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BIOLOGICAL REPORTS.

S. GEORGIA

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Brief Report on Biological Observations made at Grytviken Whaling Station, South Georgia, Season 1960/61.

J. L. Sammler

1. Introduction.

In recent years a programme of biological work has been carried out on pelagic factories in connection with research at the National Institute of Oceanography, Wormley, England. Collections of suitable whale material have been made by government-appointed inspectors, as a subsidiary to their official duties, and more detailed observations and collections have occasionally been made by biologists from the scientific staff at the N.I.O. Where possible such work was combined with the duties of official inspector, since it was realised that the two could easily be made complementary.

1960/61 was the first season ^{at South Georgia} since the pioneer Discovery investigations in the mid-1920s, in which a full programme of examination was ~~carried out~~ attempted at the whaling stations, the aim being to combine the duties of inspectors with the functions of biologist, as previously done on pelagic factories. Of the two original inspectors, i.e. appointed from the beginning of the season, one (at Grytviken) was a biologist; the other (at Ledge Harbour) already had wide experience of whaling in factory factories. A third inspector, appointed to Husvik in December, was also a biologist.

2. Biological Work.

Accurate studies of whale populations, and the effect of concentrated fishing upon them, require a detailed knowledge of whale biology, in which the age-structure of the population is an important factor. In this connection the collections at Grytviken, Husvik, and Ledge Harbour, were primarily of ovaries and earplugs - both of which have

been found to give reasonable guides towards whale age, and from which an overall picture of length and age correlation can be obtained. At the same time detailed examinations of whales were made as often as possible, being particularly concerned with determinations of state of sexual maturity, degree of parasitism, stomach contents, and estimation of length of time in Antarctic waters from an examination of diatom flora infection.

Of the whales landed at Grytviken, the following table shows the numbers + percentages of the whales landed that were actually examined:

	No. Landed	No. Examined	% Examined
Blue	3	2	66.7%
Fin	459	318	69.3
Sci	249	157	63.0
Spinn	85	54	63.5
Totals	796	531	66.7%

Earplugs were collected from approximately 67 per cent of Fin whales and 46% of Sci whales landed. The rather low figure for Sci is due to the difficulties of collection from ^{the} smaller Sci whales. The state of decomposition, an important factor at South Georgia, where the average post-mortem time is of the order of 37 hours, and tours of 200 miles or more are commonplace, actually helps rather than hinders ~~decomposition~~ the collection of earplugs, but it is an important factor against collection of ovaries. Here at least 15% of the Fin, and 25% of the Sci ovaries could not be collected because of their decomposed state.

The more interesting finds included:—

A fin whale uterus — in which both male + female reproductive characters were present;
A pair of ovaries (fin whale); and a 5 centimetre foetus, completely ^{present} with membranes.

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3. Comparison of the Catch for 1960/61 with 1959/60

1248 whales were landed by the catches operated by the Gyntviken Company (Albia Star S.G. Ltd., late Cia Argentina de Pesca). Of this number 452 were sent to Husvik, where a freezing-plant was operated. The total number is considerably more than that caught last season, and was made up as follows (last year's figures also given):

	Season 1960/61	Season 1959/60
Blue	3	6
Fin	681	463
Sei	479	421
Spum	85	33
Totals	1248	923

An interesting feature of the increase this season was the relatively large number of Fin-whales caught in February and March.

This was accompanied by a decrease in the number of Sei caught, probably due less to an actual absence of sei from the island's waters than to the unusual presence of Fin at a time when Sei are usually plentiful. Most of the Fin caught at this time were found about 100 to 200 miles south-west of Wilkes Islands, and many were found to be immature: it is interesting to speculate how much effect the rather mild weather in March this year had on the catch — since last year very little catching was done in that area, most efforts being concentrated on the nearer waters where Sei were found in fairly large numbers.

The average length for Fin-whales this season was found to be on two feet less than last year's: if this is a trend that has been current for some years, and it is suspected that it is, then the situation is not very hopeful for the future. On the other hand

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the low figure might be accounted for by ~~the~~ a large proportion in the smaller length categories (the large number ~~was~~ caught this year ^{being made up} by an increase here), and more detailed work on the catch figures is required before an answer can be given.

5. Conclusion.

Living conditions at Grytviken were comfortable, if not palatial, in the foreman's mess, and the food was good. Everyone, from the manager to the humblest whale, was most friendly and helpful, despite the fact that my behaviour, especially to the less biologically-minded, can only have been considered rather strange. Every opportunity was taken to see as much of the island and its unique wildlife as possible, and activities such as penguin-egg collecting, reindew-shooting, visits to the fur-seal and albatross colonies at Bird Island etc., were found to fit in very well with the routine official duties.

As far as biological work is concerned, South Georgia offers an interesting introduction to whales in general, and gives considerable opportunity for examination of the whales landed, as well as unparalleled opportunities for comparing two catches fleets at work in similar conditions — comparative work that is becoming increasingly important in an assessment of whaling industry economics. It is unfortunate that of the relatively small number of whales worked up (compared with pelagic catches) a high proportion of specimens, ~~some~~ particularly males, cannot be collected because of decomposition.

It would be invidious to single out any names for especial thanks when everyone gave so much hospitality and assistance. But in particular I must thank Mr. F. Rungdal, Manager of Grytvik Whaling Station; W. N. Bonner Esq, Seal Inspector; and Captain P. S. Coleman, Administrative Office, for all their help in making my six months in South Georgia so interesting and rewarding.

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REPORT ON THE SEALING INDUSTRY

AT SOUTH GEORGIA

SEASON 1960-61.

By

W. Nigel Bonner, B.Sc.,
Biologist (Sealing Inspector)

- I Progress and Production
- II Conduct of the Sealing Operations
- III Tagging
- IV Tooth Collection & Age Studies
- V Population Studies
- VI Quota Recommendations
- VII Summary of Recommendations

- Appendix (i) Catch Statistics, 1943-60
- (ii) Sealing Progress by Beaches, 1960
- (iii) Classified Counts

Biological Laboratory, King Edward Point, SOUTH GEORGIA and F.I.D.S. Office LONDON

31st May, 1961

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I PROGRESS AND PRODUCTION

The 1960-61 elephant sealing season commenced on the 4th September 1960 and the spring sealing ended on the 6th November after a short period of extension had been granted. During this time a total of 5575 seals was taken yielding 12,283 barrels of oil or an average of 2.203 barrels per seal. During March 1961 a single sealing voyage was made which resulted in a catch of 57 seals, producing 98 barrels of oil, an average of 1.719 barrels per seal. The total catch for the season was thus 5623 seals from which were produced 12,381 barrels of oil or an average production of 2.198 barrels per seal.

At a nominal price of £72 per ton for No:1 grade whale oil the value of this catch would be approximately £148,600.

MONTH	SEALS	%age CATCH	PRODUCTION	AVERAGE PER SEAL
September	1656 (917)	29.4 (15.8)	3843 (2363)	2.32 (2.58)
October	3417 (4253)	60.7 (73.5)	7332 (9030)	2.15 (2.12)
November	502 (617)	8.9 (10.7)	1108 (1169)	2.21 (1.89)
March	57 -	1.0 -	98 -	1.72 -
TOTAL	5632 (5787)	100	12381 (12562)	2.20 (2.17)

TABLE I Catch and Production in barrels - Season 1960-61.
(Values for 1959 in brackets).

The September catch was excellent, amounting to 1656 seals, the highest total for this month in the last eighteen years, the next best being 1406 in 1957. The average oil production was 2.32 barrels per seal (1959- 2.58), a rather disappointingly low figure in view of the recent improvement in oil yields. Weather conditions on the whole were good. At the beginning of the season there was comparatively little snow and nowhere was there a snow edge which could have prevented seals from hauling out as was the case on many beaches in the 1959 season. The September catch would have been even higher had it not been for a labour dispute involving the Argentine crews employed by the sealing company. On the 8th September the Argentine personelle, who make up a large proportion of the sealing shore gangs, were called out on strike. PETREL and ALBATROS continued sealing with what Norwegian crew they could muster but DIAS was compelled to cease operations as the gunner, who is in charge of the shore party, was Argentinian and therefore on strike. An agreement was reached on the 13th. On account of the dispute DIAS lost 5½ days, and the other two boats 3½ days each to which may be

added an extra day due to reduced efficiency of sealing with unskilled crews, making a total loss of $14\frac{1}{2}$ boat-days out of an available 174 for the spring sealing. In fact the proportional loss was probably considerably greater as the period of strike coincided with a spell of fine weather when the beaches of Division IV could have been worked.

By the end of the fourth week of sealing 29.5% of the available quota had been secured but this was very unevenly distributed between the three divisions, 81% of the quota having been taken in Division III, 26% in Division I and only 5% in Division IV.

The catching rate continued steady in October, instead of showing the usual marked increase due to the increased number of seals on the beaches. This was in large measure due to the virtual exhaustion of the quota in Division III, compelling the boats to go to Divisions I and IV where bad weather frequently caused periods of enforced idleness. By the 13th October only 151 seals remained to be taken from Division III though less than a third of the quota had been taken from Division IV. As in previous years the sealing company applied for an extension of the spring sealing into November. The Administrative Officer granted permission for each vessel to make one trip in November on condition that an attempt was made by the company to utilise any residue remaining in the available period of autumn sealing. By the end of October the quotas in Divisions I and III had been completed so the period of extension applied only to Division IV. As in the previous year one of the vessels was made available to the sealing inspector to carry out pup counts on various beaches around the island and on this trip 223 seals were taken from Division III. The pup count trip was included in the three cargoes allowed under the period of extension.

The October catch of 3417 seals produced an average of 2.15 barrels per seal and the small number of seals taken in November, 502, produced 2.21 barrels per seal. The circumstance of the November average production being higher than that of October has not been recorded before and the reasons for it are obscure. The October value is high and the November value the highest on record.

The spring sealing, then, though highly successful from the point of view of oil production, was disappointing with regard to the total catch of seals. This is now the fourth year in succession that the company has been unable to take the licensed quota of seals in the spring. With so large a quota (3000) due to be taken from Division IV it was obvious that the company would be handicapped from the start. The combination of divisions I, III and IV is not a particularly unfavourable one but with the quotas arranged as they were, 1500, 1500 and 3000, it meant that nearly three quarters of the total catch had to be made on the far side of the island. The obvious solution to this difficulty would seem to be to employ more catching material, i.e. a fourth sealing vessel. I am rather doubtful, though, whether this would afford as great an advantage as might be expected as the number of beaches available for working is limited and merely to increase the number of vessels employed without ensuring their distribution along the coast would probably make little difference to the catch. I am convinced that a firm managerial policy of directing the boats to seal in Division IV on all possible occasions would have resulted in a far larger catch in that division without prejudice to the state of catch in the other two divisions worked. The sealing captains, when left to their own devices, not unnaturally prefer to work the nearer and more sheltered beaches and without the certainty of good weather will not be tempted to visit Division IV. As it

was, during the first four weeks of the season only two visits were paid to Division IV, both by ALBATORS. The sealing captains themselves must, of course, be the final judges of whether the weather is suitable for working the exposed coasts of that area but it must at the same time be recognised that bad weather is the rule rather than the exception on the south west coast of South Georgia during the spring.

It will be remembered that in my report on the 1959 season I drew attention to the discrepancy of catch rates in the divisions worked then and suggested the same remedy.

It may be that even under the most favourable conditions it would have been impossible for Albion Star to have attained a total of 3000 seals from Division IV in the months of September and October. On only one occasion previously, in 1954 when 3291 seals were taken from that division, has the figure of 3000 been surpassed, the next highest being 2500 in 1948 and on both those occasions long extensions into November were granted. I would suggest 2500 as being the highest practicable quota from this division in the future but further remarks on this topic will be made later.

MONTH	I	III	IV	TOTAL
September	283	1214	159	1656
October	1217	286	1914	3417
November	-	-	279	279
March	-	-	57	57
TOTAL	1500	1500	2409	5409
Nov. pup count	-	223	-	223
TOTAL	1500	1723	2409	5632

TABLE II Catch by Months and Divisions - 1960-61

The autumn sealing was limited to a single trip from the 9th to the 13th March 1961 when PETREL took a total of 57 seals from Division IV. The weather was not particularly favourable and only Undine South Harbour, Dias Cove and Holmestrand were visited for sealing. PETREL went into Trollhul but no seal could be seen from the ship. According to Captain Hauge the only other places that would have yielded seals at that time of the year were Annenknv, Sandefjord and Ranvik. However, as the last autumn sealing had been some seven years ago it would have been prudent to have visited some other beaches had the weather allowed it; as it was the weather did not and sealing was restricted to the three beaches first named. As can be seen from the results seals were scarce and their condition poor. On the conclusion of this trip it was agreed that the sealing company had fulfilled the spirit of the condition made when the extension into November was granted by sending out PETREL and the poor return of the seals would make it pointless to send a vessel out again in an attempt to secure more of the residue. During March only a limited proportion of the stock of bulls is ashore for moulting and once these have been taken their places are not filled by fresh arrivals as in the breeding season.

III. The oil production, 1.719 barrels per seal was disappointingly low for the March sealing. In the last thirty years, during which March sealing has been attempted on twenty-four occasions, only once (in 1946, when the figure was 1.70 barrels per seal) has the average yield been less than this and in view of the improved yields for the spring seasons it had been anticipated that the production would have been very much higher. For the period 1943-1959 the average oil production in March had been slightly higher than in November (1.77 barrels per seal as compared with 1.76). The average production for the 1961 March sealing is below all the November values, save for 1956, and it would therefore seem clear that March sealing compares economically very unfavourably with November sealing. In spite of this the sealing company offered the surprising opinion that the March yield was good and that sealing in March should be continued for a couple of years in order to gain experience.

II. CONDUCT OF THE SEALING OPERATIONS

As in the previous season the same three sealing vessels were employed but the captains were shifted round, Hauge moving from ALBATROS to PETREL, Bogen from DIAS to ALBATROS and Nilsen from PETREL to DIAS. The intention of this change was that the more experienced skippers should have the fastest catching boats, PETREL and ALBATROS, at their disposal but as can be seen from Table III the proportionate catches for the skippers remained almost exactly the same.

		ALBATROS	DIAS	PETREL
1959	Catch %	1962 (Hauge) 33.9 "	2219 (Bogen) 38.3 "	1606 (Nilsen) 27.8 "
1960	Catch %	1998 (Bogen) 35.8 "	1517 (Nilsen) 27.2. "	2060 (Hauge) 37.0 "

TABLE III Proportion of Catch by Vessels (Spring Sealing only), 1959 and 1960.

With the exception of Clause 12, relating to the collection of teeth, the terms of the licence were correctly observed. No short bulls were recorded in the kill. The gunner with ALBATROS was new to the job (He had been pram-man the previous season) and his shooting was at first somewhat erratic. I was able to accompany ALBATROS on the first two trips and cover his shooting with a second rifle so that any wounded seals were promptly dispatched and no unnecessary suffering was caused. His technique rapidly improved and by the end of the season he was a quick and accurate shot. The standard of driving was high, despite the fact that on two of the boats the drivers had had no previous experience. Eye injuries amounted to only five out of the 1091 seals that were taken while I was accompanying the vessels. This improvement in the care with which driving was carried out probably resulted in some slowing down of the rate of catch but is time well spent. As far as is known no cows or pups were injured or killed. It is felt that the new form of licence issued last year provides an adequate protection for all classes of seals.

III. TAGGING

A total of 2270 tags was successfully applied to elephant seal pups during the course of the 1960 breeding season. The distribution of the tags is shown in Table IV below.

	I	II	III	IV	-	TOTAL
Tags Used	353	601	646	400	300	2300
Losses	8	4	8	8	2	30
Tags Applied	345	597	638	392	298	2270

TABLE IV Distribution of Tags - 1960.
(The tags shown as non-divisional were applied in Husvik Harbour).

The tag losses, 30, amounted to 1.3% of the total used, or slightly more than in the previous year. There were no recoveries, but this was not to be expected as three years must elapse before the tagged female pups will appear on the beaches as breeding cows, and longer before male tagged pups will appear in the commercial kill. Although a small number of female pups (148) were tagged in the Bay of Isles in 1957 there was no opportunity this season when that Division was not worked, of searching for tagged cows.

In view of the disheartening results of tagging with the fur seals, commented upon in my Interim Report on the Fur Seal Investigations in South Georgia, Season 1960-1961, it is feared that the tags may not be fully secure. It is hoped to develop a better pattern of tag for use in subsequent years.

I am indebted to Mr. Brian Nixon for valuable assistance with the tagging.

Full details of tags applied are held in South Georgia.

IV. TOOTH COLLECTION AND AGE STUDIES

Once again I regret to report that the regulation applying to the collection of teeth was not as properly observed as might have been hoped. A total of 25 teeth was returned having been cut through too near the tip so that the pulp cavity was not represented but only two of these were so grossly short that they had to be rejected from the sample. Six teeth too few were returned by the sealers for the number of seals killed and the distribution of the catch between the boats. With the distribution as it was it is interesting to note that a catch of five more seals could have resulted in the addition of four more teeth to the sample. More disturbing than shortness or deficiency was the presence of no fewer than four duplicated sets of two teeth, three sets from a single trip by ALBATROS and one from PETREL. This duplication is not obvious when the teeth are first returned but is revealed when the teeth polished and examined for ageing. There is considerable individual variation in the minute structure of the annual increments of the two different types of dentine and coupled with the external appearance of the teeth there is little difficulty in recognising a duplicate

pair if both teeth have been taken from either the mandible or maxilla though possibly it would be more difficult if both members of the pair came from the same side of the mouth. The submission of duplicate sets in the sample returned cannot be attributed to carelessness or forgetfulness as can the other irregularities and can only be due to a deliberate act. I would say here that I do not suspect the gunners of the two vessels involved to have been responsible for these teeth. Most probably they were taken when the gunner delegated the task of collecting the teeth to another member of the shore gang. The effect of the duplication is more annoying than significant, resulting as it does in the reduction of the sample by four seals.

The circumstances of the irregularities were reported to the Administrative Officer who communicated with Albion Star Company. Subsequent to the receipt of his letter there were only two cases of deficient teeth though a number of short teeth and one set of duplicates were returned.

	1954	1955	1956	1957	1958	1959	1960
Number	311	330	269	269	290	264	266
Average Age	7.31	7.32	7.51	7.41	7.46	7.23	7.32
± 2 S.E.	0.16	0.13	0.14	0.10	0.13	0.13	0.16
S.D.	1.41	1.18	1.15	1.16	1.14	1.03	1.34

TABLE V Tooth Analysis 1954-1960

	I		III		IV		TOTAL	
	1959	1960	1959	1960	1958	1960	1959	1960
Number	76	69	148	83	129	114	264	266
Average Age	7.461	7.586	7.277	7.337	7.674	7.176	7.231	7.320
± 2 S.E.	.2942	.4288	.1910	.3130	.2048	.2328	.1265	.1644
Var	1.038	1.785	1.350	2.031	1.352	1.583	1.055	1.798
S.D.	1.019	1.334	1.162	1.425	1.163	1.244	1.028	1.341

TABLE VI Results of Tooth Analysis by Divisions, 1959 and 1960 (Division IV 1958 and 1960).

As can be seen from the tables the average age of the kill showed a slight rise; however this is not significant as the difference between the means for 1959 and 1960 is rather less than the standard error of the difference. The last time this particular combination of divisions was worked, in 1956, the average age of the kill was 7.51 years. The difference between the means for that year and 1960 is 0.19 years and two standard errors of the difference 0.216 years so in this case the decline is not significant, though with less certainty.

Considering the position division by division it can be seen that Division I and Division III both show slight increases, not significant at the 5% level while Division IV shows a marked decline which is highly significant. (Difference between the means 0.4987; two standard errors of the difference 0.2932). The temporal distribution of the

kill, falling as it did almost solely in October and November, may have acted so as to reduce the average age of the kill, and it is possible that the spatial distribution, with no fewer than 1683 of the seals coming from Holmestrand, Annenkov, Undine South Harbour and Dias Cove, may also have acted in this way. However, I am very doubtful is either or both of these effects combined could have produced such a marked reduction in the average age of the kill.

Neglecting these factors it would seem that a reduction of the average age could be due to

(i) absolutely fewer of the older age groups being present or (ii) a relative increase in the younger age groups due to increased pup production in 1954, recruited to the six year class and 1953 recruited to the seven year class.

It is not possible to choose directly between these two possibilities on the evidence of the teeth alone. The data on population studies considered in the next section, makes it seem at least possible that the lowering of the average age is due to an increase in numbers of the herd.

V. POPULATION STUDIES

The Biologist accompanied the sealing vessels on ten occasions, visiting all the divisions and covering a total of 45 days. As in the previous season one of the boats was put at the disposal of the Biologist for counting and tagging on the understanding that an extra cargo of seals might be collected.

In general the seal stocks on the various beaches appeared to be in a satisfactory condition with the exception of some of the beaches of Division I and Right Whale Bay, newly assigned to Division II but worked with Division I in the past season.

Considering the position ~~dm~~ division by division a slight improvement is observed in Division I. The kill in the past season amounted to 1185 bulls, compared with 1619 in the previous season. The improvement in the cow/bull ratio at Wilson Harbour, from 80.7 in 1959 to 24.0 in 1960 is to be considered very satisfactory, particularly in view of the discrepancy of eight days in the time at which the counts were made. Nilshul showed a change in the opposite direction and a drop in the cow population. King Haakon Bay showed a marked drop in the bull population with a kill of only 402 in 1960 compared with 715 in 1959. This division has now been worked for three successive seasons and a drop in the catch is to be expected in the third year. Under the present system Division I will be due for a period of rest in 1961 which would allow a recovery of the stocks.

Division II was closed for sealing in 1960 east of Cape Buller and all its beaches showed a marked improvement. At Right Whale Bay the small total of 79 bulls was secured, only slightly more than half the expected yield. The decrease in numbers was not confined to the adult bulls but included also a marked drop in the breeding cow population with pup totals of 1444 in 1959 and about 700 (estimated) in 1960. It is difficult to account for this wholesale desertion of the beach by the seals. In view of the general behaviour patterns of elephant seals it seems most unlikely to have been due to the disturbances caused by the sealing operations. In my opinion it was probably due to the prevailing bad weather conditions throughout the breeding season. Right Whale Bay is separated from Ice Fjord on the other side of the island

only by a low ridge and south west winds of great force blow strongly over the breeding beach. Snow was lying on the beach as late as November when Right Whale Bay was last visited and blown ice crystals from the col behind the beach were swept over the ground to a height of about five feet. These crystals, which travel with surprising force, cause the seals great distress when they strike their eyes, and such conditions, if they were at all frequent at the time of the cow haul-out could well have resulted in the smaller population this year.

