | .. | — 7.0 | .. | .. |
| 38 | — 17.4 | — 2.3 | 5.4 | — 10.5 | — 12.2 | 1.6 |

Table 6. Mean precipitation in mm in Godthaab in the quarters and in the winter and summer half-years.

(On the basis of the Meteorological Institute's Aarbog 2. Del)

| | 1st qr. | 2nd qr. | 3rd. qr. | 4th qr. | Winter half-year | Summer half-year |
|---|---|---|---|---|---|---|
| 1918 | .. | .. | .. | .. | .. | .. |
| 19 | .. | .. | .. | .. | .. | .. |
| 20 | .. | .. | .. | .. | .. | .. |
| 21 | .. | .. | .. | .. | .. | .. |
| 22 | 61 | 217 | 207 | 73 | .. | 424 |
| 23 | 9 | 251 | 146 | 319 | 82 | 397 |
| 24 | 28 | 34 | 231 | 88 | 347 | 265 |
| 25 | 19 | 134 | 342 | 136 | 107 | 476 |
| 26 | 54 | 158 | 190 | 95 | 141 | 348 |
| 27 | 19 | 95 | 173 | 96 | 114 | 268 |
| 28 | 17 | 272 | 135 | 52 | 113 | 407 |
| 29 | 56 | 89 | 301 | 138 | 108 | 390 |
| 30 | 24 | 58 | 204 | 86 | 162 | 262 |
| 31 | 98 | 47 | 114 | 87 | 184 | 161 |
| 32 | 74 | 192 | 257 | 165 | 161 | 449 |
| 33 | 12 | 80 | 105 | 226 | 177 | 185 |
| 34 | 82 | 89 | 151 | 165 | 308 | 240 |
| 35 | .. | .. | 147 | .. | .. | .. |
| 36 | 85 | 216 | 222 | 211 | .. | 438 |
| 37 | 17 | 158 | 223 | 168 | 228 | 381 |
| 38 | 62 | 82 | 369 | 30 | 230 | 451 |

Table 7. Mean precipitation in mm in the Ivigtut District in the quarters and in the winter and summer half-years.

(On the basis of the Meteorological Institute's Aarbog 2. Del).

| | 1st qr. | 2nd qr. | 3rd qr. | 4th qr. | Winter half-year | Summer half-year |
|---|---|---|---|---|---|---|
| 1918 | .. | .. | .. | .. | .. | .. |
| 19 | .. | .. | .. | .. | .. | .. |
| 20 | 226 | 87 | 303 | 145 | .. | 390 |
| 21 | 114 | 297 | 318 | 326 | 259 | 615 |
| 22 | 366 | 312 | 209 | 542 | 692 | 521 |
| 23 | 109 | 377 | 228 | 382 | 651 | 605 |
| 24 | 214 | 38 | 143 | 163 | 596 | 181 |
| 25 | 213 | 190 | 375 | 433 | 376 | 565 |
| 26 | 100 | 202 | 191 | 398 | 533 | 393 |
| 27 | .. | .. | .. | .. | .. | .. |
| 28 | .. | .. | .. | .. | .. | .. |
| 29 | 502 | 323 | 224 | 200 | .. | 547 |
| 30 | 120 | .. | 151 | 325 | 320 | .. |
| 31 | 259 | 318 | 369 | 187 | 584 | 687 |
| 32 | 577 | 489 | 222 | 411 | 764 | 711 |
| 33 | 265 | 173 | 138 | 798 | 676 | 311 |
| 34 | 499 | 442 | 268 | 460 | 1297 | 710 |
| 35 | 270 | 150 | 246 | 320 | 730 | 396 |
| 36 | 244 | 518 | 326 | 589 | 564 | 844 |
| 37 | 143 | 326 | 452 | 596 | 732 | 778 |
| 38 | 330 | 329 | 614 | 205 | 782 | 943 |

Table 8. Catch of blue and white foxes in the district group Frederikshaab-Godthaab-Sukkertoppen and percentage of summer skins 1918—38 (shipment 1919—39).