To the east of Right Whale Bay, towards Cape Buller, was discovered a series of densely populated beaches (Welcome Bay) of the rock platform type. These yielded a total of 236 bulls, a large catch in view of the fact that owing to navigational difficulties on an unknown coast the rate of sealing in this area was not high. The sealing potential of the new addition to Division II, from Cape North to Cape Buller, may provisionally be put at 250 to 300 bulls though a reappraisal will be necessary if the numbers at Right Whale Bay do not show an increase next year.

In Division III catches were satisfactory. A surprising improvement was observed at Lille Jason where the pup population increased by over 50%. The local movements of seal populations was well demonstrated in East Cumberland Bay where it was found that the coast from Barff Point to the point opposite Ocean Harbour (on the north east coast) had been virtually abandoned by the seals while from this point to the Nordenskjöld Glacier were found large harems where the density of population is usually low. Despite the regular heavy killing in Cumberland Bay and West Fjord the stock seems to be holding its own satisfactorily. Owing to bad weather it was not possible to visit Theatre Beach (St. Andrew's Bay) for the second year in succession and it may be necessary to find an alternative beach in this area for census purposes. Catches to the east of Cape Harcourt were moderate with Royal Bay, Iris and Wirik neglected though Björnstadt Bay had a relative and absolute increase in catch. The stock at Gold Harbour, the main breeding beach in this area, showed a very satisfactory improvement.

The relative distribution of the catch in Division III was much the same as in previous years. Dividing the division at Cape Harcourt the proportion of the catch in the north western part of the division, from West Fjord to Sacramento Bight has been as follows:

1956	74%
1957	58%
1959	69%
1960	67%

I once again recommend that Division III be split into two sub-divisions at Cape Harcourt with the restriction that not more than 60% of the allotted quota should be taken from the north western part of the division. Had such a regulation been in force in the past season the sealers would have had to have secured another 120 seals from the south east sub-division. These would have been easily obtainable from Royal Bay, Iris or Wirik in the middle part of the season. As can be seen from the table of Sealing Progress by Beaches (Appendix ii) there were ample opportunities for sealing here at that period.

The population figures from Division IV, though rather scanty, give no cause for alarm. It is apparent that several of the beaches, including some of the most heavily worked, are in a satisfactory state. Dias Cove with a total pup population of about 350 provided the astonishing total of 259

bulls and had a cow/bull ratio of 14.7 when counted on 1st November. Holmestrand, counted on the same day, had a c/b ratio of 13.2 while Borre and Horten, counted on 28th October, had ratios of 25.7 and 29.9 respectively. These beaches together had 79 bulls on them when counted and the total kill for the season was only 50 bulls. Rocky Bay was untouched this season though in 1958 it had provided 75 bulls. There is little doubt that had the less accessible beaches of Division IV been more heavily worked and had this been coupled with a greater concentration of effort in the earlier part of the season the quota would have been more nearly attained, if not completed. It cannot be expected, of course, that the sealing company, at the mercy of the weather can guarantee to work such beaches as Horten, Seal Beach and Rocky Bay, nor to distribute the catch over the whole period available. However, as mentioned earlier in the section on Progress and Production, I am certain a great improvement in this direction could be made.

I have taken the opportunity of discussing the position of Division IV with Dr. R.M. Laws, of the National Institute of Oceanography, who is of the opinion that the available data indicate an increase in the stock and that restriction of the catch is unnecessary.

Laws, in a recent paper (The Elephant Seal at South Georgia, Norsk Hvalfangst Tidende, 10 & 11, 1960), has plotted the catch of seals in October per catcher's day's work (CDW) for recent years. This is regarded as a fairly reliable index of the availability of seals (or their numbers on the beaches worked) though it is complicated by the varying divisions worked and in recent years by the substitution of PETREL for CARL.

The index for the period 1955-58 was 34.8 while for the 1960 catch it was 36.7 despite the large number of seals that had to be taken from Division IV.

In view of these figures and discussions with Dr. Laws I do not believe that immediate steps need be taken to reduce the quota in this division though the position must be carefully watched in coming seasons. Even should this view be in error there is little probability of harm being done to the breeding stock in the division provided sealing is not permitted in November and under the current regulations there is would seem no need for that.

VI QUOTA RECOMMENDATIONS

The traditional method of working the sealing divisions, by which each is sealed for three years and allowed to lie fallow for one, has nothing to recommend it on biological grounds. Indeed, there is much to be said against it as it leads to occasional years when the sealing effort is particularly heavily directed against one division following a period of rest, as in 1959 when Division III had a quota of 3100 and 1960 when IV had a quota of 3000. There is now strong evidence that the breeding bull population is not static in any one division but tends to move from one to another as cows are available. It would be more rational if the yearly toils on the divisions were constant, subject to adjustment of the quotas on conservational grounds, and the yearly rests abolished so that all four divisions were worked each year. The introduction of such a system of continuous working would have been difficult in the previous season owing to the very large quota in Division IV which would have had to have been spread over the other divisions. 1961, on the other hand, has the proposed quotas more evenly

distributed. I would suggest that the quotas for forthcoming years might be allotted on the following scale, subject to such further revision as seems necessary in the light of later experience:

DIVISION	I	II	III	IV	TOTAL
Seals	1000	900	2050	2050	6000

This will, of course, throw an extra strain on Division I, which has endured already three years of sealing and is now due for a rest. However, I feel that if a certain amount of flexibility is allowed in the allotment of the Division I and II quotas this can be lessened if necessary. Division II now includes the coast from Cape North to Cape Buller with a suggested sealing potential of 250 - 300 seals, thus the proposed quota of 900 is equivalent to only 600 - 650 seals in previous years (though without a quadrennial close season). Division II will certainly provide a catch of this size and will, in fact, have the opportunity to improve its stock. If the catching in Division I seems to be going badly it should be possible, with the consent of the administration, to transfer up to 300 seals from the Division I quota to Division II, provided catching has been well distributed throughout the season over both divisions,

Working all the divisions every year with fixed quotas will allow a closer check to be made on population changes, particularly with regard to the interpretation of the average ages obtained from the tooth samples, and the request made by the company for Division IV to be open each year so that the best use may be made of good weather will have been met. The risk of poaching in the home divisions, i.e., taking seals in Divisions II and III and reporting them as having been taken in Divisions I or IV, will be present but I am confident that the present skippers can be relied upon not to falsify their catch reports. The possibility of residues building up in Division IV is more likely but this can be taken into account, if deemed necessary, by varying the quotas in the other divisions.

VII SUMMARY OF RECOMMENDATIONS

1. In future years all the divisions should be worked each season.
2. Division III should be divided into two subdivisions at Cape Harcourt, not more than 60% of the allotted quota to be taken in the north-western sub-division.

3. The quotas for season 1961-62 should be as follows:

Div.	I	1000	
	II	900	
	III	2050	(not more than 1230 NW of Cape Harcourt)
	IV	2050	
		<u>6000</u>	

4. There should be no extension of the sealing season into November.

	NUMBER OF SEALS TAKEN						YIELD OF OIL						AVERAGE OIL PRODUCTION PER SEAL					
	March	April	Sept	Oct	Nov	TOTAL	March	April	Sept	Oct	Nov	TOTAL	March	April	Sept	Oct	Nov	AVERAGE
1943	714	228	-	2983	1975	5927	1340	403	-	5964	3460	11,167	1.81	1.77	-	2.00	1.75	1.88
1944	685	-	785	3374	1156	6000	1192	-	1890	6773	2085	11,940	1.74	-	2.41	2.01	1.80	1.99
1945	454	57	353	2753	1765	5382	815	97	819	5471	3180	10,382	1.80	1.70	2.32	1.99	1.80	1.93
1946	212	50	65	2221	1901	4449	360	80	133	4205	3297	8,075	1.70	1.60	2.05	1.89	1.73	1.82
1947	460	288	722	3752	778	6000	820	498	1576	7635	1465	11,994	1.78	1.73	2.18	2.03	1.88	2.00
1948	436	218	1072	3808	1966	7500	751	423	2549	7839	3531	15,093	1.72	1.94	2.38	2.06	1.80	2.01
1949	456	-	783	3352	2285	6876	830	-	1812	6674	4042	13,358	1.82	-	2.31	1.99	1.77	1.94
1950	346	151	510	2943	2951	6901	576	246	1253	5828	5132	13,035	1.66	1.33	2.46	1.98	1.74	1.89
1951	474	16	730	3344	3313	7877	845	28	1706	6642	5387	14,608	1.78	1.75	2.34	1.99	1.63	1.85
1952	161	-	410	2539	2890	6000	293	-	892	4949	4673	10,807	1.82	-	2.18	1.95	1.62	1.80
1953	363	-	592	2754	2291	6000	669	-	1334	5504	3968	11,475	1.84	-	2.25	2.00	1.73	1.91
1954	177	-	388	3199	2236	6000	316	-	897	6376	3836	11,425	1.79	-	2.31	1.99	1.72	1.90
1955	-	-	1048	3342	1610	6000	-	-	2383	6730	2955	12,068	-	-	2.27	2.01	1.84	2.01
1956	-	-	994	3443	1963	6000	-	-	2218	6926	2661	11,805	-	-	2.23	2.01	1.70	1.97
1957	-	-	1406	2926	1076	5408	-	-	3189	6066	1765	11,020	-	-	2.27	2.07	1.64	2.04
1958	-	-	994	3245	1625	5864	-	-	2174	7327	2975	12,476	-	-	2.19	2.26	1.83	2.13
1959	-	-	917	4253	617	5787	-	-	2363	9030	1169	12,562	-	-	2.58	2.12	1.90	2.18
1960/61	57	-	1656	3417	502	5632	98	-	3843	7332	1108	12,381	1.72	-	2.32	2.15	2.21	2.20

Appendix 1 CATCH STATISTICS 1943 - 1960/61

For 1960/61 March values 1961, September to November values 1960.

Values for oil in barrels (six barrels= 1 ton).

WEEK	1	2	3	4	5	6	7	8	9	TOTAL
DIVISION I										
Queen Maud	-	-	-	-	41	-	70	34	-	145
King Haakon	14	-	-	118	61	71	84	54	-	402
Nlshl/Elephnt	-	-	-	-	22	-	15	16	-	53
Wilson Hbr	3	-	20	9	-	22	-	-	-	54
Ice Fjord	13	-	37	54	57	17	108	72	-	358
Schlieper B	3	-	9	23	20	-	29	-	-	84
Undine	2	-	11	-	29	7	-	33	-	82
Elsehul	-	-	-	-	-	7	-	-	-	7
Total	35	-	77	204	230	124	306	209	-	1185
DIVISION I additional										
Right Whale B	7	-	6	20	-	21	-	32	-	79
Welcome B	-	-	47	-	12	73	-	104	-	236
Total	-	-	53	20	12	94	-	136	-	315
Total above	35	-	130	224	242	218	306	345	-	1500
DIVISION III										
West Fj	33	44	74	80	9	-	-	22	84	346
Cumberlnd E	19	38	68	77	-	23	-	-	45	270
Gdthl, Penguin	7	19	15	-	-	-	-	-	-	41
Bikkjebukta	13	41	53	18	-	79	-	26	-	230
St Andrews	29	15	222	-	-	-	-	-	-	266
Sacramento	-	-	-	-	-	-	-	-	-	-
Royal B	2	64	7	-	-	-	-	-	21	94
Björnstadt	-	18	-	62	-	-	-	-	22	102
Gold Hbr	5	22	19	-	24	-	-	-	72	142
Iris	5	19	-	59	-	-	-	-	-	83
Wirik	2	7	5	-	-	-	XX	31	-	45
Cooper	11	-	28	-	-	-	23	-	-	62
Drygalski	3	-	11	-	-	-	-	28	-	42
Total	129	287	502	296	33	102	23	107	244	1723
DIVISION IV										
Paradis	-	-	24	-	29	-	52	18	42	165
Trollhul	-	-	4	-	6	-	-	32	37	79
Ranvik, Don	-	-	8	-	35	24	-	145	4	216
Dias Cove	5	-	33	-	44	-	66	51	60	259
Undine S	-	-	61	-	31	21	64	19	77	273
Rocky B	-	-	-	-	-	-	-	-	-	-
Annenkov	18	-	-	-	66	233	31	209	56	613
Larvik, Sndfj	6	-	-	-	-	33	-	42	78	159
Horten, Borre	-	-	-	-	-	-	-	50	-	50
Holmestrand	-	-	-	-	134	158	116	55	75	538
Total	29	-	130	-	345	469	329	621	429	2352

Appendix (ii) Sealing Progress by Beaches - 1960
(Catches on Pup Count trip included)

Date	District	Bulls	Cows	Pups	Cows/ Bulls
26/9	Gaesebukta	15	103	18	6.85
27/9	Discovery Pt.	16	32	5	2.00
29/9	Welcome B. part	7	88	23	12.6
		7	33	2	4.72
30/9	Holmestrand outer	88	401	89	4.55
	cove	26	27	0	1.04
	inner (part)	44	34	0	0.77
8/10	Right Whale B	13	229	85	17.6
		3	23	10	7.7
		6	43	16	7.17
	Elsehul	7	36	14	5.14
10/10	Icefjord, South B.	19	364	148	19.2
15/10	" Middle B. side	20	241	139	12.0
17/10	" " head	20	651	331	32.5
	" South B.	25	490	325	19.6
26/10	Welcome B. part	36	1101	998	30.6
		15	108	77	7.20
27/10	Undine N.	4	74	71	18.5
		6	43	35	7.17
	Icefjord North B.	37	571	532	15.4
	" Middle B. head	13	628	568	48.3
	" " side	11	241	235	21.9
28/10	Borre	23	591	?	25.7
	Horton	56	1452	?	29.9
	Wilshul	8	185	173	23.1
2/11	Björnstadt (Inner)	22	397	454	18.1
3/11	Gaesebukta	18	313	370	17.4
	Neumayer Gl.	21	610	641	29.0
	Jason Harbour (part)	20	336	464	16.8

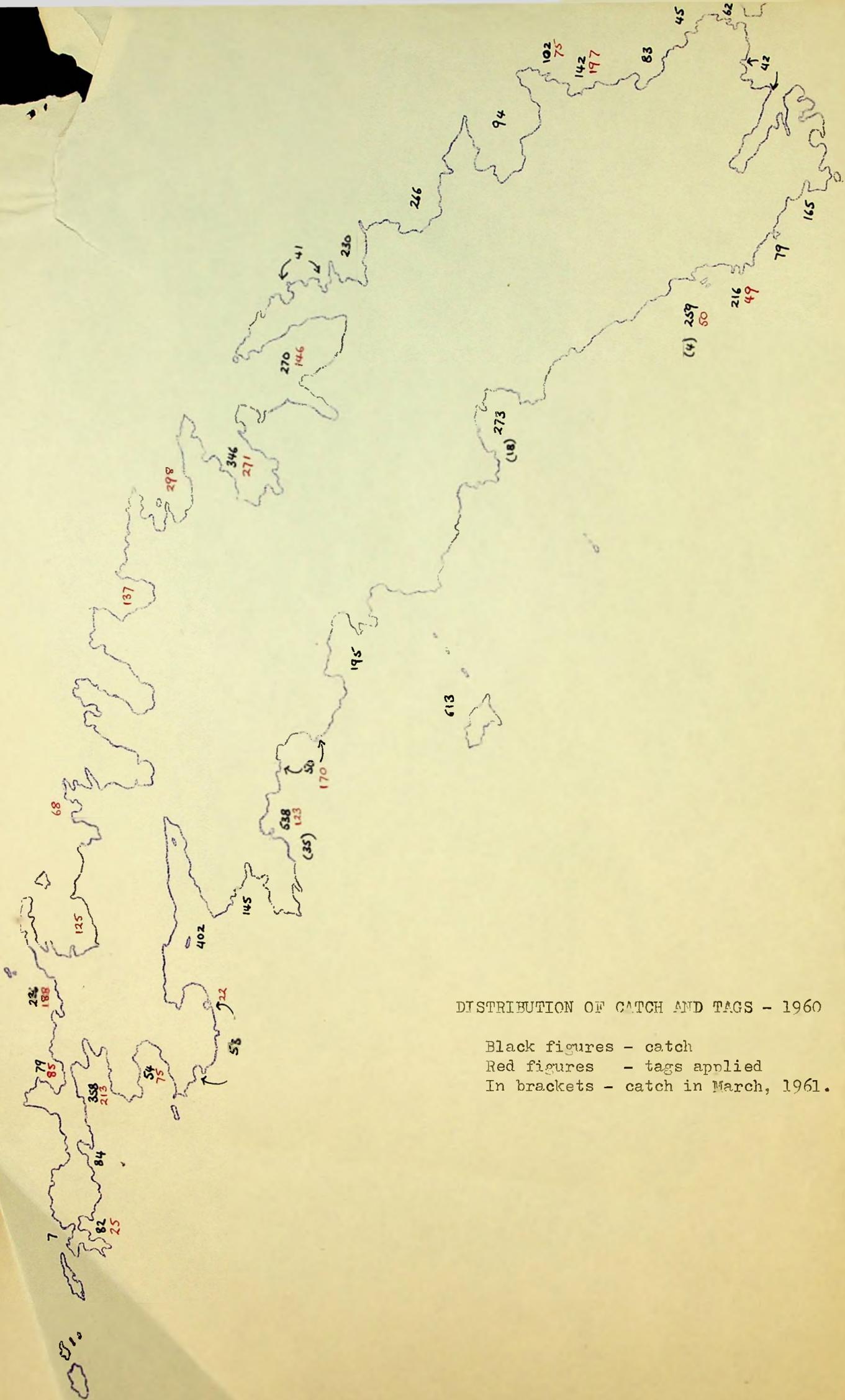
Appendix (iii) Classified Counts - Various 1960.

Date	District	Bulls	Cows	Pups	Cows/ Bulls
<u>DIVISION I</u>					
31/10	Wilson Harbour	21	504	557	24.0
(8/11	"	5	437	602	20.7)
28/10	Nilshul	6	185	173	23.1
(8/11	"	12	171	340	14.3)
27/10	Undine North	10	117	106	11.7
(8/11	" "	8	140	214	17.5)
<u>DIVISION II</u>					
30/10	Brunonia Beach	45	997	1016	22.2
(5/11	" "	22	1008	1334	45.8)
30/10	Beckman Fj.	45	600	621	13.3
(5/11	" "	12	439	572	36.6)
30/10	Fortuna Bay	111	1509	1506	13.6
(5/11	" "	29	1369	1909	47.2)
31/10	Right Whale Bay	8	568	618	71.0
(8/11	" " "	56	867	1444	15.5)
<u>DIVISION III</u>					
3/11	Lille Jason	19	432	455	22.7
(5/11	" "	7	296	304	42.3)
2/11	Gold Harbour	129	1832	2033	14.2
(10/11	" "	86	981	1945	11.4)
<u>DIVISION IV</u>					
1/11	Ranvik	9	343	455	38.1
(10/11	"	48	337	682	7.0)
1/11	Dias Cove	18	264	298	14.7
1/11	Holmestrand	114	1504	2009	13.2
(9/11	"	232	1664	3030	6.7)

Appendix (iii) continued

Classified Counts on Selected Reaches - 1960
(Values for 1959 in brackets)

The pup value for Fortuna Bay, 1960, is calculated.



DISTRIBUTION OF CATCH AND TAGS - 1960

Black figures - catch
 Red figures - tags applied
 In brackets - catch in March, 1961.

D/7/61.

Colonial Secretary's Office,
Stanley, Falkland Islands.

SK December, 1961.

Sir,

3 I am directed by the Governor to acknowledge with thanks the receipt of your most interesting report on Biological observations made by you at the Grytviken Whaling Station at South Georgia during the summer of 1960/61.

I am,
Sir,
Your obedient servant,

(Sgd.) H.L. Bound

for COLONIAL SECRETARY.

J.L. Bannister, Esq.,
Manor House Cottage,
Old Church Lane,
Stanmore,
Middlesex,
ENGLAND.

F 82
6/12/61

f.a.

HLB/IM.

MEMO

S.G. No. 627

C.S. No.



12th February 1962

From:—

To:—

THE ADMINISTRATIVE OFFICER,

SOUTH GEORGIA.

The Honourable,

The Colonial Secretary,

Port Stanley.

Sealing Reports.

Attached please find two copies of each of the sealing reports by Bonner and Vaughan.

*on copy
file, & the
copy at S.G.*

141

(i) Interim Report on the Fur Seal Investigations at Bird Island, South Georgia. Season 1961/62.

142

(ii) Report on the Sealing Industry at South Georgia. Season 1961/62.

I PROGRESS AND PRODUCTION

The 1961-62 sealing season commenced on 1st September 1961 and the spring sealing finished on 7th November after a short period of extension had been granted. During this period a total of 4765 seals was taken yielding 9666 barrels of oil, or an average production of 2.03 barrels per seal. These results can be described only as extremely disappointing. The September catch, amounting to 1414 seals, was excellent, being the second highest since 1918 and the fourth highest ever recorded. The sealing skippers described the seals as being in poor condition during that month and the very poor oil-production, 1.79 barrels per seal, bears this out though it is hard to understand how the production could have fallen to such an extent as no value lower than 2.05 barrels per seal has been recorded since 1943. It seems almost certain that the oil-extraction plant, which was being operated by the winter crew in September, was not working at full efficiency. I cannot believe that the condition of the seals alone can explain a drop in production of this magnitude. October showed a marked increase in production to 2.19 barrels per seal (a change which is very hard to explain if it is assumed that the extraction plant was working at the same efficiency as in September) but the catch of 2784 seals was extremely low. The short period of extension in November yielded 567 seals with an average production of 1.81 barrels per seal.

MONTH	SEALS	%age CATCH	PRODUCTION	AVERAGE PER SEAL
September	1414 (1656)	29.7 (29.4)	2535 (3843)	1.79 (2.32)
October	2784 (3417)	58.4 (60.7)	6102 (7332)	2.19 (2.15)
November	567 (502)	11.9 (8.9)	1029 (1108)	1.81 (2.21)
March	(57)	(1.0)	(98)	(1.72)
TOTAL	4765 (5632)	100.0 "	9666 (12381)	2.03 (2.20)

TABLE I Catch and Production in barrels - Season 1961-62 (Values for 1960-61 in brackets).

It is not difficult to find reasons for the lack of success this season. A prime cause was probably the weather in October when almost continual strong winds built up a swell which rendered landing on the beaches difficult or impossible. On the few calm days when landings were attempted on the south-west coast of the island in Division IV they were frequently frustrated by the heavy swells from the previous gales. The sealing skippers laid a lot of the blame on the very heavy snow cover that accumulated during the winter leaving snow edges up to six feet in height on many of the beaches as late as the second week in October. In view of the extremely high September catch this opinion would seem to be erroneous. It is certainly true to say, however, that once the harem groups had formed the soft rotten snow then lying thickly on the

main beaches hampered the movements of the seal hunters and slowed up operations. The presence of such large quantities of snow (said to be as much as anyone could remember in South Georgia) did not seem to have any effect on the time of pupping, nor apparently on the first haul-out of the bulls.

MONTH	I	II	III	IV	TOTAL
September	63	363	732	256	1414
October	526	599	1318	341	2784
November	234	-	-	161	395
Total	823	962	2050	758	4593
Nov. pup count	-	-	172	-	172
TOTAL	823	962	2222	758	4765

TABLE II Catch by Months and Divisions - Season 1961-62

Another contributory cause to the poor results, and in my opinion more important than the bad weather, was the employment of unskilled labour on the seal boats. Almost since its inception the sealing industry in South Georgia has depended on the expatriate Poles and Russians living in Argentina to fill the skilled roles of gunners, flensers and drivers on the beaches. When the sealing company severed its connections with the Argentine many of these were replaced by Norwegians and as the sealing is both arduous and uncomfortable and, in addition, not particularly highly paid, these have not represented the best of the labour available at Grytviken. This season the company recruited labour for the seal boats from Aalesund, a district of western Norway where the tradition of sealing is strong. It was apparently overlooked that the type of sealing with which Aalesund is concerned, the taking of harp seals and blue-backs from the pack ice of the North Atlantic, is as different as well could be from the operations in South Georgia. While some of the Aalesunders proved adaptable and skillful workers it was not to be expected that, lacking the experience of their predecessors, they could perform the many intricate tasks involved in sealing at the same rate and at the same level of efficiency. In particular the driving off the seals and getting the flensed skins from the beach to the motor boat were very much slower than in the previous season. It is probably the lowering of the efficiency of driving that accounts for the fall-off in the October catch; once the cows are present in large numbers driving becomes very much more difficult and great skill is needed to get the bulls to the water's edge from the dense crowds of cows that form the harem groups.

If there is one observation that can be made with certainty it is that the low catch was not in any way due to a shortage of seals. Save perhaps for Division I seals were plentiful throughout the season and the rate of replacement was high.

The sealing company applied for an extension of the season into November on 15th October, by which time the catch amounted to no more than 2771 seals. The grounds given for the application were that the heavy snow cover had prevented the seals from hauling out and that the south-west coast had been blockaded by pack ice, making sealing impossible in Division IV. As stated above there is no evidence that the snow in any way prevented the hauling of the seals but it was true to say that pack had hindered the sealing operations early in the season. At the date on which the application was received it was difficult to make a forecast of the expected catch by the end of October and a decision on a possible extension was post-poned till the end of the eighth week of sealing, 26th October. By then 3877 seals or 64.6% of the licensed quota had been taken and only five days of the spring season remained in which to secure the residue. In view of the exceptional weather conditions it was decided to grant an extension into November of seven days, this period to include a trip for the purpose of counting and tagging pups. The seal boat DIAS was allotted for the pup counting and a total of 172 seals were taken on this trip; ALBATROS and PETREL fished on only three days during the extension period and secured a total of 139 seals between them. The manager of Albion Star Co. has stated that he will strongly recommend against November sealing in the future, on the grounds of the uneconomic utilisation of the seal stocks. The usual biological objections to November sealing did not apply this season owing to the small number of seals taken in October.

It must long have been apparant to the sealing company, both as Compania Argentina de Pesca and Albion Star Co. , that there was no chance of obtaining the licensed quota in September and ~~NE~~ October with the present catching material. It is not thought that the provision of a fourth catching boat would significantly ease the situation but much could be done to improve the equipment on the boats already in use. The use of more powerful and reliable motor boats for towing, and particularly the provision of a reserve motor boat at Grytviken which could be used when one of the others needed repairs, would save much valuable time. Smaller details, such as the provision of some form of line-throwing apparatus in the motor boats and the substitution of nylon cordage for natural fibres would also simplify and accelerate the handling of the skins. Probably the greatest difference would be made by the installation of a diesel engine in DIAS, which has had a speed of not much better than $6\frac{1}{2}$ - 7 knots this season, thus both increasing the carrying capacity of the vessel and shortening the hauls between beaches and to and from the station. However, no amount of material improvements can be expected to solve the problem unless an experienced labour force can be built up. I have gathered the impression that few of the sealers employed this season intend to return the next and it thus seems likely that the 1962-63 season will again see an unskilled crew and a consequently poor production.

II CONDUCT OF THE SEALING OPERATIONS

The boats used and their captains were the same as in the previous season and the comparative catches are set out in the table below.

part of the tagging next season will be with Rototags, provided they arrive in time.

A synopsis of the tags applied is given in

Table IV. Full details of the tags are held in

		ALBATROS		DIAS		PETREL	
1959	catch	1962	Hauge	2219	Bogen	1606	Nilsen
	%age	33.9		38.3		27.8	
1960	catch	1998	Bogen	1517	Nilsen	2060	Hauge
	%age	35.8		27.2		37.0	
1961	catch	1564	"	1375	"	1654	"
	%age	34.1		30.0		35.9	

TABLE III Proportion of catch by vessels (Spring sealing only) 1959-61. (Catches for pup-count trips not included).

Owing to the late arrival of the sealing inspectors the first four weeks of the season were not covered by our observations but by the time we arrived the standard of driving and shooting seals was high, at least from the view-point of not causing the animals unnecessary suffering. DIAS and PETREL still had their original gunners and the new gunner on ALBATROS was generally an accurate and quick shot. On two occasions, however, he wounded cows, once with a ~~right~~ ricochet and once with a straight miss, and the animals had to be destroyed. Two short seals (3.4m and 3.3m) were recorded, one each from ALBATROS and DIAS.

The most serious infringement of the sealing regulations was the taking of 62 seals in excess of the licensed quota in Division II. These seals were taken by PETREL (Captain Ole Hauge) on the sector of the coast between Cape Buller and Cape North. As will be remembered this part of the island had been included in the Division I licence last year and Hauge had omitted to read the notice issued to each of the boats stating the limits of the divisions at the beginning of the season. When this infringement was brought to the notice of the sealing company a whale catcher was at once dispatched to warn the other seal boats not to take further seals from this division. The number of seals concerned was relatively small and had been taken from that part of the division that could best stand an extra crop. The sealing company apologised for the incident and the matter was not taken further.

III TAGGING

A total of 1289 tags was applied to pups in the 1961 breeding season. They were all of the monel metal Ketchum type as used in the previous seasons. It had been intended to experiment with nylon "Rototags" this season but the tags ordered did not arrive. These nylon tags are considerably cheaper than the monel metal ones and while they may be ~~more~~ more difficult to apply will probably cause less discomfort to the tagged animals. Stocks of monel tags in hand amount to 1500 and at least

part of the tagging next season will be with Rototags, provided they arrive in time.

A synopsis of the tags applied is given in Table IV. Full details of the tags are held in South Georgia. Losses amounted to 11 tags, or 0.85% of the total, representing a high standard of efficiency in tagging.

DIVISION	I	II	III	IV	TOTAL
Tags used	130	680	365	125	1300
Losses	3	5	1	2	11
Tags applied	127	675	364	123	1289

TABLE IV Distribution of Tags - 1961

No tagged animals from previous years were observed in South Georgia though approximately 800 tags have been applied to female pups which by now should be old enough to appear as breeding animals on the beaches; losses due to natural mortality and tags falling out will, of course, reduce this figure greatly so that only a minute proportion of the cows on the beaches might be expected to bear tags. Younger animals and three and four year old males are not available on the beaches for observation at the time of the breeding season.

One tag recovery has been recorded from Southern Argentina. This was tag no; 9777, applied to a pup of unknown sex in Right Whale Bay in 1959. Further details of the recovery are not at present available.

LV TOOTH COLLECTION AND AGE STUDIES

The standard of tooth collection this season was considerably higher than in previous years, though still not perfect. Such irregularities as there were, mostly concentrated in the first half of the season, were concerned with the correct number of teeth returned with the kill rather than returns of short teeth or duplicate pairs. From a total sample of 232 teeth returned only five were recorded as short and of these only one was so grossly short that it had to be rejected from the sample. No teeth were duplicated in the sample. On the whole it is felt that the standard of tooth collection this year is as high as it is likely to be, though with greater care by the gunners in inspecting the teeth as they are taken perfection would not seem to be unattainable.

The results of the tooth analyses are set out in Tables V and VI. As can be seen the average of the kill shows a considerable increase and is, in fact, the highest age recorded since the analyses first started in 1951. The increase as measured in a statistical test is a significant one, but it is important to remember that in view of the concentration of the catch in September, when younger seals are scarcer, the sample is not strictly

comparable with those from previous years which have always included a large number of specimens. In attending this research, the stock is in a satisfactory state.

Considering the position division by division we find that except for Division I there has been an increase in the average age in each division. However, none of the divisional differences is significant considered on its own save for Division IV where the increase was highly significant. Division IV was not nearly so hard-pressed this season as last, the weekly catch never exceeding 500, and it is likely that the younger age classes had less opportunity to be removed. It will be observed that the last season Division IV showed a decrease in the average age.

	DIV I		DIV II		DIV III		DIV IV		TOTAL	
	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
Number	69	39	39	49	83	107	114	36	266	231
Average Age	7.568	7.281	6.974	7.225	7.337	7.710	7.176	8.833	7.320	7.710
± 2 SE.	.4288	.3708	.3184	.2902	.3130	.2418	.2328	1.126	.1644	.1862
Var.	1.785	1.341	0.999	1.032	2.031	1.564	1.583	3.362	1.798	2.002
S.D.	1.334	1.158	0.998	1.016	1.425	1.251	1.244	1.834	1.341	1.415

TABLE VI Results of Tooth Analysis by Divisions 1960 & 1961
(Division II 1959 & 1961).

	1954	1955	1956	1957	1958	1959	1960	1961
	Number	311	330	269	269	290	264	266	231
Average Age	7.31	7.32	7.51	7.41	7.46	7.23	7.32	7.71
± 2 SE.	0.16	0.13	0.14	0.10	0.13	0.13	0.16	0.19
S.D.	1.41	1.18	1.15	1.16	1.14	1.03	1.34	1.42

TABLE V Tooth Analysis 1954-1961

comparable with those from previous years which have always included a large number of seals from November. Notwithstanding this reservation, however, it may be taken that the stock is in a satisfactory state.

Considering the position division by division we find that except for Division I there has been ~~an~~ increase in the average age in each division. However, none of the divisional differences is significant considered on its own save for Division IV where the increase was highly significant. Division IV was not nearly so hard-pressed this season as last, the weekly catch never exceeding 204 seals, while last year it reached a maximum of 469, and it is thus likely that the younger age classes had less opportunity to come ashore. It will be remembered that the last seasons results in Division IV showed a lowering of the average age from 7.674 years to 7.176 years and it was suggested that this might be to an increase in the proportion of younger bulls in the stock. The rise in the average age this year does not controvert this view, for if there are sufficient seals available and taxation is not high the younger seals, even if numerous, will not be available on the beaches for killing.

V POPULATION STUDIES.

The Biologists accompanied the sealing vessels on 11 occasions covering a total of 45 days and visiting all the divisions. Owing to the late arrival of the transport ship the first trip out was made on the 1st. October, and the early part of the season was missed.

As mentioned in the first section of this report, seals were plentiful on the beaches throughout the season though there was some tendency for the cows to avoid hauling out on the broader beaches where the steep snow edges made access difficult, and instead to haul in the rocky coves where the snow cleared more quickly.

As in previous years one of the seal-catchers was placed at the disposal of the biologists for counting and tagging pups at the end of the season, in return for an extra cargo of seals (taken in the period of extension). "Dias" was made available this year and results were disappointing, of the thirteen census beaches only seven were visited on the pup count trip. There is no doubt that the weather would have prevented landing on the beaches of Division IV but there seemed little reason why an attempt should not have been made to visit Division I. It was doubly unfortunate that there was no recent count from four of the six beaches not visited.

In general the proportion of bulls on the beaches in the latter part of the season was satisfactory, though as usual Division II was worst off in this respect. Even here however the position was considerably better than in previous years, and of the census beaches only Fortuna Bay, with a cow/bull ratio of 59.4 can be considered underpopulated. This was a suprisingly high ratio, as although the catch in Fortuna Bay had been heavy (206) there was no catching here in the ten days preceding the count.

VI QUOTA RECCOMENDATIONS.

It is not proposed at this stage to alter the quota reccomendation made in the previous report. It will be appreciated that although the quota had been fixed at 6000 seals per year for the last eleven years, this quota has not been attained for the last five of them. The average catch for these years has been 5491 seals and it may well be thought that a yearly quota nearer this figure would be more appropriate as there has not been any very marked increase in the number of seals on the beaches. There is however a limiting factor involved in the number of bulls on the beaches as the larger, more aggressive harem bulls will prevent the smaller ones from hauling and thus although the actual numbers seen ashore may not be greatly increased, there is a greater availability of bulls from the stock of aquatic bachelors which perambulate the coasts. This is indicated by the more rapid replacement of bulls when a beach is harvested by the sealers. The aquatic bulls are not confined to any one division but evidently visit all beaches around the island so that the large residue of seals left in division IV in the years that the quota has not been attained do not represent merely a building up of the stock in this division alone, but are available for the other divisions as well.

While it has been stated that the availability of seals is now greater it must be admitted that the fall off in catch would seem to ~~be~~ indicate exactly the opposite. The number of seals per catcher's day's work was last season only 23.35, while in 1960 it was 36.7. I am convinced, however, that this fall in efficiency is due to the employment of unskilled crews, coupled with the unfortunate weather conditions.

Should the sealing company attain the licensed quota of 6000 seals it is only to be expected that the average age of the kill will fall off but unless it falls consistently below a value of 7.25 years there would seem no grounds for lowering the quota.

The sub-division of the Division III quota, whereby the sealers were not allowed to take more than 60% of the total quota north-west of Cape Harcourt, worked well and catches in the south-eastern part of this division were good and the total divisional catch much more evenly distributed than in previous years. It is recommended that this practise should be continued.

Square of skin was collected from a female seal shot 31st January and carefully freed of all blubber and the rounded oil wiped off. This sample was then weighed, giving a weight of 540.8 grams or 0.541 kilograms per square metre. The approximate area of skin of a bull of average length (in the experimental groups) is 8.75 square metres and as the skin of the bulls is about half as thick again overall as that of the cows the weight of the skin of a bull is thought to be 100 kilograms. The weight of the seal adhering to the blubber, mostly subcutaneous and neck fat, is estimated at 15 kilograms, giving a total weight of 115 kilograms. From this deduction is made from the average weight of the two groups and assuming that the blubber weight of the blubber weight it is found that the weight of the two groups is 351 kg and 387 kg in the early part of the season and 387 kg and 351 kg towards the end. Both these values are very close to those of the actual oil production at these times of the year, although there was deliberate selection for large weights in the first group there was none at all in the second and the high oil content would thus be

VII EXPERIMENTAL WORK

Advantage was taken of the presence of two biologists to carry out two experiments designed to test (i) the loss in weight of the blubber of bulls through the course of the season, and (ii) the transfer of weight between cows and pups through the lactation period.

The Bull Blubber Experiment

For this experiment two series of ten bulls each were taken as near the beginning and the end of the season as possible. Owing to our late arrival in the field the "early" series of bulls was taken between 2nd and 6th October, but deliberate selection was made for animals that were newly hauled out, rather than those that had been ashore some time. The late series was taken between 3rd and 7th November and consisted of animals selected for leanness. The seals were shot in the ordinary course of sealing, measured and the skin divided into four pieces on the beach. On being brought out to the ship the pieces were weighed using a 180 kilogram circular spring balance equipped with a pulley system to read to 360 kilograms. A blubber sample was collected from each experimental animal. The samples were labelled and placed in a tin with a close-fitting lid; about half the samples were wrapped in polythene bags before being placed in the tin. On return to the whaling station the samples were stored under refrigeration before being analysed in early January. For analysis the samples were trimmed and 5 gram samples cut out with a razor from the centre of the block. The 5 gram samples from each group were bulked, mashed and the final samples for analysis taken from the resulting slurry. Helmut Skjelby, chief chemist of Albion Star Company, kindly performed the analyses for oil, water and ash content and iodine number of the oil. The results are given in Tables VII and VIII.

The weighings made on board the sealer and referred to as "blubber" in Table VII are in fact of the skin, blubber and adhering musculature and a deduction must be made for the skin and meat. It was not possible to measure this quantity directly on the boats but a 25 cm square of skin was collected from a female seal shot 31st January and carefully freed of all blubber and the exuded oil wiped off. This sample was then weighed, giving a weight of 510.8 grams or 8.173 kilograms per square metre. The approximate area of skin of a bull of average length (in the experimental groups) is 8.75 square metres and as the skin of the bulls is about half as thick again overall as that of the cows the weight of the skin of a bull is found to be 106 kilograms. The weight of the meat adhering to the blubber, mostly abdominal and neck musculature, is estimated at 15 kilograms, giving a total deduction of 121 kilograms.

When this deduction is made from the average "blubber" weight of the two groups and assuming that the oil comprises 90% of the blubber weight it is found that the average oil content of the two groups is 551 kg (=3.31 barrels) in the early part of the season and 387 kg (2.09 barrels) towards the end. Both these values are very much in excess of the actual oil production at these times of the year. Although there was deliberate selection for fatter animals in the first group there was none at all in the second and the high oil contents cannot thus be

attributed to selection. The average ages of the samples, 7.7 and 7.3 years, show that they are representative of the catch as a whole (average age 7.71 years).

The mean oil production from the commercial catch in the period 1943 - 1960 for September has been 2.30 barrels per seal, and for November 1.78 barrels per seal. If the calculated oil contents are taken as being accurate and it is assumed that the production in September and November can be equated with the two experimental groups values for the efficiency of the oil production can be obtained.

Oil content - early group	3.31 barrels
Average September prodn.	<u>2.30</u> "
Difference	<u>1.01</u> "

Efficiency of production = 69.5%

Oil content - late group	2.09 barrels
Average November prodn.	<u>1.78</u> "
Difference	<u>0.31</u> "

Efficiency of production = 85.2%

The reason for the considerable difference in the two estimates of production efficiency it thought to be that while the "early" group can fairly be compared with the entire September catch, the seals comprising the "late" group are much keener than the average November catch, for all were chosen as having been on land for several weeks though in fact a fair proportion of the November seals are newly hauled. It is felt that the September efficiency value is more accurate and it may be assumed, on the basis of this experiment, that the utilisation of the raw product is only about 70 - 80% efficient.

According to Skjelby losses in the factory are negligible, amounting to less than a kilogram of oil for each skin processed. It would therefore seem that the oil must be lost between loading the skins on the seal catcher and their entry into the blubber cutter, the beginning of the production line in the factory. There is known to be a considerable loss in the hold of the catcher as when the skins are stowed the weight of the load, combined with heat from the oil bunkers that form the after bulkhead of the hold, press out a large quantity of oil which is subsequently pumped to waste when the hold is cleaned after unloading. Further losses are caused when the skins are unloaded from the catcher on arrival at the station. The skins are hoisted out of the hold and dumped in the water alongside the ship, thus washing off any oil that might be clinging to them. They are then towed over to the plan where they are heaved up on a wire in bunches of fifteen or twenty at a time; as they are dragged over the edge of the plan ramp more oil is pressed out. Some oil is no doubt also wasted when the skins are cut up into strips for loading into the blubber cutter. These losses have always been recognised but it is now apparent that they represent a much greater quantity of oil than had been realised. The samples

Specimen number	Nose-tail length	Blubber Weight	Blubber thickness		Age
			Shoulder	Back	
1	3.78	469	-	-	7
2	4.24	697	-	-	6
3	4.50	755	8	9	9
4	4.25	583	8	8½	7
5	4.75	917	9	8	10
6	4.40	807	8	9	8
7	4.20	868	9½	9½	9
8	4.02	799	10½	11½	7
9	4.65	882	10	10	9
10	3.93	556	6	7	5
Average					
	4.27	733	8.6	9.1	7.7
11	4.28	689	5½	5	10
12	3.71	442	5½	7½	6
13	3.70	390	5	5	5
14	3.88	540	5½	6	9
15	3.73	461	5	5½	7
16	3.84	525	6½	8	7
17	3.61	474	6	6½	6
18	3.89	468	5	5½	6
19	3.85	466	5	6	6
20	3.93	624	4½	6	11
Average					
	3.84	508	5.4	6.1	7.3

TABLE VII Results of Bull Blubber experiment. Specimens 1 - 10, early group; 11 - 20, late group. Lengths in metres, weights in kilograms, blubber thicknesses in centimetres.

	Fat	Water	Solids other than fat
Early group	89.4	8.1	2.5
Late group	91.2	7.7	1.1

TABLE VIII Percentage composition of bull blubber.

uses in the experiment are too small to give an accurate value for the loss involved but it is hoped to repeat the work on a larger scale next season, weighing samples of fifty skins when they are brought on board the catcher and again when they finally arrive on the plan.

Cow Blubber Experiment

This experiment was performed in a similar manner to the one described above. A series of pregnant cows was obtained at the beginning of the season. The specimens were shot and measured and the fetuses extracted. The cows were flensed in the same way as bulls, the skins weighed and blubber samples collected. Late in the season a similar series of cows was collected as nearly at the end of the lactation period (as judged by the size of the accompanying pups and the leanness of the mothers) as possible. The pups were also collected, weighed entire, then flensed and the blubber weighed separately. A sample of milk was obtained from the stomach of a pup which was observed suckling immediately before being shot. Skjelby kindly performed the analyses of the blubber and the milk. The results are set out in Tables IX to XII.