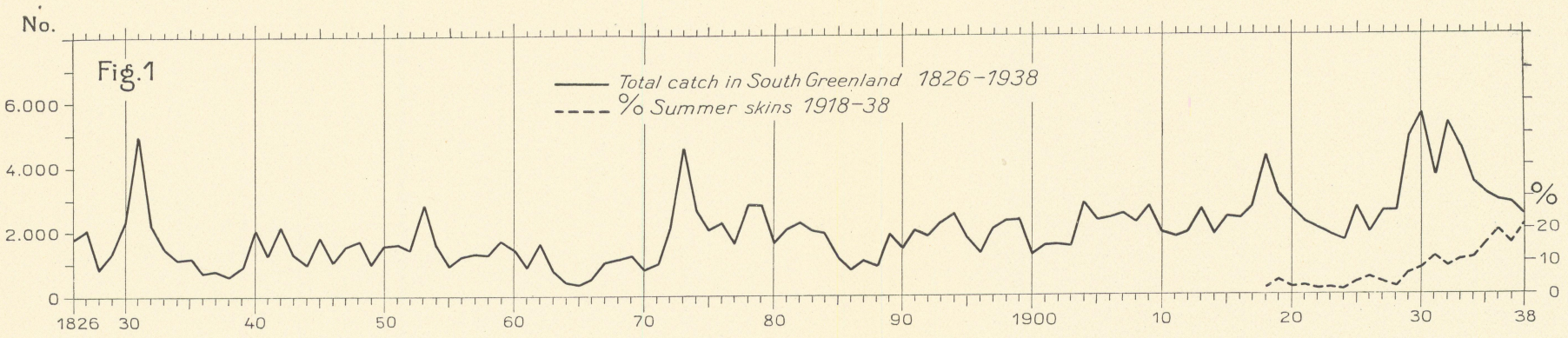
| | Blue foxes | | | White foxes | | |
|---|---|---|---|---|---|---|
| | Total | "Summer-skins" | % | Total | "Winter-skins" | % |
| 1918 | 1427 | 50 | 3.5 | 681 | 14 | 2.1 |
| 19 | 969 | 87 | 8.9 | 414 | 5 | 1.2 |
| 20 | 883 | 33 | 3.7 | 377 | 0 | 0 |
| 21 | 608 | 20 | 3.3 | 288 | 3 | 1.0 |
| 22 | 748 | 20 | 2.7 | 352 | 5 | 1.4 |
| 23 | 731 | 20 | 2.7 | 307 | 7 | 2.3 |
| 24 | 587 | 14 | 2.4 | 247 | 6 | 2.4 |
| 25 | 881 | 41 | 4.6 | 341 | 5 | 1.5 |
| 26 | 656 | 44 | 6.7 | 190 | 11 | 5.8 |
| 27 | 1063 | 38 | 3.6 | 405 | 10 | 2.5 |
| 28 | 965 | 32 | 3.3 | 353 | 2 | 0.6 |
| 29 | 2214 | 116 | 5.2 | 868 | 63 | 7.3 |
| 30 | 2271 | 125 | 5.5 | 917 | 69 | 7.5 |
| 31 | 1321 | 133 | 10.1 | 495 | 114 | 23.0 |
| 32 | 2510 | 165 | 6.6 | 931 | 108 | 11.6 |
| 33 | 1926 | 117 | 6.1 | 642 | 92 | 14.3 |
| 34 | 1112 | 182 | 16.4 | 508 | 105 | 20.7 |
| 35 | 1346 | 147 | 10.9 | 440 | 83 | 18.9 |
| 36 | 1293 | 140 | 10.8 | 380 | 103 | 27.1 |
| 37 | 1307 | 184 | 14.1 | 368 | 129 | 35.0 |
| 38 | 853 | 170 | 19.9 | 327 | 105 | 32.1 |

# PLATES

## Plate 1.

Fig. 1. Total fox catch in South Greenland 1826—1938 (after F. W. BRÆSTRUP) and percentage of "summer skins" in the same region 1918—38 (Table 1).