The average loss of blubber weight of the cows was found to be 73 kilograms and the equivalent blubber increase of the pups 67 kilograms. As there are no important oil-depots in the body of the seal, other than its blubber, it can be calculated that the efficiency of the transfer of fat between the mother and its young is around 90% (calculated value 91.8%).

It had been hoped further the efficiency of the entire transfer by assuming that the pup successfully utilised all the fat available in the milk and thus from the fat-gain of the pups calculating the total amount of milk transferred. Unfortunately there are grounds for doubting the accuracy of the composition of the milk as determined from the sample collected. As can be seen from Table XII, where the analysis is compared with three analyses of seal milk (adapted from Sivertsen, 1941) the elephant seal milk sample showed a relatively very low fat content and a correspondingly high water content. It is probable that the sample was contaminated with stomach juices before collection. From the figures obtained in the analysis it can be calculated that the amount of milk equivalent to the known gain of fat by the pups is 269 kilograms. As the total weight gained by the pups is only 111.1 kilograms this would give a transfer efficiency of only 41.3%, which is almost certainly too low.

Further samples of seal milk will be collected next season when it is hoped to carry the results of this experiment further.

TABLE XI Change of weight of pups.

Specimen number	Nose-tail length	Blubber weight	Blubber thickness shoulder	Blubber thickness back	Age
1	2.89	213	6½	6½	13
2	2.89	238	7½	8	6
3	2.52	157	7	7	3
4	2.70	218	8	7	4
5	2.62	173	7	8	4
6	2.93	241	7	7½	5
7	2.69	213	7	8½	6
8	2.43	107	7	7	3
9	2.75	218	7	6½	5
10	2.80	216	7	7	4
11	2.50	216	7½	8	4
Average	2.70	201	7.1	7.4	5.2
12	2.81	147	3	3½	10
13	2.58	118	3½	3	7
14	2.51	96	3	2¾	3
15	2.78	185	4	3½	10
16	2.56	116	3½	3½	6
17	2.91	149	3½	4	14
18	2.41	90	2½	2	6
19	2.43	123	3	3	7
20	2.70	129	2½	3	10
21	2.68	123	3½	3	10
Average	2.64	128	3.2	3.1	8.3

TABLE IX Results of Cow Blubber experiment; units as Table VII. Specimens 1 - 11, pregnant; specimens 12 - 21 lactating.

(For Table XI see over)

	Males	Females	All
Wgt. weaned pups	117.7	134.9	128.0
" foetal "	15.2	18.9	16.9
" gained	102.5	115.0	111.1
%age increase	673	612	657

TABLE XI Change of weight of pups.

Specimen number	Sex	Nose-tail length	Blubber wgt	Carcase wgt	Total wgt		
1	F	1.38	4.99	11.11	16.10		
2	F	1.18	4.90	11.11	16.01		
3	F	1.19	3.86	9.44	13.30		
6	F	1.18	4.54	9.98	14.52		
8	F	1.27	3.99	8.85	12.84		
9	F	1.40	5.90	12.70	18.60		
Average		1.27	4.70	10.53	15.23		
4	M	1.58	5.54	11.57	18.69		
5	M	1.52	4.90	10.66	17.08		
7	M	1.64	5.22	13.16	20.02		
10	M	1.58	5.22	11.80	18.60		
11	M	1.69	5.44	13.16	20.29		
Average		1.60	5.26	12.07	18.94		
AVERAGE		1.42	4.95	11.23	16.91	Blubber thickness Shoulder Back	
12	F	1.50	67.1	48.1	115.2	4 $\frac{1}{2}$	5
14	F	1.53	60.8	48.1	108.9	4 $\frac{1}{2}$	6 $\frac{1}{2}$
17	F	1.64	78.9	59.0	137.9	5 $\frac{1}{2}$	7
18	F	1.48	61.7	47.2	108.9	5 $\frac{1}{2}$	6
Average		1.54	67.1	50.6	117.7	5	6
13	M	1.67	75.8	69.4	145.2	5 $\frac{1}{2}$	5 $\frac{1}{2}$
15	M	1.58	90.7	63.5	154.2	7 $\frac{1}{2}$	8 $\frac{1}{2}$
16	M	1.59	69.0	56.3	125.3	6 $\frac{1}{2}$	7 $\frac{1}{2}$
19	M	1.45	63.5	50.8	114.3	5	7 $\frac{1}{2}$
20	M	1.68	81.7	54.4	136.1	6	6 $\frac{1}{2}$
21	M	1.63	72.6	61.7	134.3	5	6
Average		1.60	75.5	59.4	134.9	6	7
AVERAGE		1.58	72.2	55.9	128.0	7.5	6.6

TABLE X Pup lengths and weights. Units as Table VII. Specimens 1 - 11, foetal; 12 - 21 near weaning.

	Elephant	Harp Seal	Harp Seal	Hooded Seal
Water	65.9	45.3	43.8	49.9
Fat	22.4	42.7	42.8	40.4
Protein	10.2	10.5	12.0	6.7
Ash	0.6	0.8	0.9	0.9

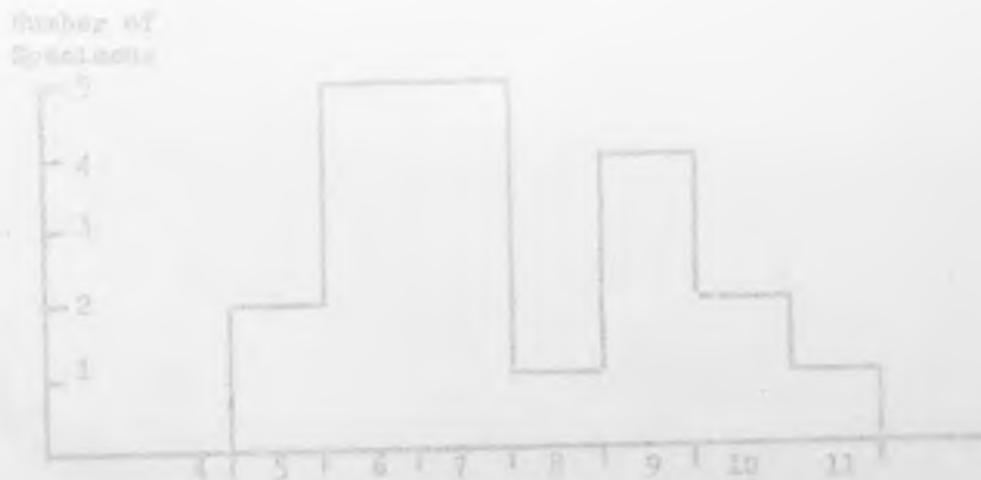
TABLE XII Percentage composition of seal milks

The values for Harp and Hooded seals are taken from Sivertsen, 1941.

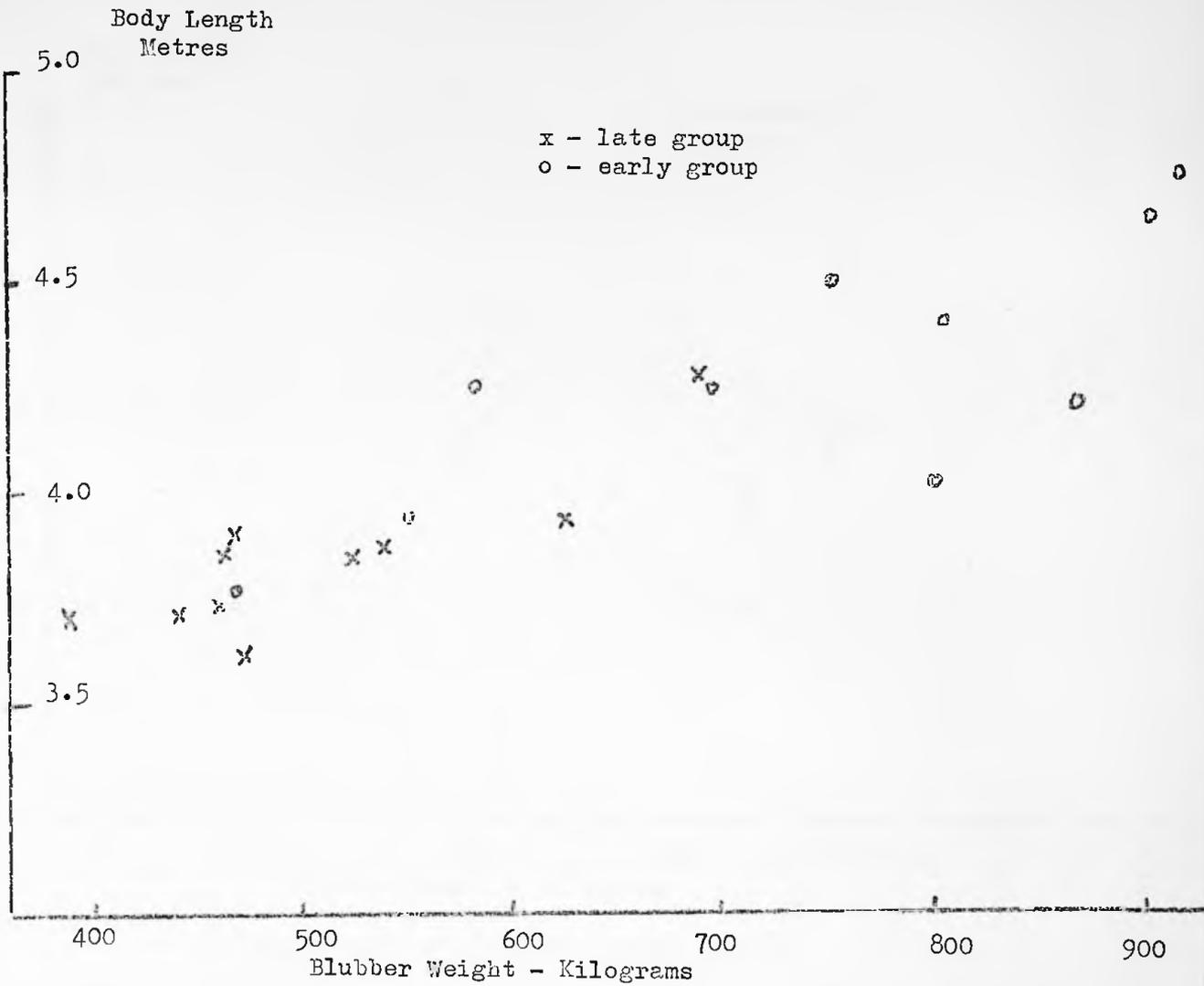
		Fat	Water	Solids other than fats	Iodine Number	S.G. gm/cc.
Bulls	Early	89.4	8.1	2.5	* 133.2	9.40
	Late	91.2	7.7	1.1		8.70
	Pregnant	92.3	6.2	1.5	-	9.68
Cows	Lactating	91.1	9.8	0.1	133.9	9.45
	January	87.4	8.4	3.2	-	-
Pup	Near weaning	88.5	7.7	3.8	139.8	9.11

* Average value for whole seasons catch.

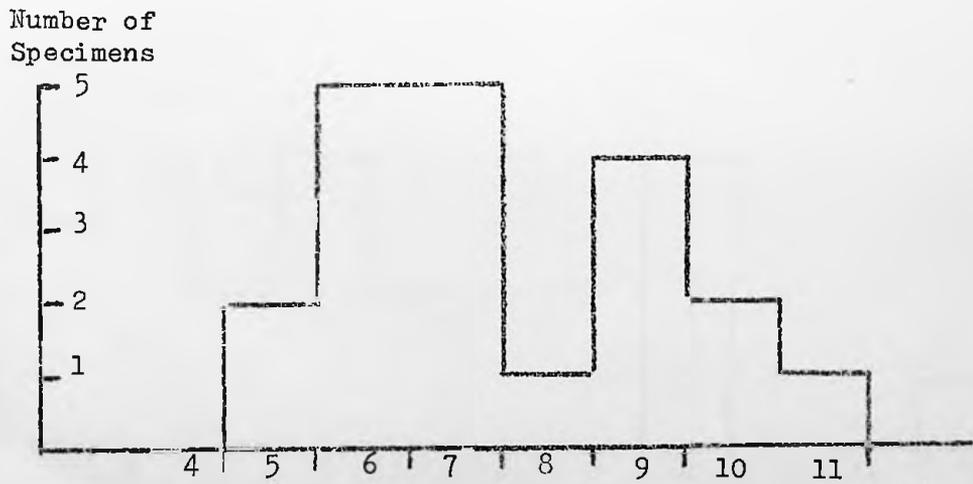
Table XIII. Some characteristics of Elephant Seal blubber. Values for fat, water and solids other than fat are percentages.



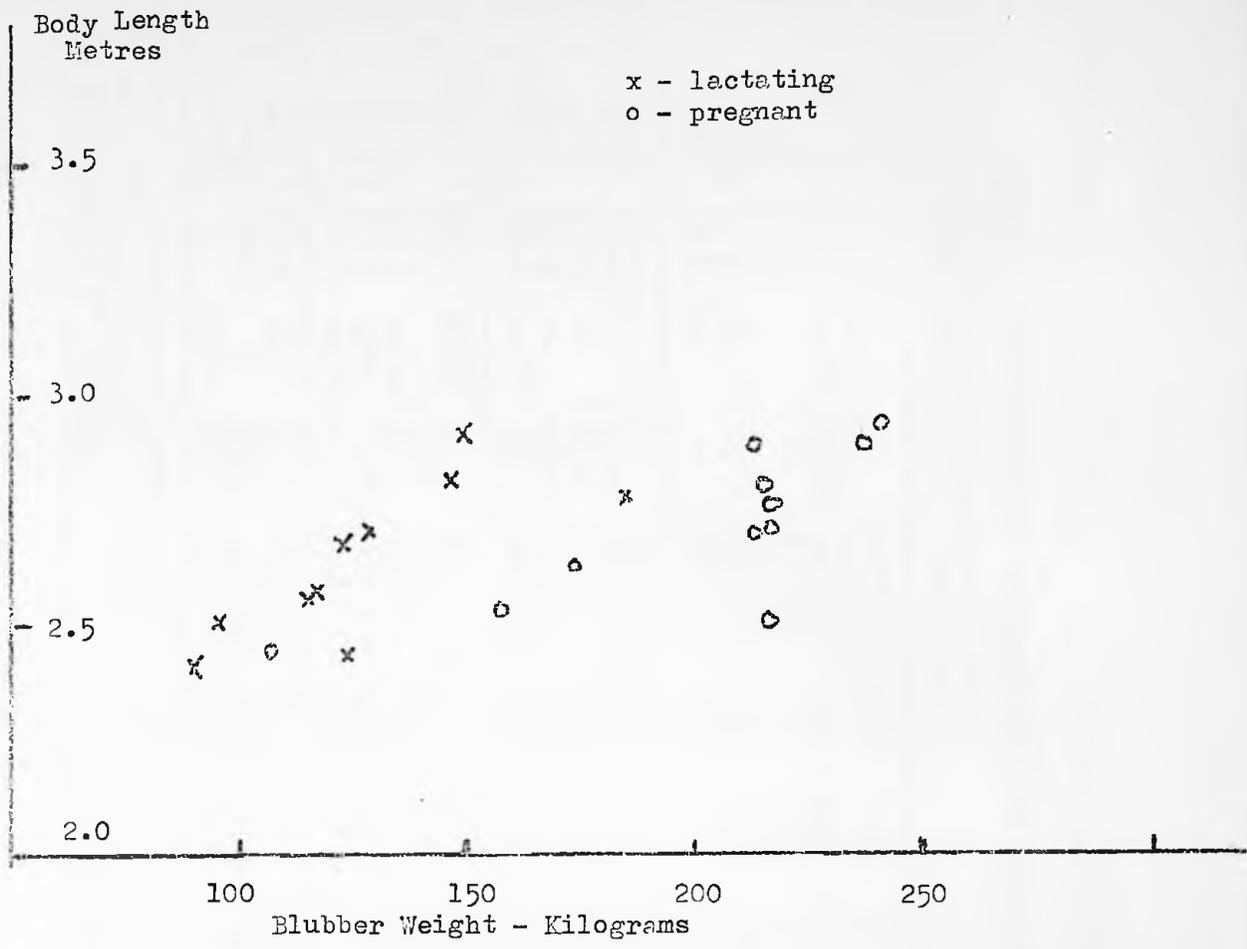
Age Distribution of Bulls



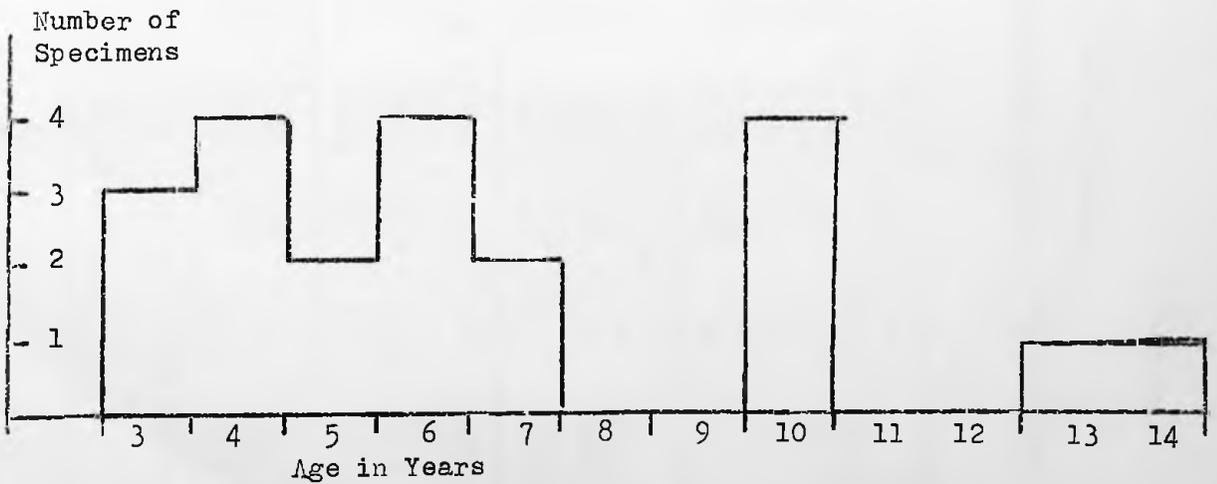
Body Length and Blubber Weight of Bulls



Age Distribution of Bulls



Body Length and Blubber Weight of Cows



Age Distribution of Cows

	NUMBER OF SEALS TAKEN						YIELD OF OIL						AVERAGE OIL PRODUCTION PER SEAL						
	March	April	Sept	Oct	Nov	TOTAL	March	April	Sept	Oct	Nov	TOTAL	March	April	Sept	Oct	Nov	AVERAGE	
1943	741	228	-	2983	1975	5927	1340	403	-	5964	3460	11,167	1.81	1.77	-	2.00	1.75	1.88	
1944	685	-	785	3374	1156	6000	1192	-	1890	6773	2085	11,940	1.74	-	2.41	2.01	1.80	1.99	
1945	454	57	353	2753	1765	5382	815	97	819	5471	3180	10,382	1.80	1.70	2.32	1.99	1.80	1.93	
1946	212	50	65	2221	1901	4449	360	80	133	4205	3297	8,075	1.70	1.60	2.05	1.89	1.73	1.82	
1947	460	288	722	3752	778	6000	820	498	1576	7635	1465	11,994	1.78	1.73	2.18	2.03	1.88	2.00	
1948	436	218	1072	3808	1966	7500	751	423	2549	7839	3531	15,093	1.72	1.94	2.38	2.06	1.80	2.01	
1949	456	-	783	3352	2285	6876	830	-	1812	6674	4042	13,358	1.82	-	2.31	1.99	1.77	1.94	
1950	346	151	510	2943	2951	6901	576	246	1253	5828	5132	13,035	1.66	1.33	2.46	1.98	1.74	1.89	
1951	474	16	730	3344	3313	7877	845	28	1706	6642	5387	14,608	1.78	1.75	2.34	1.99	1.63	1.85	
1952	161	-	410	2539	2890	6000	293	-	892	4949	4673	10,807	1.82	-	2.18	1.95	1.62	1.80	
1953	363	-	592	2754	2291	6000	669	-	1334	5504	3968	11,475	1.84	-	2.25	2.00	1.73	1.91	
1954	177	-	388	3199	2236	6000	316	-	897	6376	3836	11,425	1.79	-	2.31	1.99	1.72	1.90	
1955	-	-	1048	3342	1610	6000	-	-	2383	6730	2955	12,068	-	-	2.27	2.01	1.84	2.01	
1956	-	-	994	3443	1563	6000	-	-	2218	6926	2661	11,805	-	-	2.23	2.01	1.70	1.97	
1957	-	-	1406	2926	1076	5408	-	-	3189	6066	1765	11,020	-	-	2.27	2.07	1.64	2.04	
1958	-	-	994	3245	1625	5864	-	-	2174	7327	2975	12,476	-	-	2.19	2.26	1.83	2.13	
1959	-	-	917	4253	617	5787	-	-	2363	9030	1169	12,562	-	-	2.58	2.12	1.90	2.18	
1960/61	57	-	1656	3417	502	5632	98	-	3843	7332	1108	12,381	1.72	-	2.32	2.15	2.21	2.20	
1961/62	-	-	1414	2784	567	4765	-	-	2535	6102	1029	9,666	-	-	1.79	2.19	1.81	2.03	
													Averages:	1.77	1.69	2.27	2.04	1.78	1.97

Appendix i CATCH STATISTICS 1943 - 1961/62 Value for oil in barrels (six barrels = 1 ton)

March values from 1960/61 refer to the later year.

Week	1	2	3	4	5	6	7	8	9	10	TOTAL
DIVISION I											
Queen Maud	-	4	-	-	-	-	23	-	21	-	48
King Haakon	15	3	-	-	-	24	121	42	132	-	337
Nilsh/Elephnt	-	-	-	-	-	-	-	6	11	-	17
Wilson Hbr	-	-	-	13	13	20	-	31	19	-	96
Ice Fjord	9	-	-	19	25	-	26	21	92	-	192
Schlieper B	-	-	-	-	29	-	-	35	17	-	81
Undine Hbr	-	-	-	-	-	19	-	8	11	-	38
Elsehul	-	-	-	-	-	-	6	5	3	-	14
Total	24	7	-	32	67	63	176	148	306	-	823
DIVISION II											
Right whale H	-	1	-	6	-	13	6	-	21	-	47
Welcome Bay	-	-	-	21	-	-	-	23	108	-	152
Bay of Isles	-	16	51	10	55	30	-	14	9	-	185
SeaLpd/Beckmm	3	2	17	-	4	35	-	47	-	-	108
Possession	12	6	27	-	45	13	-	99	-	-	202
Antarctic	2	1	15	-	28	-	-	16	-	-	62
Fortuna	3	6	28	4	37	14	64	50	-	-	206
Total	20	32	138	41	169	105	70	249	138	-	962
DIVISION III											
West Fjord	17	8	63	34	80	71	43	54	48	43	461
Cumberland E	11	4	5	39	13	38	-	-	-	-	110
Gdthl/Ocn/Pengn	3	2	8	5	14	13	39	-	16	-	100
Bikkjebukte	4	3	17	17	43	23	29	42	22	-	200
St Andrews B	10	19	31	110	26	157	-	-	25	51	429
Sacramento	-	-	-	-	-	-	-	-	-	-	0
Royal Bay	6	26	-	37	72	43	18	49	-	-	251
Bjørnstadt	2	5	-	-	3	73	-	31	-	-	114
Gold Hbr	7	2	11	14	31	79	16	57	-	30	247
Iris	2	3	18	6	13	18	27	15	-	30	132
Wirik	3	3	15	-	-	22	4	47	47	18	108
Cooper	5	3	4	-	-	21	-	19	-	-	52
Drygalski	-	-	-	-	-	-	9	9	-	-	18
Total	70	78	172	262	295	558	181	323	111	172	2222
Division IV											
Paradis	-	7	-	14	-	-	28	-	-	-	49
Trollhul	-	-	-	4	-	-	13	8	-	9	34
Ranvik/Don	-	18	-	24	-	-	9	-	-	14	65
Dias Cove	-	-	-	35	-	-	22	-	-	12	69
Undine S	-	8	-	-	-	-	54	22	-	-	84
Rocky Bay	-	54	-	-	-	-	-	-	38	-	92
Annenkov	-	21	-	-	-	-	19	-	-	-	40
Larvik/Sandefj	-	13	-	-	-	-	30	-	27	-	70
Horten/Borre	-	5	-	-	-	-	-	-	-	-	5
Holmestrand	-	9	-	44	-	73	29	34	61	-	250
Total	-	135	-	121	-	73	204	64	126	35	758

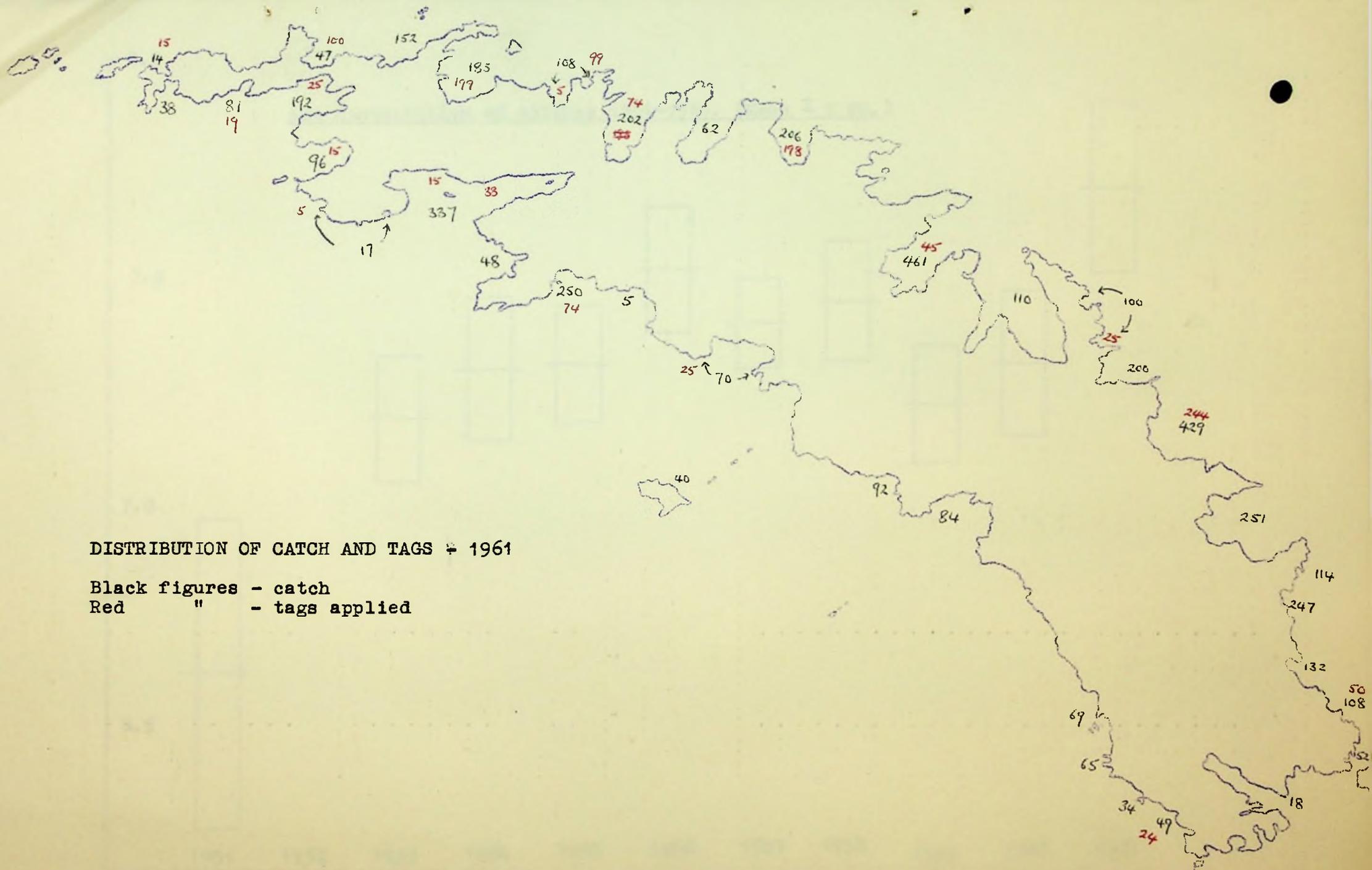
Appendix (ii) Sealing Progress by Beaches 1961
(Catches on pup count trip included).

DATE	DISTRICT	Bulls	Cows	Pups	P/Q	♀/♂
1/10	Neumayer Gl N	12+	89	11	0.124	-
	" Gl S	13	190	44	0.232	14.62
2/10	Lille Jason	11	24	4	0.167	2.18
4/10	Wirik	23	255	41	0.161	11.09
5/10	Cooper Bay & Sound	19	93	17	0.183	4.90
5/10	Gold Harbour	17	332	45	0.135	19.54
10/10	Leopard B (West Fj)	7	66	7	0.106	9.43
	Neumayer Gl S	9	348	150	0.431	38.7
13/10	Icefjord South B	28	499	226	0.453	17.81
	" Middle B	16	157	80	0.510	9.82
15/10	Annenkov S	19	293	180	0.614	15.42
	Undine South	36	545	172	0.316	15.14
17/10	Paradise	35	636	320	0.503	18.17
	Ranvik	9	156	62	0.398	17.34
	Right Whale	10	533	249	0.467	53.3
18/10	Ocean	19	189	105	0.568	9.96
21/10	Cooper Bay	9	61	33	0.541	6.78
22/10	Lillebeach	10	218	144	0.660	21.8
	Trollhul	9	118	101	0.856	13.1
23/10	Wilson Hbr	36	568	417	0.734	15.7
	Schlieper Bay	38	495	380	0.768	13.0
24/10	Elsehul	6	86	67	0.779	14.3
28/10	Penguin Bay	17	415	374	0.901	24.42
29/10	Holmestrand Inner	15	107	100	0.936	7.14
30/10	" Outer	49	976	1045	1.07	19.9
1/11	Haakon B Longbeach	24	220	229	0.955	9.16
2/11	Elephant B	-	151	156	1.04	25.2

Appendix (iii) Classified Counts -- Various 1961

DATE	DISTRICT	Bulls	Cows	Pups	P/Q	♀/♂
<u>DIVISION I</u>						
23/10	Wilson Hbr	36	568	417	0.734	15.7
(31/10	"	21	504	557	1.10	24.0)
<u>DIVISION II</u>						
7/11	Right Whale B	18	416	679	1.63	23.1
(31/10	"	8	568	618	1.09	71.00)
6/11	Brunonia Beach	22	1050	1753	1.67	47.8
(30/10	"	45	997	1016	1.02	22.2)
6/11	Beckman Fj	15	431	708	1.64	28.7
(30/10	"	45	600	621	1.035	13.3)
6/11	Fortuna Bay	21	1247	1731	1.39	59.4
(30/10	"	111	1509	1506	0.998	13.6
<u>DIVISION III</u>						
7/11	Lille Jason	22	219	309	1.41	9.96
(3/11	"	19	432	455	1.05	22.7)
3/11	Theatre Beach SAB	230	3645	3844	1.06	15.8
(	No value 1960)
3/11	Gold Harbour	63	1628	1395	0.857	25.4
(2/11	"	129	1833	2033	1.11	14.2)
<u>DIVISION IV</u>						
30/10	Holmestrand	64	1083	1145	1.05	16.9
(1/11	"	114	1504	2009	1.33	13.2)

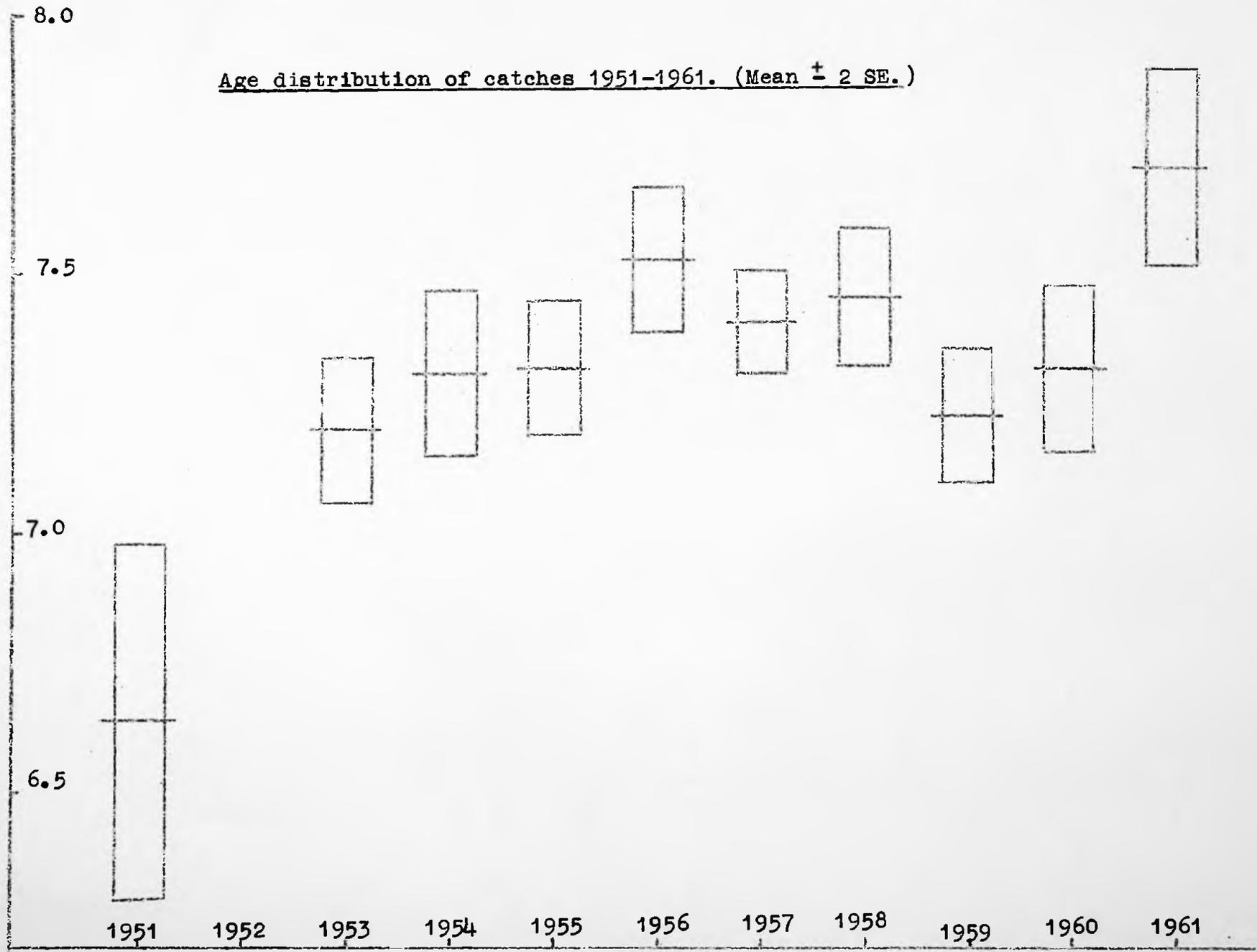
Appendix (iii) Classified Counts on selected beaches
(Values for 1960 in brackets).



DISTRIBUTION OF CATCH AND TAGS * 1961

Black figures - catch
 Red " - tags applied

Age distribution of catches 1951-1961. (Mean \pm 2 SE.)



1. Organisation and Field Trips

Two visits were made to Bird Island in the 1961-62 breeding season for the purpose of studying the fur seals.

The November Visit

This covered the period from November 21st to 28th December. Bonner and Vaughan departed for Bird Island on 21st November. Some difficulty was experienced in getting ashore owing to heavy sea and strong wind.

INTERIM REPORT ON THE FUR SEAL INVESTIGATIONS

AT BIRD ISLAND, SOUTH GEORGIA

SEASON 1961-62

by

W. NIGEL BONNER, B.Sc.

and

R.W. VAUGHAN, B.Sc.

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**Biological Laboratory
King Edward Point
SOUTH GEORGIA**

7th. February 1962

I. Organisation and Field Trips

Two visits were paid to Bird Island in the 1961-62 breeding season for the ~~for~~ purpose of studying the fur seals.

The December Visit

This covered the period 22nd November to 21st December. Bonner and Vaughan embarked for Bird Island on 22nd November. Some difficulty was experienced in getting ashore owing to nearly gale force winds from the east which created a heavy sea in Bird Sound and it was necessary to stand off Bird Island and anchor in Undine Harbour for a couple of hours before the wind calmed sufficiently to make the landing possible. The delay unfortunately meant that the ship had to anchor for the night before returning to Grytviken with a subsequent increase in charter costs.

On 10th December Bonner was severely bitten in the leg by a fur seal and had to be evacuated to Grytviken for hospital treatment. PETREL arrived in very bad weather on the 11th and brought Mr. David Bashford to take Bonner's place for the rest of the intended stay there. Vaughan and Bashford continued with the planned work but were naturally handicapped by lack of experience.

On 21st December PETREL was chartered to pick up Vaughan and Bashford. The pick up was successfully accomplished and a visit was paid to Johan Harbour (Discovery Bay) to count the pups there. Weather conditions did not allow an attempt to be made to visit Willis Island or Elephant Rocks on this occasion.

The January Visit

It had been intended to arrive at Bird Island for this visit as early in the New Year as possible, as the programme involved was mainly tagging which is considerably easier when the pups are smaller, but we were requested to delay our departure till after the arrival of Kista Dan, with Dollman and LeFeuvre on board who were planning to visit Bird Island in connection with the research programme on ornithology organised by W.L.N. Tickell under the United States Antarctic Research Program. Kista Dan was late in arriving at South Georgia and after her arrival bad weather and other commitments of PETREL delayed our departure for Bird Island until 19th January. The landing was successfully made in bad weather and the tagging programme completed with the assistance of Dollman and LeFeuvre. Arrangements were made for PETREL to carry out the pick-up on 26th January but this had to be postponed for a day on account of gales. Unfortunately PETREL set out on the afternoon of the 26th and spent the night in Prince Olaf Harbour, adding considerably to the charter cost. She arrived at Bird Island at 8 o'clock on the morning of the 27th January; the gear was stowed on board and PETREL left Bird Island at 8.50 and arrived back at Grytviken at 3.10 p.m., the fastest time yet recorded for the trip.

Charter Costs

The total cost of the various charters to and from Bird Island for the season's work amounted to £1146 - 14 - 9d. This included a sum of £157 for the trip up to take Bonner to hospital, leaving £989 - 14 - 9d as the expense of the planned visits, much the same as in the previous season.

II. RADIO COMMUNICATIONS

As in the previous season a TR 11 HLS transceiver was taken to Bird Island. Radio schedules were kept with the Government radio station at 2030 local time each day and on only one occasion was it impossible to make contact. The frequency used was 2016 kilocycles as normal and 3186 kcs as a reserve should the lower frequency prove unsuitable. Communications were made from time to time with the whale boats at ranges of up to 150 miles on 1675 kcs though this frequency was too low for good communications with Grytviken whaling station. The TR 11 HLS is very suitable for this work and has proved a robust and reliable set. It was powered from two 6 volt 170 ampere-hour acid batteries connected in series and charged from a small petrol generator. These batteries are too heavy for boat work, each weighing about 80 lbs, and smaller cells could be used with advantage.

III. POPULATION STUDIES

A series of censuses was carried out during the December visit, the Main Rookery being counted at two day intervals, alternating complete with partial censuses; visits were paid to Johnson Cove and Bird Sound and the seals there counted.

Date	Bulls	Cows	Pups
23-11-61	572	770	309
25-11-61	574	1286	602
27-11-61	603	2325	1126
29-11-61	638	2691	1718
1-12-61	677	3487	2428
4-12-61	694	4244	3448
6-12-61	718	4700	4432
8-12-61	727	4922	5521
10-12-61	740	4790	6040
12-12-61	752	4687	6559
14-12-61	772	4714	7687
17-12-61	738	3508	7815
19-12-61	696	3943	8058

TABLE I Fur Seal Census Totals - 1961
Census Areas 1 - 15 (Main Rookery) only.

As in the previous season great difficulty was experienced in obtaining accurate pup totals in the latter part of the season. When Bonner was injured and returned to base Vaughan continued the counts with the assistance of Bashford. When the results of the counts are plotted on a graph it is found that the part of the curve prior to 8th December shows a steady trend but later values cause the curve to fall off more sharply than in previous years; on certain individual beaches consecutive pup counts taken after 8th December

show a decline, which is clearly impossible (the increase in the number of pups born from day to day always heavily outweighs losses due to random wandering of pups).

Arbitrary corrections were applied to the later counts and the results plotted and a smooth curve drawn through them. The final total of pups obtained in this manner for the Census Area is 8,400. The equivalent figure as given in last year's report for the same area was 8,200; this however was incorrect and should have been 8,600 for the 1960-61 season. There is thus a decline in the counted number of pups as compared with last year. It is not certain that this decline is real as counting errors in 1960 were known to have been high and it is possible that an overcorrection was made in the number of pups 6-12-60 which would have had a large influence in the final total. From the general appearance of the rookery one would say that about the same number of pups were present in the last season as in 1960; there has certainly been no considerable increase.

These results might seem to indicate that the population density on Census Area had reached saturation point but as will be seen later there has been no sudden increase of population on the subsidiary beaches which might have been expected had this been the case.

Year	Population			Final Diff.	%age 8th-final
	8th Dec	19th Dec			
1957	3175	4970	5100	1925	60.6
1958	4075	6235	6400	2325	57.1
1959	4850	7225	7500	2850	58.8
1960	5630	8255	8600	2970	65.5
1961	5525	8060	8400	2875	65.8

TABLE II Pup populations at various dates 1957-61. The column headed "Diff" refers to the difference between the pup populations on 8th Dec and final.

Besides the population on Census Area the colonies at Extra Beaches, Bird Sound, Johnson Cove and Cleft Beach (subsidiary beaches) have to be considered.

Extra Beaches was counted on 29th November and a total of 47 pups found there. Unfortunately no later count was made and it is not possible to consider that Extra Beaches has the same rate of population build-up as Census Area. A final total can be obtained by comparing Extra Beaches with Sound Beach in the years 1960 and 1961. In 1960 (when both Extra Beaches and Sound Beach were counted with a high degree of accuracy) there were 309 and 585 pups respectively on them. The 1961 value for Sound Beach (final) was 704 (see below) and this gives an equivalent value of 372 for Extra Beaches.

Johnson Cove was counted on 14th December. Using the 1958 curve for population build-up (best available) this will be equivalent to a final total of 493 pups.

Similarly Sound Beach was counted on 2nd and 15th December giving a value of 638 for the latter date, equivalent to a total of 704 as a final value. Cleft Beach, counted on the same day, had 76 pups equivalent to a final total of 84.

Final pup totals then are:-

	1959	1960	1961
Main Rookery (Areas 1 - 15)	7500	8600	8400
Extra Beaches (Area 16 On)	180	309	372
Johnson Cove	304	394	493
Sound Beach	313	585	704
Cleft Beach	-	49	84
	<u>8297</u>	<u>9937</u>	<u>10053</u>
Rounded to	<u>8300</u>	<u>9950</u>	<u>10050</u>

Year	Total Pups	Difference	%age Increase
1957	5350	-	-
1958	6800	1450	27.1
1959	8300	1500	22.1
1960	9950	1650	19.9
1961	10050	100	1.0

TABLE III Pup Populations, 1957-1961

The total pup population on Bird Island thus shows practically no change from the previous year. If however the subsidiary beaches, where population density has obviously not reached saturation point, are considered alone the increase in population is found to be 23.6%.

Year	Total Pups	Difference	%age Increase
1957	230	-	-
1958	400	170	74.0
1959	797	397	99.3
1960	1337	540	67.8
1961	1653	316	23.6

TABLE IV Pup Populations on Subsidiary Beaches, 1957 - 1961.

This however compares with a similar increase of 67.8% in the previous year, though here again too much faith cannot be put in the figures as the value for Extra Beaches 1961 is by no means certain, and is dependent on the count on Sound Beach. It can be said, however, that the expected increase of seals which should have hauled on Census Area have not hauled instead on the subsidiary beaches.

As mentioned in the first section of the report a visit was paid to Johan Harbour on 21st December. Here were counted 8 harem bulls, 36 breeding cows and 29 pups, compared with 3 bulls, 19 cows and 12 pups last year. Conditions were not suitable for visiting the other newly-established colonies commented upon in last season's report but it is hoped that next season weather conditions will allow visits to be paid to the Discovery Bay region (which includes Johan Harbour) and Willis Island. The two counts for Johan Harbour are not strictly comparable as last season's was made on 21st December while that for the previous season on 22nd January, but one can certainly say that there has been a considerable increase. The breeding cows did not appear to consist of a majority of young ones (primiparae and uniparae) though it is admittedly very difficult to age a cow that has been ashore some time.