- 2 a, b. Mean temperature at Godthaab in the winter and summer seasons 1918—38 (Table 4) compared with the catch of white foxes and percentage of "summer skins".
- 3 a, b. Mean temperature at Jakobshavn in the winter and summer seasons 1918—38 (Table 5) compared with the catch of white foxes and percentage of "summer skins".
- 4. Annual mean temperature at Godthaab 1918—38 (Table 4) and the same curve averaged out (triennial average).
- 5 a, b. Mean precipitation at Godthaab in the winter and summer seasons 1918—38 (Table 6) compared with the catch of white foxes and percentage of "summer skins".
- 6 a, b. Mean precipitation at Ivigtut in the winter and summer seasons 1918—38 (Table 7) compared with the catch of white foxes and percentage of "summer skins".
- 7 a, b. Catch of blue and white foxes in the district group comprising Frederikshaab—Godthaab—Sukkertoppen 1918—38 and percentage of "summer skins" (Table 8).


No.
Fig.1
Total catch in South Greenland 1826–1938
% Summer skins 1918–38
6.000
4.000
2.000
0
%
20
10
0
1826 30 40 50 60 70 80 90 1900 10 20 30 38

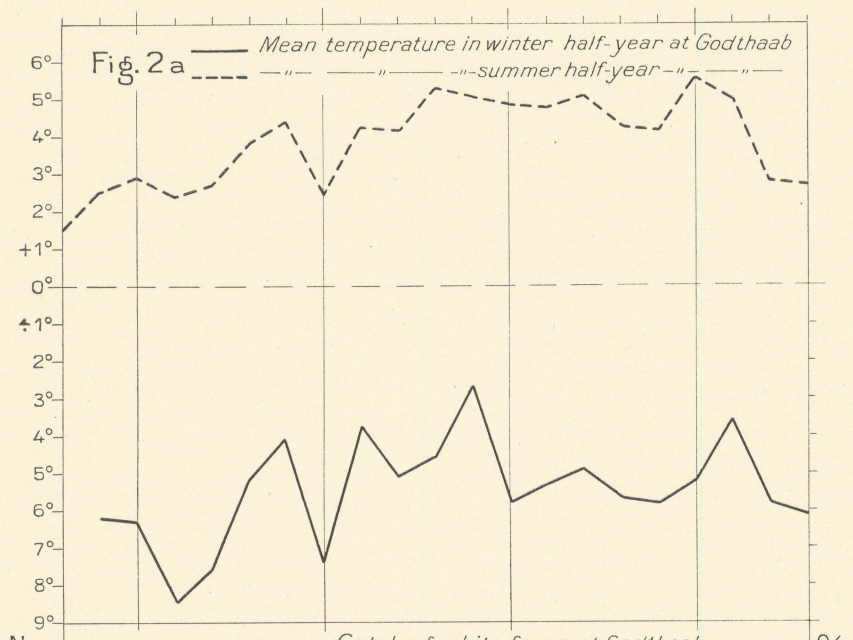
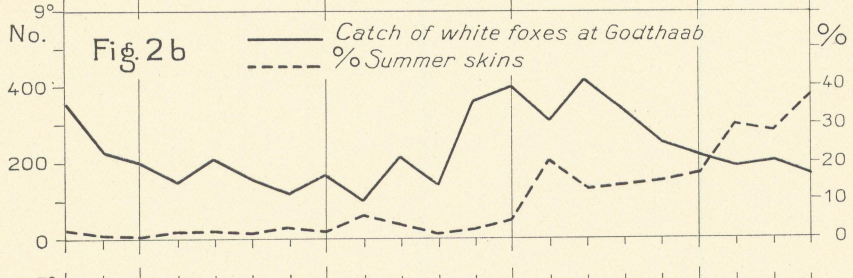


Fig. 2a
Mean temperature in winter half-year at Godthaab
-"- -"- -"-summer half-year -"- -"- -"-
6° 5° 4° 3° 2° +1° 0° ÷1° 2° 3° 4° 5° 6° 7° 8° 9°


No.
Fig. 2b
Catch of white foxes at Godthaab
% Summer skins
%
400
200
0
40
30
20
10
0

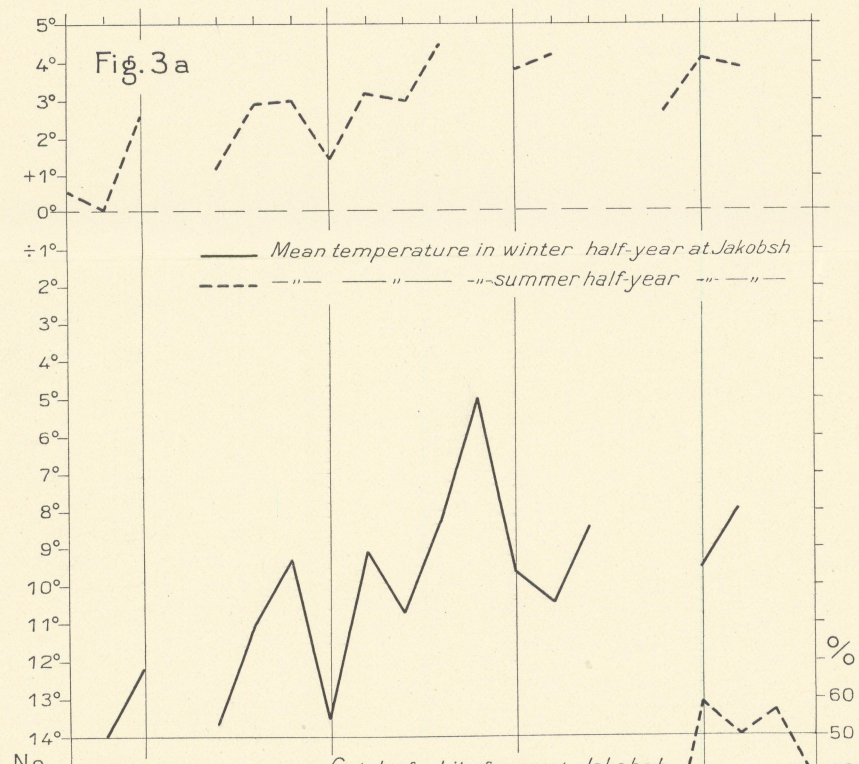
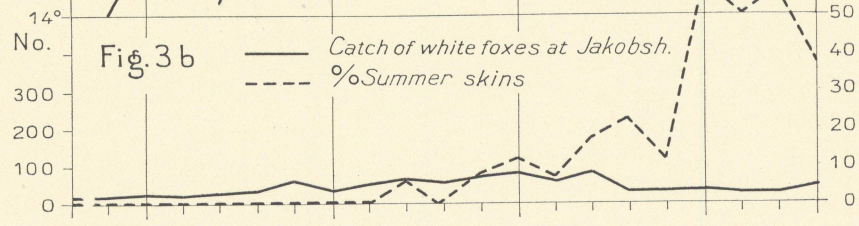


Fig. 3a
Mean temperature in winter half-year at Jakobsh
-"- -"- -"-summer half-year -"- -"- -"-
5° 4° 3° 2° +1° 0° ÷1° 2° 3° 4° 5° 6° 7° 8° 9° 10° 11° 12° 13° 14°
%
60
50
40
30
20
10
0


No.
Fig. 3b
Catch of white foxes at Jakobsh.
% Summer skins
300
200
100
0
30
20
10
0