There are several possible explanations for the failure of the herd as a whole to show the expected increase although it must be admitted that none of them are specially satisfactory.

Had mortality and the behaviour of the primiparous cows remained the same a total of about 1500 pups would have been expected if all the cows had pupped on Bird Island. It seems unlikely that mortality from birth to breeding age will suddenly have increased greatly, thus reducing the number of accessing cows. A very high mortality of adult seals on the breeding beaches was observed in 1959 and it is just conceivable that this represented an epidemic that affected the yearling class (due to be the accessing class in 1961) surely though in fact mortality of juvenile seals in 1959 was not notably high. On the other hand the great majority of yearling females are at sea. Had the general mortality of the herd as a whole increased considerably the replacements that would have had to have been made by the accessing class could have masked the increase in new breeders. Again, there is no evidence for such an increase in mortality.

Had the population density on the beaches of Main Rookery driven the accessing cows (and established breeders, for that matter) to seek hauling grounds elsewhere a much higher rate of increase would have been found on the subsidiary beaches, which was not the case, though it is conceivable that the cows might have moved further afield.

There remains the possibility that a large part of the breeding cow population abandoned Bird Island as a breeding station. The only likely cause for this would seem to be the presence of the Naval Survey Party on Bird Island last season. Fur seals are timid animals and easily scared and it seems not inconceivable that a considerable number could have been so disturbed

by the activities of the survey launches that they have sought hauling grounds elsewhere.

It will not be possible to be more definite on this matter till counts are available for next year and this raises the difficulty of making counts under the conditions of crowding on the rookery in the last two years. It is clearly impossible to make accurate pup counts over the entire rookery area single-handed after about 8th December at the latest. It is hoped, however, that until this date censuses can be made which will provide the data for constructing the first part of the curve of population build-up. If subsequently assistance can be obtained from the ornithological party that is planning to spend the summer at Bird Island next season it may be possible to make two censuses of the complete rookery after this date, the latter on or as near as possible to the 19th December. Otherwise reliance will have to be placed on sample counting. For this purpose it has been decided to select Stinker Cape and First Kill Beach as two representative ~~XXXX~~ areas, together comprising about 15% of the population in Census Area. Particular attention will also have to be paid to counting the subsidiary areas at the end of the season.

IV. EXPERIMENTAL WORK

During the November/December visit experiments were carried out to investigate the efficiency of food transfer between cow and pup. The idea being to capture preparturient cows, keep them in cages while they pupped, and weigh them and their pups daily.

To this end three cages were constructed in sections at King Edward Point and then made up at Bird Island. The cages themselves had to be large enough to hold an adult cow and her pup, as light as possible, and strong enough to resist the attentions of any bulls attracted by a cow in oestrus.

The cages were made 4'6" long, by 2'0" wide and 2'6" deep, with a 3 x 1/2" wooden framework. The walls were of wire-netting and the floor from a sheet of 'Expamet'. The weight of the completed cage with lid being about 23kg.

Weighing was carried out using a circular spring balance, 0-180 kg., suspended from a bamboo pole gantry by a block and tackle.

The cows were captured by dropping an inverted cage over them, and then sliding a lid underneath ~~at the~~ ~~side~~. Then the cage could be turned the right way up and carried back from the beach sedan-chair fashion by means of two bamboo poles. Altogether three cages were constructed and four cows captured, the first of these however being released when she had failed to produce a pup after three days. Catching the cows proved to be not too difficult especially if a small harem group was selected from which to take them.

and tying
it in place

All the animals were weighed daily, first thing in the morning, and the usual procedure was to weigh each cow complete with cage, and then to find the weight of the cow by subtraction of the known tare ~~weight~~ of the cage.

Pups were placed in a small bag and weighed by a small hand-held spring balance, 0-30 kg., This method of weighing the cows was not entirely satisfactory as the weighings were affected by the weather, heavy rainfall during the night soaked both cages and cows thus adding a little to the weight and also a strong wind while weighing was actually in progress made it difficult to obtain a steady recording on the balance.

RESULTS.

The results of the daily weighings are shown in Table V below, and the graph.

In addition to the caged animals, two other pups were also weighed daily. These were both born in Freshwater Bay, and were paint marked on head and rump so that they could be identified each morning for weighing. One of these, the Green pup, was subsequently found and weighed during the January tagging.

Date	COW 1	COW 3	COW 4
Nov 27	53.35	64.1	-
28	-	-	57.0
29	-	54.35	-
30	48.35	50.9	51.5
Dec 1	46.85	50.6	50.5
2	47.35	50.1	51.0
3	-	-	-
4	46.35	48.6	50.0
5	46.35	47.25	49.0
6	44.35	43.4	46.5
7	43.85	43.3	48.0
8	43.35	41.0	45.0
9	42.35	39.6	

TABLE V. Daily weights of three cows kept in captivity.

AS can be seen from the graph and table the daily weight loss of the cow was of the order of 1-2 kg., the pups recording a similar gain. The weights of the three pups at birth were 4.25, 4.7 & 6.7 kg, all of them males, and after 18 days they had all increased by over 50%.

Effeciency of transfer between cow and pup.

Cow 1 lost 11kg. in 13 days = 0.846 kg/day
 & Cow 4 - 10 - - 11 - = 0.910 -

Therefore average rate of loss
 = 0.878 kg/day.

Cow 3 can therefore be assumed to lose

weight at a similar rate - to satisfy her own needs.

From birth of pup to time of release she should lose

$$0.878\text{kg.} \times 11\text{days} = 9.66 \text{ kg.}$$

but her actual loss during this period was 14.75 kg. and of this 9.66 kg. were used for her own requirements thus leaving 5.09 kg. used in feeding her pup.

In this same period the pup actually gained 2.25 kg. therefore the efficiency of transfer may be calculated as

$$\frac{2.25 \times 100}{5.09} = 48.7\%$$

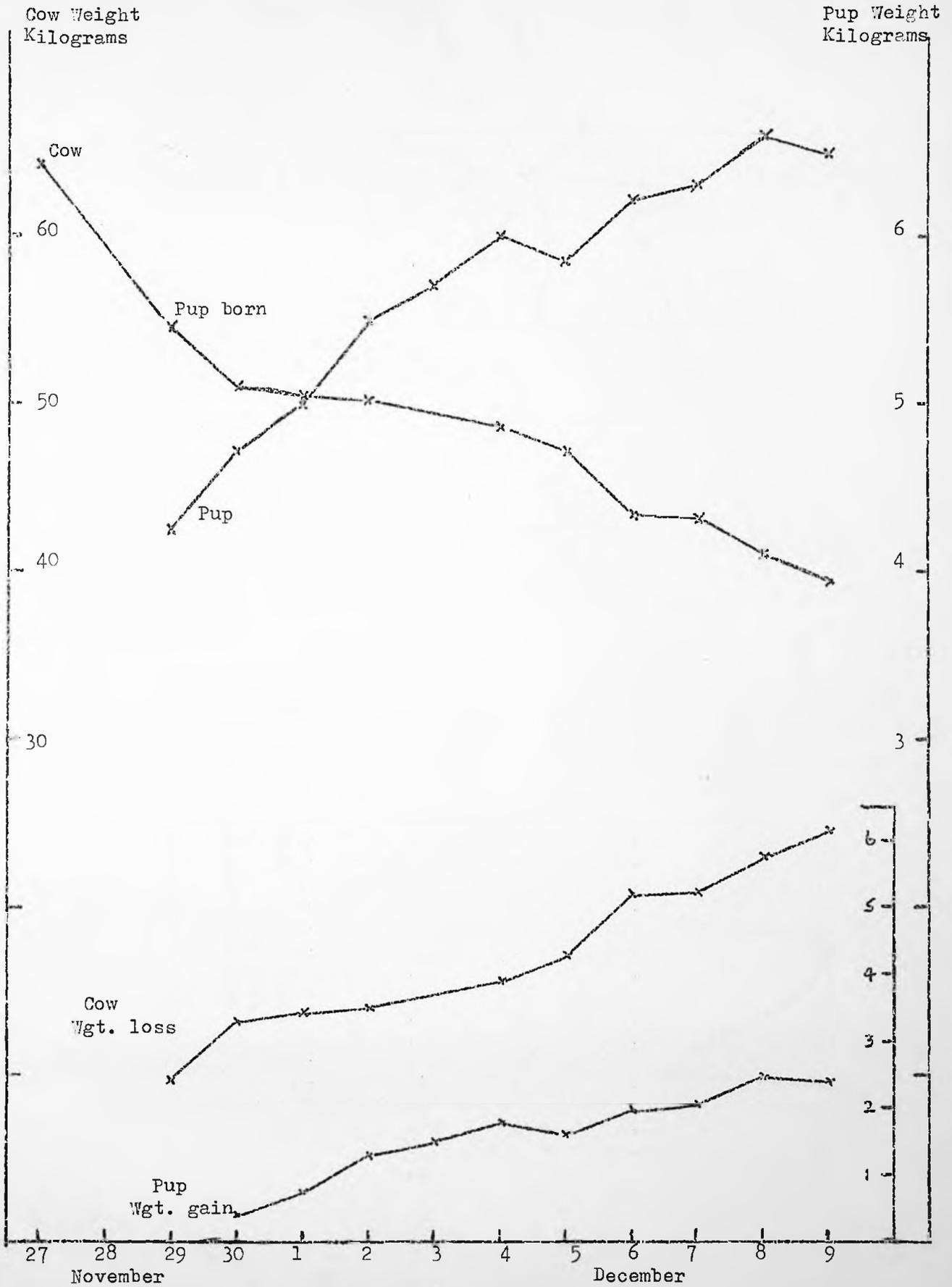
Before parturition the weight loss of the cow is much greater, in two days she lost exactly 5 kg. -- a rate of 2.5 kg/day compared with a rate of 1.34 kg/day after the birth of her pup.

Cows 1 & 4 which did not produce pups both showed a greater loss of weight during the first few days of captivity.

Cow 1 lost 1.67 kg/day for 3 days and Cow 4 2.75 kg/day for 2 days and this corresponds roughly to the pre-parturition loss of Cow 3. It is assumed that after these first few days their pups had died.

Date	Green Pup	Red Cow 3 Pup	Pink Pup
29-11	-	4.25	-
30-11	6.7	4.7	-
1-12	7.1	5.0	-
2-12	7.3	5.5	4.7
3-12	7.7	5.7	4.8
4-12	7.85	6.0	5.05
5-12	7.75	5.85	5.25
6-12	7.9	6.2	5.5
7-12	7.7	6.3	5.5
8-12	7.45	6.6	5.5
9-12	7.25	6.5	5.6
10-12	7.0	6.2	5.3
11-12	8.8	6.05	5.1
12-12	8.8	6.0	5.9
13-12	8.5	6.0	5.7
14-12	8.2	6.95	5.45
15-12	8.0	7.1	6.45
16-12	10.0	6.8	6.7
17-12	10.2	-	6.2
18-12	9.6	7.7	7.6
19-12	9.5	7.5	7.8
20-12	9.7	7.2	7.5

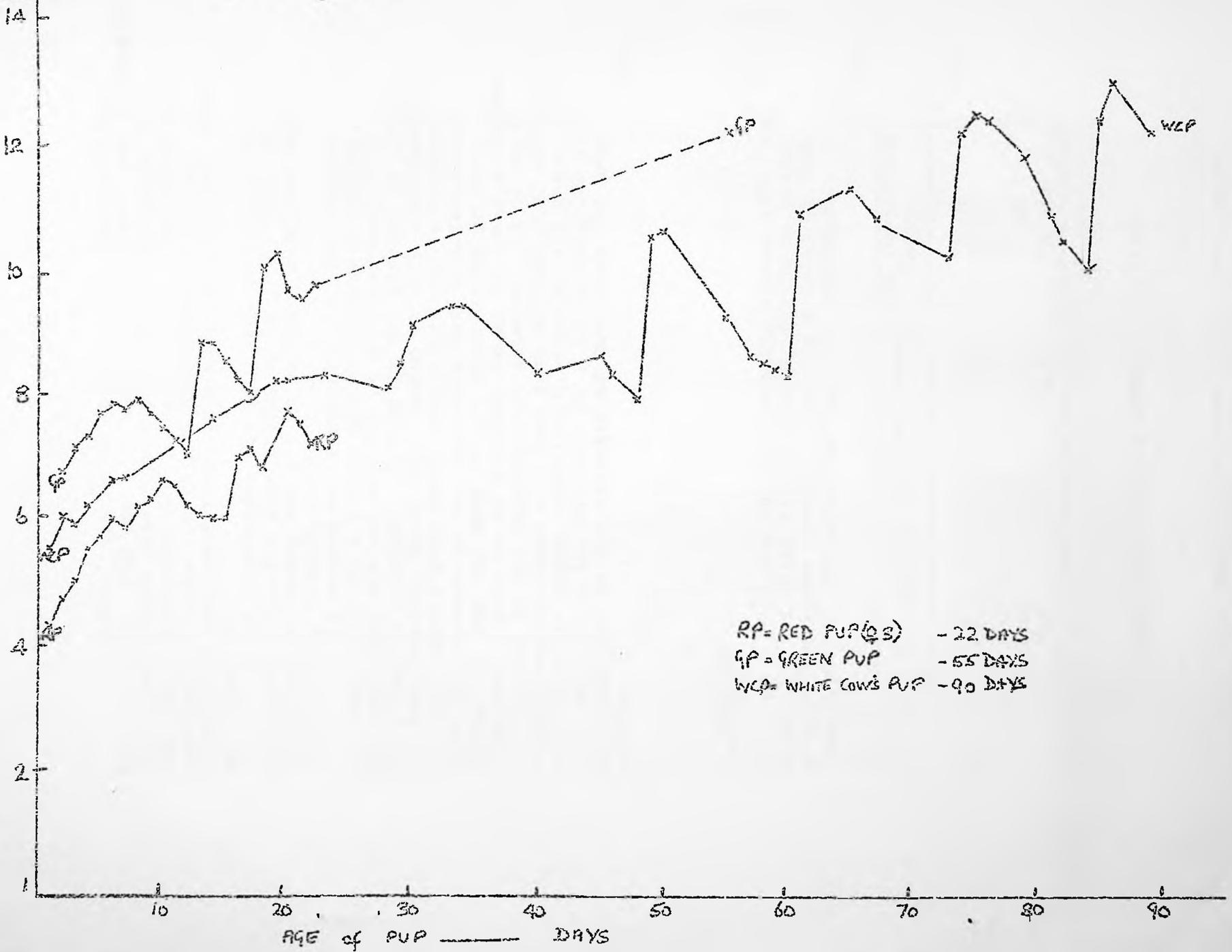
TABLE VI Daily weights of three pups in kilograms.



DAILY WEIGHTS OF COW 3 AND PUP

KILOGRAMS

GROWTH of PUPS



RP = RED PUP (♂) - 22 DAYS
 GP = GREEN PUP - 55 DAYS
 WCP = WHITE COW'S PUP - 90 DAYS

Overall the caged animals were disappointing, Cow 3 was the only one to produce a pup; Cow 1 was released after three days and Cows 2 and 4 were kept caged for ten days after which Cow 4 was sacrificed and found on examination to be carrying a dead foetus. On the assumption that conditions were similar with Cow 2 she was released.

Cow 3 provided the only real result of the experiment, and she also proved to be quite tame in captivity, allowing her pup to be taken from the cage each morning without trouble.

It should be remembered that the results are based only on a single set of cow/pup weighings, and thus lack the reliability of a larger sample of experimental animals. In view of the loss of at least two and possibly three pups caused by this experiment it would hardly seem worth repeating. It is assumed that the capture or the captivity had interfered with pregnancy, and any ~~far~~ future experiments on these lines would have to be designed so as to cause a minimum of distress to the experimental animals. It is worth noting however, that all four cows settled down extremely well in their cages, only Cow 4 being at all upset, and then usually by the presence of a young bachelor bull that remained in the vicinity of the cages for over a week.

V. TAGGING

In the 1961-62 breeding season 1300 tags were used, of which six, or 0.46%, failed to clinch or were otherwise unusable, leaving a total of 1294 tags applied. Web-punching was also continued.

Season	Tags Applied	Losses	Pup Population Tagged
1957	1718	5.4%	33.0%
1958	1185	6.6%	18.5%
1959	1395	0.5%	18.7%
1960	1195	0.4%	13.9%
1961	1294	0.5%	15.41%

Table VII Tagging Results 1957-1961

The tags applied were of the monel metal type as used in previous years, since the nylon "Rototags" ordered in London did not arrive. The tagging was carried out between 21st and 24th January, by which time the pups were greatly scattered and had mostly grown to a size that made them difficult to handle, the only advantage of the lateness of tagging being that the adverse attentions of the cows and harem bulls are at a minimum.

Tag recoveries this year have been better than ever before, altogether in the December and January

visits 24 tagged animals were identified and a number of others seen though their tag numbers could not be read. Of those identified the majority, 13, were two year old animals, the remainder being, yearlings - 5; 3 year olds - 2; and 4 year olds - 4. The yearling and two-year old animals had in addition to tags a hole punched in the first interdigital web of the hind flipper (yearlings, right flipper; two-year olds, left flipper). These holes had in most cases been completely occluded in healing but were quite easily felt as a hard pad of scar tissue in the thin skin of the web.

Perhaps the most interesting recovery was of a yearling female, tag RF 13493 (specimen number FS 83), taken in Fresh Water Bay 22nd January 1962. This is the first specimen of its class ever identified on shore, all yearlings previously examined having been males.

Tag Number	Tagged		Recovered		Age	Notes & Sex
	Date	Area	Date	Area		
LH 0285	2-1-58	1	12-12-61	2	4	FS79 F
LH 0483	3-1-58	2	19-12-61	2	4	F
LH 0641	3-1-58	4	18-12-61	4	4	FS80 F
LH 0751	4-1-58	6	17-12-61	7	4	F
RF 5038	16-12-58	6	8-12-61	6	3	F
RF 5069	16-12-58	6	19-12-61	1	3	M
LF 7026	12-1-60 8-1-60	1	12-12-61	2	2	M
LF 7116	8-1-60	1	1-12-61	1	2	M
LF XXXX 7213	8-1-60	1	1-12-61	1	2	M
LF 7282	8-1-60	1	15-12-61	Sound Beach	2	M
LF 7313	8-1-60	1	12-12-61	2	2	M
LF 7450	9-1-60	1	19-12-61	1	2 (large)	M
LF 7461	9-1-60	1	9-12-61	1	2	M
LF 7486	9-1-60	1	9-12-61	1	2	M
LF 7495	9-1-60	1	25-1-62	North Valley	2	M
LF 7696	9-1-60	2	13-12-61	2	2	FS78 M
LF 7981	10-1-60	2	2-12-61	Sound	2	M
"	"	"	15-12-61	Beach		
LF 10274	11-1-60	7	25-1-62	North Valley	2	M
LF 10469	11-1-60	7	23-1-62	4	2	M
RF 13098	26-1-61	2	24-1-62	4	1	
RF 13294	27-1-61	2	9-12-61	2	1	
RF 13493	28-1- 61 61	6	22-1-62	5	1	FS83 F
RF 13663	28-1-61	7	19-12-61	1	1	
RF 13915	31-1-61	15	22-1-62	5	1	FS82 M

TABLE VIII Summary of Tag Recoveries 1961-62

VI. SPECIMENS KILLED

During the 1961-1962 season nine fur seals were killed for scientific purposes. These were made up of ~~two~~ three males and six females. The usual specimens were collected from the animals killed. Special mention may ~~be~~ be made of FS 83, the yearling female referred to above, and FS 85, an adult cow suffering from a condition of the skin resembling mange.

Specimen	Class	Date Taken
FS 76	Adult cow	8-12-61
FS 77	3 yr cow	9-12-61
FS 78	2 yr bull	13-12-61
FS 79	4 yr cow	16-12-61
FS 80	4 yr cow	18-12-61
FS 81	adult bull	found dead
FS 82	1 yr male	22-1-62
FS 83	1 yr cow	22-1-62
FS 84	adult bull	25-1-62
FS 85	adult cow	25-1-62

TABLE IX Specimens Killed, 1961-62 season

VII. PROPOSED PROGRAMME 1962-63.

It is proposed to follow the same pattern as this year's programme, with a visit from mid-November until just before Christmas to continue with the annual censuses as suggested in the last part of section III. Also a second visit in January to apply tags as in previous years. It is also hoped that it will be possible to visit Willis Islands and places on the mainland to investigate the spread of fur seal rookeries there.

In addition to this work it is also proposed to continue investigation of fur seal skin and especially the occurrence of a type of mange found mainly in cows; and a series of experiments on temperature regulation.

ACKNOWLEDGEMENTS.

We should like to record our thanks to Captain Ole Hauge who was in charge of PETREL for all the journeys to Bird Island, and to Messrs. Dollman and LeFeuvre for assistance with the tagging.

D/27/III.

9/c

27th February, 62.

Sir,

I am directed to forward herewith for your retention:-

- (i) Report on the Sealing Industry at South Georgia
- (ii) Interim Report on the Fur Seal Investigations at Bird Island, South Georgia.

I am,

Sir,

Your obedient servant,

(sgd) H. L. Bond

for COLONIAL SECRETARY.

The Director,
British Antarctic Survey,
4, Millbank,
LONDON, S.W.1.

DRM/III.

Dec 3. 3. 62

144

g. e for information

5/3/62

145

HCS

10

Very interesting.

~~AAA~~

5.4.62

B. B.

6.4.62.

S.G. No. 627...



MEMO

TS
12
C.S. No.....

31st. August, 1963.

From:—

THE ADMINISTRATIVE OFFICER,
SOUTH GEORGIA.

To:—

The Honourable,
The Colonial Secretary,
Port Stanley.

Fur seal Report.

16. Please find herewith two copies of the following report by Vaughan.

"Report on the fur seal investigations
Bird Island, South Georgia, 1962-1963."

Officer-in-Charge,
South Georgia.