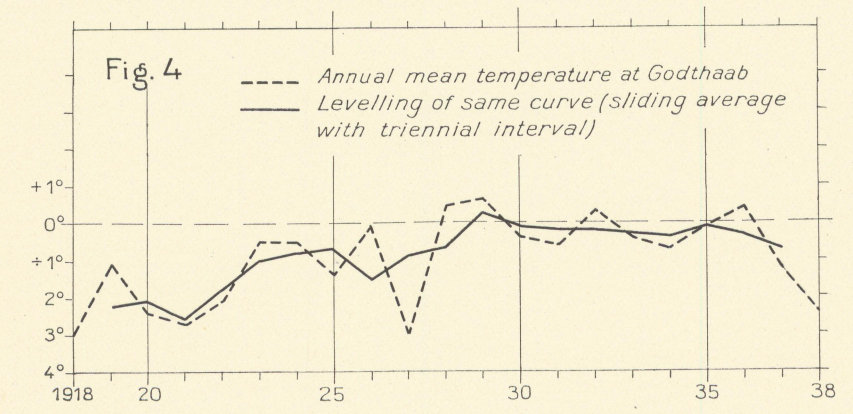
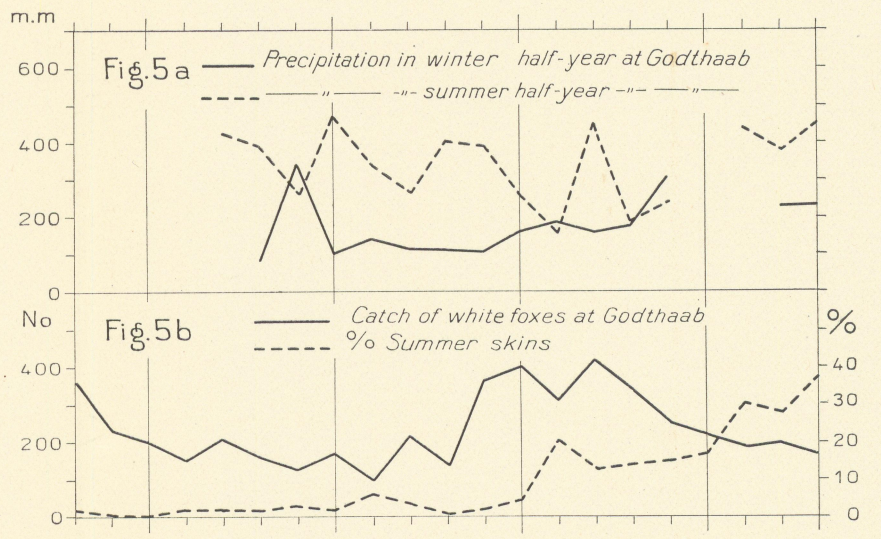
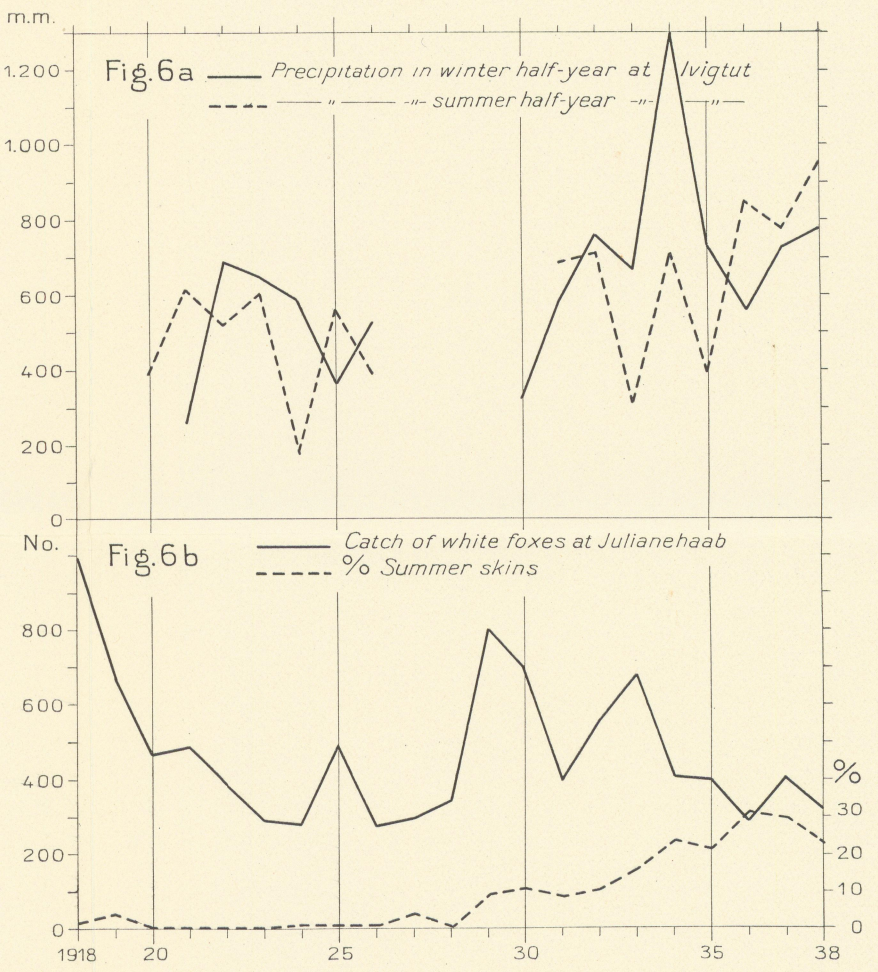
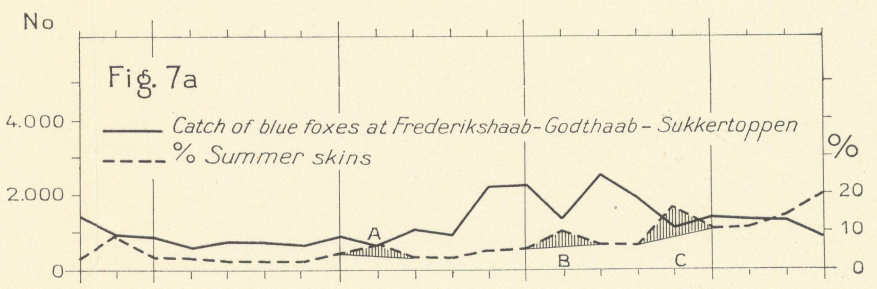
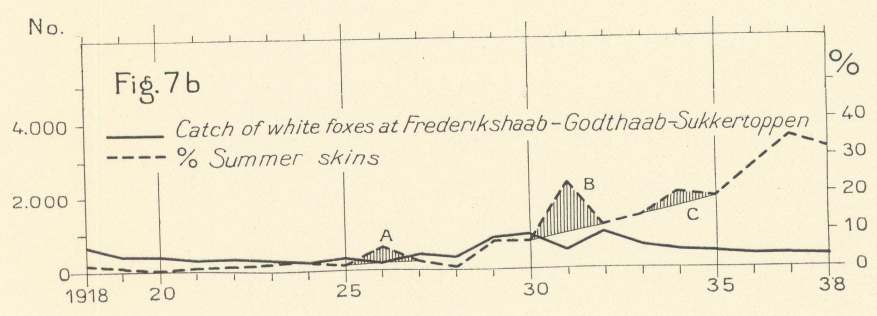


Fig. 4
Annual mean temperature at Godthaab
Levelling of same curve (sliding average with triennial interval)
+1° 0° ÷1° 2° 3° 4°
1918 20 25 30 35 38


m.m
Fig.5a
Precipitation in winter half-year at Godthaab
-"- summer half-year -"-
600
400
200
0
No
Fig.5b
Catch of white foxes at Godthaab
% Summer skins
%
400
200
0
40
30
20
10
0


m.m.
Fig.6a
Precipitation in winter half-year at Ivigtut
-"- summer half-year -"-
1.200
1.000
800
600
400
200
0
No.
Fig.6b
Catch of white foxes at Julianehaab
% Summer skins
800
600
400
200
0
%
30
20
10
0
1918 20 25 30 35 38


No
Fig. 7a
Catch of blue foxes at Frederikshaab-Godthaab-Sukkertoppen
% Summer skins
4.000
2.000
0
%
20
10
0
A
B
C


No.
Fig. 7b
Catch of white foxes at Frederikshaab-Godthaab-Sukkertoppen
% Summer skins
4.000
2.000
0
%
40
30
20
10
0
A
B
C
1918 20 25 30 35 38

## Plate 2.

Fig. 1. Catch of white foxes in West Greenland 1918—38 (Table 2 a) and percentage of "summer skins" 1918—38 (Table 3 a).

- 2. Catch of blue foxes in West Greenland 1918—38 (Table 2 b) and percentage of "summer skins" 1918—38 (Table 3 b).