16

13

REPORT ON THE FUR SEAL INVESTIGATIONS
BIRD ISLAND SOUTH GEORGIA
1962-1963

By

R. William Vaughan. B.Sc.

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IV	Tag Recoveries	5
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BIOLOGICAL LABORATORY

KING EDWARD POINT

SOUTH GEORGIA

August 1963

I. INTRODUCTION

The programme as carried out during the 1962-1963 season turned out to be far different from that outlined in last year's report. One long visit was made to Bird Island lasting about two and half months, and it proved impossible to get to the Willis Islands to investigate the spread of the fur seal herd.

Transport to Bird Island was provided by R.R.S. "Shackleton", which was also taking three members of a U.S.A.R.P. (United States Antarctic Research Program) party to Bird Island to continue work on the Wandering Albatross and other ornithological studies, and in addition some entomological collecting.

R.R.S. "Shackleton" arrived at King Edward Point on 25th. November and left for Bird Island the following afternoon. She anchored for the night in Elsehul, and next day at first light she steamed through Stewart Strait to Bird Sound to find a heavy south-westerly swell, making all hope of a landing impossible. Captain Turnbull then returned to Right Whale Bay to await an improvement in the weather.

The following five days were spent at anchor in Right Whale Bay as the strong south-westerly winds continued and there was no hope at all of getting ashore on Bird Island. Eventually the weather moderated and we left our anchorage on the afternoon of the 1st. December. Bird Sound was still rough but "Shackleton's" crew managed to get the USARP party and myself ashore together with our personal gear, before having to return to her anchorage for the night. She returned next day and started offloading supplies, but deterioration of the weather put an end to this and she had to leave for a rendez-vous with H.M.S. "Protector" to carry out previously arranged seismic investigations. It was to be mid-January before the last of the 50 tons of stores and equipment was landed on the island.

During the time I was on the island I worked with the USARP party, living and cooking together and assisting them with their programme in return for assistance with the seal census and pup tagging. The first part was spent in erecting the three new huts to provide dry storage space, a workshop and living and laboratory accomodation. With these now in full use it will be possible for much more work to be done at Bird Island, previous programmes having been limited through lack of facilities. My programme was successfully accomplished and I was eventually picked up from Bird Island on 12th. February by helicopter and transferred to H.M.S. "Protector" and thence to King Edward Point on the same day.

II. POPULATION STUDIES.

The form of the census this year was rather different to that of previous years, normally the entire main rookery has been counted every few days, thus enabling the build-up of the breeding population to be followed and the final number of pups born to be calculated with a fair degree of accuracy. This year however I did not arrive on Bird Island until the 1st. December and the next few days were occupied in unloading stores from the "Shackleton" and then getting them stowed under cover. Consequently it was impossible to start on a census until about 5th. December by which time the rookery was so crowded as to make it very difficult to count some of the larger beaches. The proposal made last year to sample count the areas known as Stinker Cape and First Hill had to be abandoned, as the latter was very crowded and in both areas there were large numbers of seals in the tussac.

The census this year was carried out by means of a careful and accurate count on 12th. December with the aid of two members of the USARP party, and this result in conjunction with last year's figures, and by continuing to count certain selected beaches after the main census, until all the pups had been born. In this way it is possible to correct the complete census figure of the 12th. to a total which represents the number of pups born on Bird Island this year within a reasonable degree of accuracy.

In addition to the counts made on the main rookery, other counts were carried out in the subsidiary areas such as Extra Beaches, Johnson Cove, Pearson Inlet and Bird Sound. Results of these counts have been set out in the tables below.

Table 1. Full census figures 1961 & 1962.

Date	Bulls	Cows	Pups
12-12-62	783	4937	6743
12-12-61	752	4687	6559

Table 2. Census of selected beaches. Pup totals only.

Beach	12-12-62	9-1-63
BBLM4	78	109
Cleft	27	63
BOLB3	160	151
BBLB2	267	186
BBLB1	159	354
TOTAL	691	873

Table 3. Census of subsidiary areas.

Location	Date	Bulls	Cows	Pups
Johnson Cove	17-12-62	52	375	554
Bird Sound	17-1-63	43	504	596
Extra Beaches	30-1-63	-	-	390
Other Areas	-	31	108	139

(figures given above are the latest obtained from any particular area)

These figures now make it possible to calculate the final pup total for Bird Island.

Full census figure 12-12-62 = 6743

Census sample area 12-12-62 = 691

Census sample area 9-1-63 = 873

%age increase in sample area from 12-12-62 to 9-1-63

$$= \frac{(873 - 691)}{691} \cdot 100 = 26.3\%$$

So assuming that full census area has increased by the same amount:

$$\frac{6743 \cdot 26.3}{100} = 1777$$

Therefore final total = 6743
 1777
 8520

FINAL TOTAL FOR MAIN CENSUS AREA = 8520

The full total for Bird Island may now be added as

Main Census area 8520
 Subsidiary areas 1679
 10199

Say final total for 1962/63 of 10200

Total for 1961/62 = 10050

The final pup total as calculated for the main rookery in 1962-63 was 8520, an increase of 120 over the previous seasons total. This would seem to be in keeping with the small increase observed during the 1961-62 season and is an indicator that the Bird Island rookeries are reaching their saturation point.

The pup total for Bird Island in 1960 was calculated as 8600 but it seems as though this may have been a rather optimistic calculation. However the fact remains that the number of pups born on Bird Island during the last three years has not altered very much.

Table A. Pup populations 1957-1963.

Year	Pup Total	Percentage increase
1957	5100	-
1958	6400	25.5
1959	7500	17.2
1960	8600	14.7
1961	8400	-2.3
1962	8520	1.19

Discussion of this apparent saturation of breeding beaches is discussed more fully in Section IV of this report.

III. TAGGING.

During the 1962-63 season only 325 tags were applied. the reason for this small total was the failure of the new tags to arrive; these tags were a new pattern ordered the previous year from America, they were supposed to be flown to Montevideo to catch the R.R.S. "Shackleton". However they failed to reach South Georgia until the end of January, by which time the pups were too large to handle and too much dispersed in the tussac, and the tagging programme had to be carried out with the few tags remaining from last season. However 25 of the new pattern tags were applied and found to be quite successful, and on the basis of this small test a further 2000 have been ordered (March 1963) and it is hoped that they will arrive in time for next seasons tagging (January 1964). These new tags are slightly larger and it is hoped that they will be more successful especially on the larger elephant seals.

The nylon "Rototags" ordered last season could not be made to the necessary specification, so this project has been postponed pending further investigation.

Tag losses this year amounted to 2, both of which had failed to clinch properly.

Table 5. Tagging results 1957-1962.

Season	Tags applied successfully	Losses	Pup population Tagged
1957	1718	5.4%	33.0%
1958	1185	6.6%	18.5%
1959	1395	0.5%	18.7%
1960	1195	0.4%	13.9%
1961	1294	0.5%	15.4%
1962	823	0.25%	8.2%

The disappointing small number of tags applied this season is entirely due to the failure in the supply of the new tags, but it is hoped that next season a larger proportion of the year's pups will be tagged, --provided the new tags arrive.

IV. TAG RECOVERIES.

The numbers of tagged animals recovered this year has been most encouraging. To date 76 tagged animals have been identified, including 6 five year old animals. One point of interest in all these recoveries is that out of the total of 76 there is not one recovery from the 1958-59 season, although two were recovered in the previous season. At the moment the reason for this missing series is quite beyond explanation.

Table 6. Summary of tag recoveries 1962-1963.

TAG NUMBER	TAGGED		RECOVERED	
	Place	Date	Place	Date
0209	BBLB	2-1-58	Landing Beach	9- 1-63
1428	Main Bay	5-1-58	FW Bay	15-12-62
1445	Main Bay	5-1-58	Wanderer Valley	5- 2-63
1459	"	5-1-58	FW Bay	22- 2-63
1790	Point Beach	6-1-58	Landing Beach	3- 5-63
1892	BBLB	6-1-58	Square Pond	1- 5-63
7146	"	8-1-60	Landing Beach	6- 7-63
7173	"	8-1-60	Stinker Cape	30- 1-63
7572	Landing Beach	9-1-60	FW Bay	3- 1-63
7585	"	9-1-60	"	14- 2-63
7730	Iceberg Point	8 -1-60	Landing Beach	6- 7-63
7756	"	9-1-60	FW Bay	10- 2-63
7892	Point Beach	10-1-60	Stinker Cape	4- 4-63

7987	Point Beach	10-1-60	Extra Beaches	30- 1-63
10254	Main Bay	11-1-60	FW Bay	2- 1-63
			"	5- 2-63
10315	Main Bay	11-1-60	North Valley	19- 2-63
10340	"	11-1-60	Main Bay	3- 2-63
10358	"	11-1-60	Square Pond	30- 1-63
12835	BBLB	24-1-61	Sooty Cove	6- 2-63
12838	"	24-1-61	Sound Beaches	17-1- 63
12937	"	24-1-61	Landing Beach	6- 2-63
12944	"	24-1-61	"	5- 5-63
12958	"	24-1-61	Wanderer Valley	20- 3-62
13019	"	24-1-61	Stinker Cape	4- 1-63
13108	Landing Beach	26-1-61	BBLB 1	8- 1-63
13142	"	26-1-61	Landing Beach	9- 1-63
13198	"	26-1-61	FW Bay	11- 2-63
13242	"	26-1-61	"	18- 1-63
			"	19- 2-62
13243	"	26-1-61	Wanderer Valley	26- 2-62
13252	"	27-1-61	FW Bay	19- 3-62
13274	"	27-1-61	Landing Beach	17- 5-63
13277	"	27-1-61	FW Bay	9- 1-63
			"	30- 1-63
			"	6- 2-63
13395	FW bay	27-1-61	Wanderer Valley	25- 1-63
13399	"	27-1-61	North Valley	5- 3-63
13528	Stinker Cape	28-1-61	Kelp Bay	5- 2-63
13544	"	28-1-61	North Valley	12- 3-62
13642	Main Bay	28-1-61	Wanderer Valley	25- 2-62
13666	"	28-1-61	"	19- 4-63
13695	"	28-1-61	Square Pond	3- 7-63
13729	"	30-1-61	"	5- 2-63
15310	BBLB4	20-1-62	FW Bay	27- 2-63
15337	"	20-1-62	Wanderer Valley	19- 4-63
15373	"	20-1-62	FW Bay	3- 2-63
15593	BBLB1	21-1-62	Kelp Bay	5- 2-63
15594	"	21-1-62	FW Bay	4- 2-63
15637	"	21-1-62	HesteslettenECB	25- 3-63
15671	Landing Beach	21-1-62	Wanderer Valley	31- 1-63
15779	Iceberg Point	21-1-62	FW Bay	11- 4-63
			"	22- 1-63
15784	Iceberg Point	21-1-62	Iceberg Point	24- 2-63
			Square Pond	1- 5-63
15803	FW Bay	22-1-62	"	5- 2-63
15808	"	22-1-62	Landing Beach	5- 7-63
15837	"	22-1-62	BBLB	8- 1-63
15871	"	22-1-62	Wanderer Valley	5- 2-63
15909	"	22-1-62	FW Bay	6- 2-63
15954	"	22-1-62	"	21- 2-63
16217	Main Bay	23-1-62	"	1- 2-63
16241	"	23-1-62	"	9- 2-63
16258	"	23-1-63	Square Pond	11- 4-63

16344	Point Beach	23-1-62	FW Bay	20- 2-63
16353	"	23-1-62	Main Bay	3- 2-63
16398	"	23-1-62	Stinker Cape	5- 1-63
16480	First Kill	24-1-62	Round How	22- 2-63
16509	"	24-1-62	Landing Beach	8- 1-63
16540	Rock Platform	24-1-62	Main Bay	3- 2-63
16553	"	24-1-62	FW Bay	7- 1-63
16623	Kelp Bay	24-1-62	Main Bay	3- 2-63
16624	"	24-1-62	FW Bay	7- 1-63
16645	"	24-1-62	"	12- 2-63
16674	"	24-1-62	Main Bay	3- 2-63
			Square Pond	16- 2-63
17950	First Kill	5-1-63	Johnson Cove	8- 8-63

One of the interesting recoveries was that of 15637 applied at Bird Island in January 1962 and later seen at Hestesletten in East Cumberland Bay in March 1963. This animal was one of a number that have been seen in the Cumberland Bay area over the past few months. However all of these animals have been either yearling or two year olds and these age groups are usually the ones found wandering furthest from the rookeries.

Tag 0209 was also of particular interest, this was a male animal seen on Landing Beach on several occasions, but was not holding a harem. The animal was less fully developed, (small mane etc) than the harem bulls, and rather smaller than what has previously been regarded as the five year old class, but possibly this animal was an exception. All the other five year old animals recovered were female and all breeding. It is hoped that next year more five year old males will be found to see if 0209 is an animal typical of it's age group. One heartening fact is that the tags are fully satisfactory and known to last 5 years at least.

V. EXPERIMENTAL WORK.

Experimental work was continued this season on a variety of projects. A few more skin specimens were collected especially from animals showing a "mangy" condition, but as yet these have not been examined microscopically. A start was made on the collection of endoparasites, which are now awaiting identification, and also a collection of stomach contents for investigation of feeding habits.

A careful search was made in all animals collected for parasites, this included examination of the nasal and genital passages for ectoparasites, as well as the usual search for parasites of the alimentary tract. In some cases sections of the gut were washed through with

normal saline to extract the smaller Protozoan parasites that might be expected to occur. Examination of this latter material was necessarily limited due to lack of facilities at the time of collection. But now with the USARP hut in commission it will be possible to make fuller use of specimens in the field.

The collection of stomach contents proved most rewarding and a summary of the results so far is provided in Table 7, below.

Table 7. Analysis of stomach contents.

No.	Age	Sex	Date	Stomach Contents				
				Squid Beaks	Fish	Krill	Stones	Nematodes
FS79	4yr.	F	16-12-61	1	-	-	+++	-
FS80	4yr.	F	18-12-61	3	-	-	-	-
FS86	Adult	F	24-12-62	2	-	-	-	++
FS87	Adult	F	3- 1-63	-	-	++++	-	++
FS88	Pup	M	"	-	-	-	-	- Milk
FS89	1yr.	F	10- 1-63	-	-	-	-	+
FS90	Adult	F	14- 1-63	-	-	-	++	+
FS91	Adult	F	1- 2-63	-	-	-	+++	+
FS92	Adult	F	11- 2-63	1	-	-	-	-
FS93	Pup	F	11- 2-63	-	-	-	-	- Milk

In the above table it will be noted that no fish remains were found in those animals collected, but examination of the faeces on beaches indicates that fish are eaten to a considerable extent, and seals are not infrequently seen catching fish in FW Bay.

VI. EXPANSION OF THE FUR SEAL HERD.

It had been hoped that sometime during the 1962-63 season it would be possible to visit the Willis Islands and other areas in the vicinity of Bird Island to see if and how much the fur seal herd is expanding. The population on Bird Island seems to have reached saturation level, the numbers of pups born during the last three seasons being almost the same. Since the numbers had been increasing

steadily before, it is reasonable to assume that those animals which return to Bird Island to breed for the first time, will, if the breeding beaches are overcrowded, move elsewhere. The Willis Islands and the UndineHarbour/Elsehul area already support small populations and it seems possible that these could accept any overflow from Bird Island.

With the whaling station at Grytviken closed down, and the BAS ships fully committed it proved impossible to visit the overflow areas and so the state of expansion remains unknown. However when I visited Right Whale Bay at the end of November I saw numerous young fur seals, but no breeding animals. And in the Cumberland Bay area more fur seals than usual have been seen, including one tagged animal from Bird Island.

In a recent article in the "Polar Record" Dr.M. Holdgate reports a thriving fur seal population in the South Sandwich Islands, and it would be of great interest to see if any tagged animals have found their way there. This would seem quite likely since it is more than possible that the South Georgia herd is acting as a reservoir for re-colonisation of the Scotia Arc.

The shipping situation in the coming season is at the moment highly uncertain, but it is hoped that more vessels will be available than have been during this season since it is likely that at least one of the whaling stations will be operating.

VII. FUTURE WORK.

At this stage it is very difficult to decide on a programme for the coming season, but it is hoped that the routine census and tagging will be carried out, since a great part of the value of this work lies in the regularity with which it is carried out.

Every effort will be made to visit the areas adjacent to Bird Island, but this depends entirely upon the availability of shipping at the right time, and also most importantly upon suitable weather.

Studies on the fur seal diet will continue and it is hoped that it will be possible to carry out an analysis of seal milk, but this depends on the correct apparatus and chemicals arriving on time.

One factor of importance in connection with any future work on Bird Island is the USARP hut. This building will enable a four man party to stay on Bird Island for a long period in comfort, and also offers good laboratory space, so conditions at least are favourable for future fur seal work.

VIII. ACKNOWLEDGEMENTS.

I should like to place on record my thanks to Messrs. Tickell, Pinder and Clagg of the Usarp party for much valuable assistance in carrying out the seal census, and the strenuous task of pup tagging.

And to Captain Turnbull of R.R.S. "Shackleton" and Captain Graham of H.M.S. "Protector" and their crews for transport to and from Bird Island both of which took place in extremely rough weather.

The impressive list of tag recoveries is in no small way due to the USARP party who have continued to report tags since my departure from the island in February.

IX. REFERENCE.

Holdgate, M.W. "Fur seals in the South Sandwich Islands". Polar Record, Vol 11, No. 73, January 1963.

17.

J. E.,

for information.

L. E.

26.11.63

~~PA~~

25.11.63

Pa

S.G. No. 627.....



MEMO

C.S. No.....

From:—

THE ADMINISTRATIVE OFFICER,
SOUTH GEORGIA.

To:—

15th March, 1964.

The Honourable,
.....
The Colonial Secretary,
.....
STANLEY.

Report on the Sealing Industry at South Georgia 1962/63.

19
I have the honour to forward herewith 2 copies of the abovementioned Report by R.W. Vaughan, B.Sc., Biologist/Sealing Inspector, South Georgia.

Administrative Officer.

19
15

REPORT OF THE SEALING INDUSTRY

W.I.

AT SOUTH GEORGIA

SEASON 1962-1963

By

R. W. Vaughan, B.Sc.

I	State of the Industry	1
II	Elephant seal studies	1
III	Sample census	2
IV	Tagging	3
V	Discussion	4
VI	Future Investigations	5
VII	Acknowledgements	6

UNIVERSITY OF BIRMINGHAM

May 1963

I. STATE OF THE INDUSTRY

In the season 1962-1963 there was no sealing at South Georgia due to the decision by Albion Star (South Georgia) Limited to suspend all whaling operations for one season. The reason for this suspension was the falling prices for whale oil and the increased difficulty in obtaining the quota of whales. The sealing operations are normally carried out in conjunction with the whaling, the seal blubber and whale blubber being processed in the same way, thus sealing alone would not have been an economic proposition for the company.

The suspension of sealing was provisionally for one season, to see if oil prices would improve, but at this stage, May, it seems most unlikely that Albion Star will continue with any sealing operations in the 1963-1964 season.

II. ELEPHANT SEAL STUDIES

With there being no sealing operations this season, the planned work has been severely curtailed. This was to have included a repeat of the blubber experiment as carried out last season, but on a larger scale, and also further analyses of seal milk. Since there was no sealing the blubber experiment had to be abandoned, and the analyses could not be carried out since this required the facilities of the whaling station laboratory.

Furthermore the planned tagging programme was curtailed by the absence of transport, usually a seal boat, and by the fact that none of the seal tags ordered arrived on time. The first batch sent by air did not arrive until January, and so the tagging programme had to be carried out with the few tags left over from last season.

With there being no seal boats in operation, travel was severely limited, and only the Cumberland Bay area was visited during the season. It had been hoped to carry out a full census in view of the disappointing results last season, but all that was possible was a sample census in the Hestesletten area.

Other studies undertaken during the season included a continuation of the histological examination of seal skin and the start of a study on the feeding habits of the elephant seal, but as with the census this was rather curtailed by the cessation of sealing. It had been hoped to examine the stomach contents of a large number of bulls as they were killed on the beaches, in this way it would have been possible to obtain a sample of several hundred. In fact the number examined was only in the region of a dozen.

III. SAMPLE CENSUS

A sample census was carried out in the Hestesletten area of East Cumberland Bay during the season. This particular area was chosen because it was the only area of reasonable size within easy distance of King Edward Point, and also because a comparable census was carried out in 1951 by R.M. Laws, a biologist of the Falkland Islands Dependencies Survey, and the two provide an interesting comparison.

Counts were made about twice a week of the numbers of bulls, cows and pups ashore. The census area is shown on the appended map, each beach was given a name for convenience in tabulation, each of the seven being roughly the same size, although the population on each varied considerably depending upon the terrain.

These counts enabled the population build-up to be followed, and also gave useful information on the rate of pupping, date of maximum haul out and the average harem size. In addition to this census on Hestesletten I carried out two counts on Dartmouth Point, one of the seal reserves, which area was also counted by Laws in 1951

Results of the main counts on Hestesletten are tabulated below, Table 1. Also given are some figures from Laws' report (Falkland Islands Dependencies Survey Scientific Report No.13), Table 2.

Table 1. Census figures for Hestesletten 1962

Date	Bulls	Cows	Pups	Cows per Bull	Pups per Cow
Sep.5	19	0	0	-	-
Sep.9	32	0	0	-	-
Sep.12	24	1	0	0.04	-
Sep.17	26	3	0	0.11	-
Sep.21	28	18	0	0.64	-
Sep.26	40	128	12	3.20	0.09
Sep.28	35	214	33	6.11	0.15
Oct.2	41	356	109	8.68	0.30
Oct.4	32	488	193	15.25	0.39
Oct.9	32	1077	443	33.65	0.41
Oct.13	34	1155	718	33.97	0.62
Oct.18	32	1605	1169	50.15	0.73
Oct.20	30	1644	1365	54.80	0.83
Oct.23	29	1646	1434	56.75	0.87
Oct.31	40	1490	1654	37.25	1.11
Nov.5	37	1133	1790	30.62	1.57
Nov.10	29	696	1860	24.0	2.67

Table 2. Census figures for Hestesletten 1951

Date	Bulls	Cows	Pups	Cows per Bull	Pups per Cow
Sep.20	4	3	0	0.75	-
Sep.26	17	52	0	3.0	-
Oct.2	30	119	14	3.9	0.12
Oct.8	33	319	100	9.6	0.31
Oct.15	40	621	310	15.5	0.49
Oct.22	39	938	-	24.0	-
Oct.31	41	845	-	20.6	-
Nov.9	41	540	949	13.1	1.75
Nov.13	40	300	1113	7.5	3.71
Nov.19	41	192	1023	4.8	5.32

(Taken from Laws 1956)

In addition to the regular counts on Hestesletten it was also possible to carry out two counts on the Dartmouth Point Seal Reserve, and one more the corresponding figures for 1951 are available.