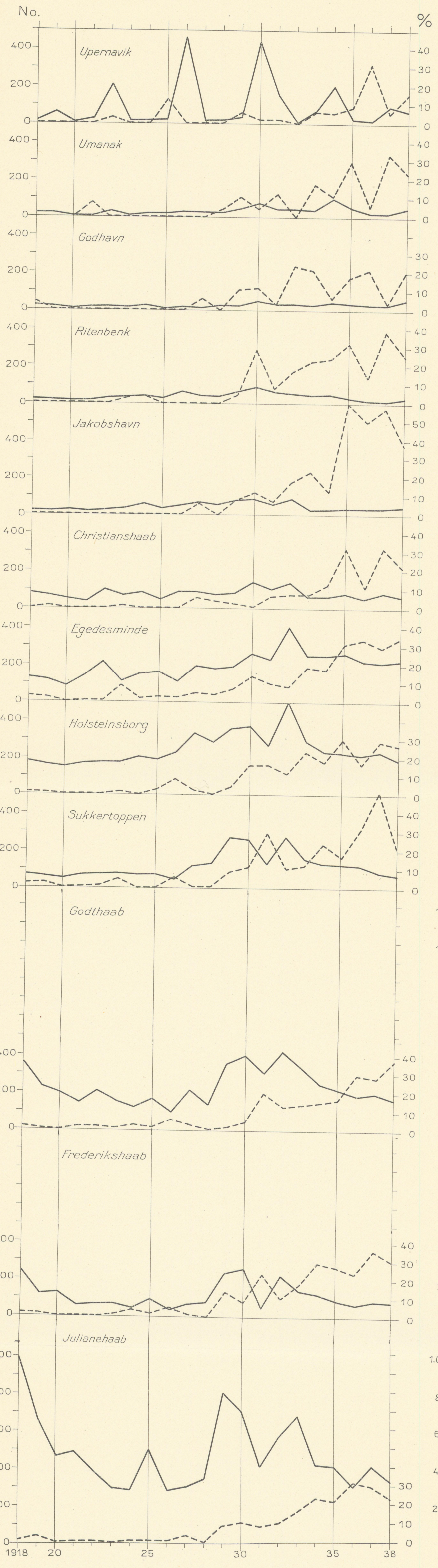

No.
%
Upernavik
Umanak
Godhavn
Ritenbenk
Jakobshavn
Christianshaab
Egedesminde
Holsteinsborg
Sukkertoppen
Godthaab
Frederikshaab
Julianehaab
1918
20
25
30
35
38
Catch of white foxes
% Summer skins

Fig. 1

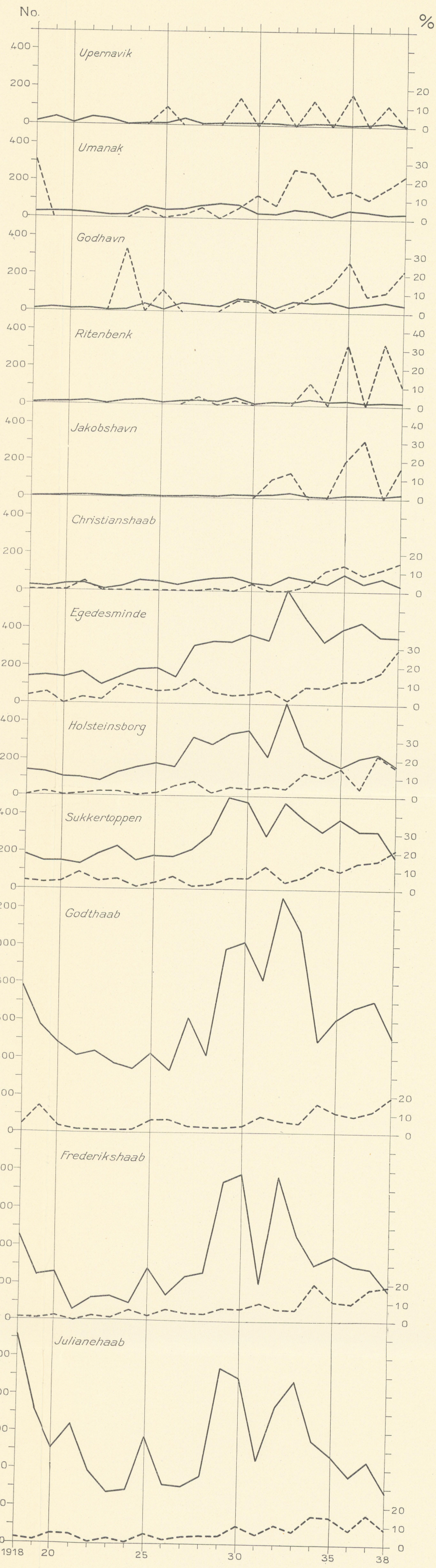

No.
%
Upernavik
Umanak
Godhavn
Ritenbenk
Jakobshavn
Christianshaab
Egedesminde
Holsteinsborg
Sukkertoppen
Godthaab
Frederikshaab
Julianehaab
1918
20
25
30
35
38
Catch of blue foxes
% Summer skins

Fig. 2