Table 3. Counts for Dartmouth Point 1962 (Vaughan)

Date	Bulls	Cows	Pups	Cows per Bull	Pups per Cow
Sep.24	71	243	25	3.42	0.12
Oct.26	137	2912	1892	21.2	0.65

Table 4. Counts for Dartmouth Point 1951 (Laws)

Date	Bulls	Cows	Pups	Cows per Bull	Pups per Cow
Sep.24	69	118	12	1.71	0.10
Oct.11	84	1066	621	12.57	0.58

IV. TAGGING

In view of the difficulties encountered this season in travelling about the island it was proposed to concentrate all the tagging operations on a relatively small area, and the most convenient was Hestesletten where the census had been

carried out earlier. Hestesletten is within twenty minutes walk of King Edward Point and thus is often visited by Government personnel, thus it is hoped that there will be a far greater chance than before of tagged animals being recovered in future seasons, since the seals are reputed to return to the same beach each year.

It had been my intention to try and tag every pup in the Hestesletten census area, a total of some two thousand pups, but unfortunately the tags ordered did not arrive and the programme had to be carried out with the few tags remaining from last season, a mere six hundred. Of the 600 tags used there were 7 that failed to clinch properly, due to a fault in the shape of the tags, and many others were slightly at fault and required a great deal of care in application. The distribution of these tags was entirely in Division III, being spread around Cumberland Bay.

Hestesletten	407
Dartmouth Point	75
Barff Peninsula	75
King Edward Cove	43
<u>TOTAL</u>	<u>600</u>

The new tags ordered from America arrived much too late for use, however, a few were applied to fur seal pups and it is hoped that they will be more satisfactory than the present design, further tests will be carried out next season.

V. DISCUSSION

The small census of the Hestesletten area although insignificant in itself becomes of greater interest and significance when compared with the figures obtained by Laws in 1951 when he counted the same area.

Both in 1951 and 1962 the same area was counted, the important difference being that in 1951 commercial sealing

was taking place, whereas in 1962 the population was undisturbed. A comparison of the numbers of seals ashore in the two years is interesting, the total number of pups in the area has increased in 10 years from 1113 to 1860, an increase of 67.1%. The greatest number of cows ashore at any time has also increased by 75.4%, from 938 to 1646, an interesting fact is that the greatest number recorded by Laws was on Oct.22nd in 1951, and by myself on Oct.23rd. 1962, which would seem to indicate that the date of maximum haul-out has not altered significantly.

The number of bulls has not altered greatly, the maximum of about 40 being the same for both years, although in 1962 the numbers showed rather more fluctuation. The fact that the number of bulls has not altered greatly means that the ratio of cows to bulls has greatly increased, in 1951 this reached a maximum of 24:1, but in 1962 this figure had risen to 57:1, which is rather a disturbing figure in view of the fact that no seals were taken this last season.

Apart from the bulls recorded above, which were harem bulls, a count was also made of the subordinate bulls. Subordinate bulls being those that are sexually mature but not yet large enough to hold a harem. In the area between Grytviken and the Gun Hut, where most of the subordinate bulls were found, I counted 20 on Oct. 23rd. and 54 on Nov.10th. This comparatively large number is presumably due to the fact that commercial sealing has not removed the older bulls thus leaving room for the younger animals on the breeding beaches.

This larger number of bulls was also noted by Norwegian whaling personnel, they stated that there were more animals in the vicinity of Grytviken than there had been for many years. It was also noted that the numbers of pups hauled out in King Edward Cove in December and January was far greater than in previous years and it is thought that this is due to the fact that there was far less disturbance by whaling vessels normally travelling in and out daily.

VI. FUTURE INVESTIGATIONS

In view of the fact that there has been no reliable census for a year or two, and it is quite possible that there will be no sealing for some years to come, I consider it to be of prime

importance that a full and accurate census should be carried out this season, if at all possible, so that the resources of the island will be known.

In the 1963-1964 season it is hoped to be able to carry out another census in the Hestesletten area to see how seal stocks have altered with no commercial sealing taking place. Steps have been taken to ensure that adequate stocks of tags will be available in South Georgia next season, and it is further hoped that there will be some tag recoveries to report due to the concentration of tagging in one area.

Equipment has been ordered for the laboratory and it is intended to carry out some detailed analyses of seal milk in conjunction with further studies on feeding habits.

VII. ACKNOWLEDGEMENTS

I should like to thank the management of Albion Star Limited, especially Manager Thor Thorsen, for making it possible to visit a larger part of Cumberland Bay than would have been otherwise possible, and Mr. David Bashford, Meteorological Assistant for valuable assistance with the census and tagging.

Grytviken

King Edward
Cove

Hope Point

Gull
Lake

Rocky
Beach

SAMPLE CENSUS AREA

Hobart
Rock

○ = census limits

Gun
Beach

Brown
Mountain

Seal
Beach

100'

Horse Head

Penguin
Beach

Penguin
River

Hestesletten
Beach

"Hestesletten"

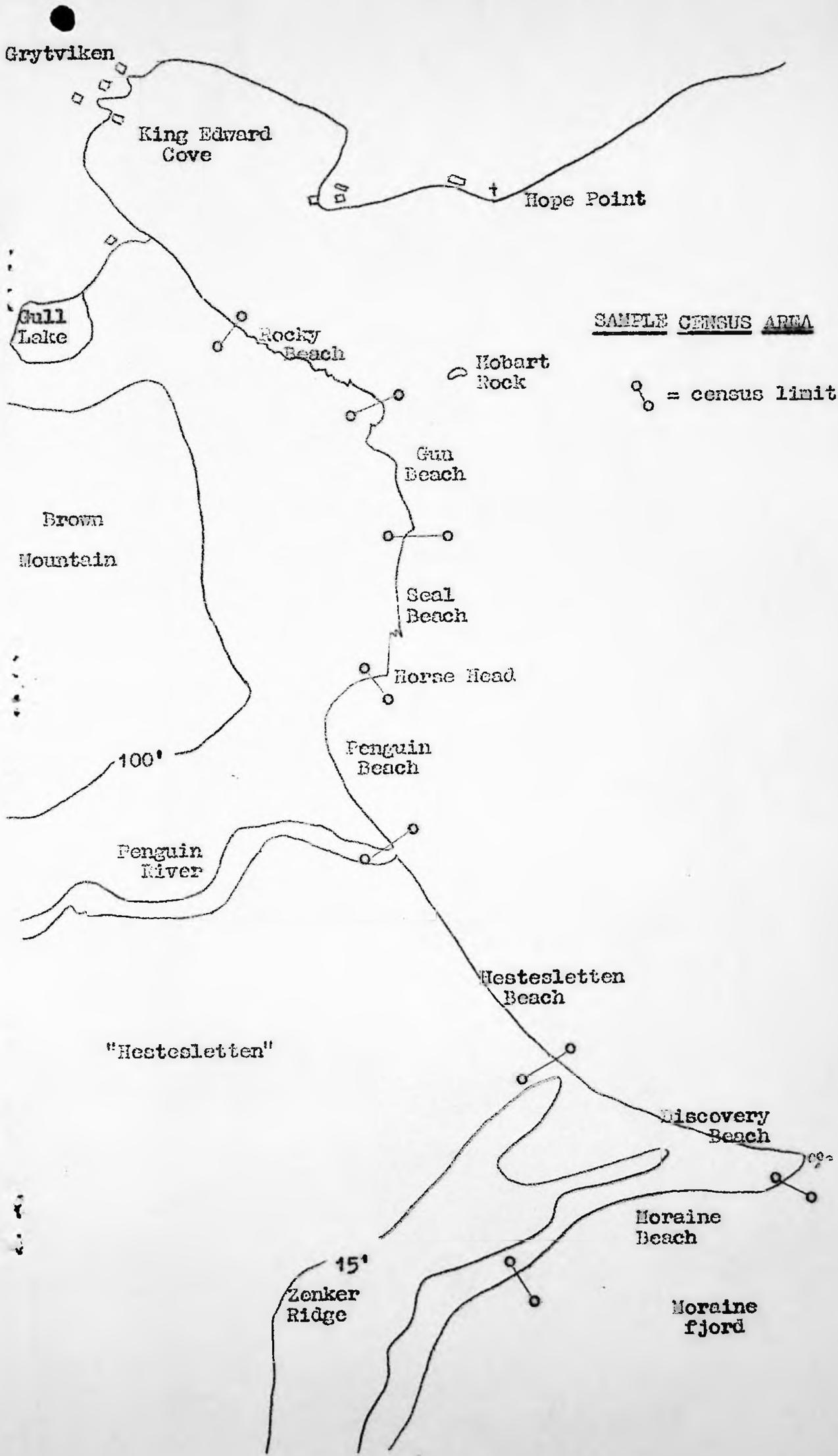
Discovery
Beach

Moraine
Beach

15'

Zenker
Ridge

Moraine
fjord





KNIGHTSBRIDGE 8303
KENSINGTON 6323 (EXT. 73)

20
16
WHALE RESEARCH UNIT
NATIONAL INSTITUTE OF OCEANOGRAPHY
C/O BRITISH MUSEUM (NATURAL HISTORY)
CROMWELL ROAD
LONDON, S.W.7



4th November, 1964.

The Honourable,
The Colonial Secretary,
Stanley,
Falkland Islands,
South Atlantic.

Yic. fyi.
S.

23. 11. 64

Sir,

Report on biological observations made at
Leith Harbour, South Georgia, 1963/64

201A
During the 1963/64 whaling season at South Georgia I had the privilege of serving as whaling inspector at the station at Leith Harbour. Together with my colleague, Mr. David Cram, I was able to carry out a series of biological observations on the whales landed, and make an extensive series of collections of anatomical material. A report on this work has been produced for the National Institute of Oceanography and I now enclose a copy for your information.

I have the honour to be,

Sir,

Your obedient servant,

Sidney G. Brown

Sidney G. Brown.

249 1.

17

REPORT ON BIOLOGICAL OBSERVATIONS MADE AT LEITH HARBOUR, SOUTH GEORGIA,
SEASON 1963/64 BY S.G. BROWN AND D.L. GRAM.

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D.L. Gram.

1. DIARY

- 27.ix.63 Left London Airport, East African Airways Flight E.C.711, for Durban via Benghazi, Entebbe, Nairobi and Johannesburg.
- 28.ix.63 Arrived Durban.
- 29.ix.63 Visited Union Whaling Company station at Durban with R. Gambell. Boarded "Miyajima Maru" for passage to South Georgia.
- 30.ix.63 Sailed from Durban.
11. x.63 Arrived South Georgia. S.G.B. with inspectors J. Dye and A. Smith to Grytviken, D.L.C. to Leith Harbour.
14. x.63 S.G.B. to Leith Harbour.
24. x.63 Whaling season opened - first fin whale caught.
28. x.63 First sperm whale caught.
7. xi.63 Catcher "Konan Maru No.20" left to join Antarctic pelagic fleet.
- 25.xi.63 Catchers "Konan Maru No.15" and "Konan Maru No.23" left to join Antarctic pelagic fleet.
- 28.xi.63 First sei whale caught.
- 30.xi.63 Catcher "Konan Maru No.7" left to join Antarctic pelagic fleet.
- 1.xii.63 to end of season. Two catchers ("Konan Maru No.10" and "Konan Maru No.11") and two buoy boats ("Konan Maru No.2" and "Koyo Maru"(No.51)) only operating.
- 12/14.i.64 D.L.C. on catcher "Konan Maru No.11"
- 19/23.i.64 First visit of "Nanko Maru" with frozen whale meat from pelagic expeditions.
- 28/31.i.64 First visit of "Hokko Maru" ditto
- 14/17.ii.64 Second visit of "Nanko Maru" ditto
- 18/20.ii.64 Second visit of "Hokko Maru" ditto
- 15/20.ii.64 Swedish reefer "Tarantella" loading frozen meat for Japan.
- 23/25.ii.64 Experimental sealing.
- 1.iii.64 Transport "Shinyo Maru" arrived.
- 5.iii.64 Whaling season closed.
- 14.iii.64 Tanker "Matsushima Maru" arrived.
- 16.iii.64 "Matsushima Maru" and "Miyajima Maru" left South Georgia for Europe and Japan respectively.
- 17.iii.64 "Shinyo Maru" sailed for Durban.
4. iv.64 Arrived Durban.

2. WHALING AT SOUTH GEORGIA, SEASON 1963-64.

In the 1962/63 Antarctic whaling season, for the first time since 1904, there was no whaling at South Georgia. In the 1963/64 season the two stations at Grytviken and Leith Harbour were in operation, both under Japanese management.

GRYTVIKEN

The Grytviken station was operated by KOKUSAI GYOGYO KABUSHIKI KAISHA (The International Fishery Company Ltd.) of Tokyo, which we understand is a combine of three Japanese whaling companies. The season lasted from 1st October to 1st December 1963. The station was then closed and all Japanese vessels and personnel sailed for the pelagic fishery. A refrigerator vessel "Koyo Maru", 7659 gross tons, was moored alongside and eight whale catchers were used. 363 fin whales and 28 sperm whales were taken; production amounting to 19,608 barrels of whale oil, 1565 barrels of sperm oil, 2869 metric tons of frozen fin whale meat, together with meat meal, bone meal and meat extract. This company also hold the sealing licence and using the sealing vessels belonging to the Albion Star Company, took 3939 elephant seals.

LEITH HARBOUR

The station at Leith Harbour was opened by NIPPON SUISAN KAISHA LTD. (The Japanese Marine Products Company) of Tokyo. The refrigerator vessel "Miyajima Maru" (9613 gross tons) was moored alongside throughout the season and all Japanese personnel with the exception of the managing director (Captain T. Miyata), lived aboard, while he and the ten Europeans on the station were quartered ashore.

The season was regarded as an experimental one, mainly concentrating on the production of frozen meat and oil. It extended from 24th October 1963 to 5th March 1964 and was divisible into two periods on the basis of the number of catcher boats employed. Six catchers and two buoy boats were at first employed, this number being reduced to two catchers and two buoy boats by the end of November, four catchers having left to join the Antarctic pelagic fleet. From 1st December until the end of the season two catchers and two buoy boats only were employed except for the four days 16th/19th February when they were all in port, their crews assisting in the loading of the "Tarantella". Details of the gross tonnage and horsepower of the catchers and buoy-boat are given in the whaling inspectors' report.

3. CATCH AND PRODUCTION 1963/64

THE CATCH

The monthly catch figures were :-

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Fin	30	119*	31+	6	3	-	189
Sei	-	1	17	215	138	38	409
Sperm	1	18	5	2	4	2	32
Totals	31	138	53	223	145	40	630

* inc. 1 lost + inc. 2 lost

The catch included 5 undersized fin whales and 7 lactating females (1 fin, 6 sei).

The season opened on October 24th and whaling started slowly with three days of no catch before the end of the month. In November there were six days without catch and the withdrawal of four whale boats at intervals during the month undoubtedly reduced the size of the catch of fin whales. The single sei whale was taken on the 28th.

With only two whale boats operating, the December catch dropped to a low level. For the first five days of the month no whales were taken and there were a further eight days without catch during the month.

Sei whales were taken steadily throughout January, ten or more being taken on nine separate days, the largest number being twenty whales on the 11th. The six fin whales were all caught during the first week of the month.

In February the catch of sei whales dropped to a little over half of the January total but this was in part a result of the catchers being in port for the four days 16/19th February. The season closed with a catch of twenty sei whales on March 5th.

The small numbers of fin whales taken in January and February reflect their absence on the whaling grounds within 200 miles of the island, so far as these could be searched by four boats. Virtually no fin whales were reported from January 6th to February 7th inclusive, and no further fin whales were caught from February 9th to the 25th inclusive.

PRODUCTION

The total production figures for the season are as follows :-

Whale oil	19126 barrels
Sperm oil	1584 barrels
Frozen meat	3654 tons
Meat meal	634 tons
Bone meal	57 tons
Salted meat	55 tons
Baleen (Finners)	10 tons
Sperm whale teeth	220 pounds

The estimated value of the whale oil was £241,944 and of the frozen meat £255,780. The total estimated value of the production was £553,882.

4. BIOLOGICAL EXAMINATION AND COLLECTIONSGeneral

With 24-hour inspection, the two inspectors each working a twelve hours shift, and with assistance promised in the collection of material, it was decided from the start of operations to attempt to examine and make collections of material from every whale taken. The numbers of whales examined in each month are listed below :-

	Fin				Sei				Sperm	
	Caught	Examined	♂	♀	Caught	Examined	♂	♀	Caught	Examined
Oct.	30	30	9	21	-	-	-	-	1	1
Nov.	119	118	58	60	1	1	-	1	18	18
Dec.	31	29	12	17	17	17	5	12	5	5
Jan.	6	6	3	3	215	215	106	109	2	2
Feb.	3	3	2	1	138	138	66	72	4	4
Mar.	-	-	-	-	38	5	2	3	2	1
Totals	189	186 (98.4%)	84	102	409	376 (91.9%)	179	197	32	31 (96.9%)

Of the 630 whales caught, 593 (94.1%) were examined and/or collected from. The percentage examined was reduced by the need to concentrate on the packing of the collections during the last week of the season.

ROUTINE ADOPTED

There are two major differences in the method of working up adopted by the Japanese at Leith Harbour and Grytviken, as compared with the Norwegian practice, a the carcass is not turned over b the different treatment of the head. Neither of these differences affected the usual routine of collection which was as follows for baleen whales.

As soon as the whale being hauled onto the plan had come to rest, it was measured with the aid of the job officer (plan foreman) and an assistant. The sex was noted and an assessment of the degree of scarring, the extent of diatom infection, and the presence of external parasites noted immediately before flensing commenced. While the belly blubber was being removed, the mammary gland was cut, measured, and its condition noted. At this time the job officer measured the blubber thickness on the flank at approximately the level of the dorsal fin.

The belly of the carcass was slit at sea and this caused the loss of a large number of the fetuses from pregnant females, and of a number of pairs or single ovaries. However, it also facilitated collection of ovaries and testes as those could often be obtained before the carcass was opened up and the ventral fillets of meat removed. The assistant was usually present at this stage and helped to obtain the ovaries or testes for later examination and labelling; the ovaries were removed to the laboratory hut/testes were immediately measured, weighed and a slice taken for sampling, at the side of the plan. The uterus was examined in females at this stage also. The amount and condition of the stomach contents was next noted and if suitable, a sample taken.

A numbered bandage label (for the ear plug) was nailed to the plate and, in the case of sei whales, the colouration of the baleen plates examined before the head was removed from the body. In the majority of cases the ear plugs were obtained by the assistant who was again present when the head was dissected separately at the rear of the plan before being taken up to the bone loft. One plug was given to the biologist with its label, the assistant kept the other for transmission to the Whales Research Institute, Tokyo. If only one plug was obtained it was taken by the biologist.

In the case of sperm whales, the routine was essentially similar except that the 10th right mandibular tooth was marked with "Magic Marker" and labelled for collection, together with a maxillary tooth, by the assistant later when the head was worked up. During the working up of the head,

the earlier count of the number of maxillary teeth was checked on the removal of the lower jaw.

WORKING SPACE AND CARE OF COLLECTIONS

The laboratory hut erected by Noel Baker inside the old Hartmann plant immediately off the plan in 1960/61 was used throughout the season. This hut is excellently fitted out with electric light, sink, running fresh water, work bench and shelving. A small electric heater was provided by the Japanese. Immediately outside the hut is ample space for the storage of boxes on dunnage, ovary barrels, and drums of formalin. Two small barrels for specimens were kept inside the hut.

All bottled material, i.e., ear plugs, small anatomical specimens, testes samples, stomach contents, were preserved in 10% formalin neutralised with hexamine. Ovaries, large fetuses, and other specimens in barrels were preserved in 10% formalin.

Ear plugs and testes samples were checked, listed, and packed for shipment at intervals throughout the season and ovaries were similarly checked and packed in barrels. This undoubtedly lessened the inevitable rush in packing the collections at the end of the season and future biologists will be well advised to adopt a similar practice.

COLLECTIONS

i Ear plugs.

The Japanese method of collecting ear plugs was used throughout the season. The routine of labelling and collection have been noted above. Ear plugs were obtained from 175 fin whales (94% of the whales examined) and of these at least 130 plugs (75%) were duplicated for the W.R.I. collections. In the case of sei whales 312 plugs were collected (83% of the whales examined) and at least 262 (84%) duplicated for the Japanese collections. Some of the sei whale plugs are very small and may not yield accurate lamination counts.

Plugs were lost because of their small size in some sei whales, and because of harpoon damage to the base of the skull in both fin and sei whales.

ii Ovaries.

Fin whales - 58 pairs of mature or doubtful ovaries were collected. Of these 49 pairs came from females of 65 ft. or more in length. This is

71% of the 69 females examined which were sexually mature on this length criterion. In addition one or two specimens of immature ovaries were collected.

Sei whales - 132 pairs of ovaries were collected, 126 pairs from females of 47 ft. or more in length. This is 67% of the 188 females examined which were sexually mature on this length criterion.

In both species, in about 30% of the sexually mature females landed, either one or both of the ovaries had been lost at sea as a result of the opening up of the carcass before towing in.

iii Testes samples.

Samples were obtained from 70 fin, 161 sei and 22 sperm whales. In all three species, specimens were collected from whales of considerable post-mortem times. In the case of fin and sei whales, samples were not restricted to animals which were obviously sexually mature, and a substantial collection of material, even though some of it proves valueless, was felt to be worthwhile since the question of sexual maturity and the sexual cycle in these species appears to warrant further investigation. To this end, all testes obtained were also measured and weighed.

iv Teeth from sperm whales.

Teeth were obtained from 30 of the 31 sperm whales examined, 27 sets of the 10th right mandibular tooth plus one or more maxillary teeth, two animals with maxillary teeth only obtained, and one with the mandibular tooth only.

Details of the method of collection are given above. It is essential to have the mandibular teeth adequately labelled since they cannot be obtained until the heads are worked up, often after a series of carcasses have been disposed of. The teeth were not boiled but roughly cleaned, relabelled and preserved in 10% formalin.

v Stomach contents.

Baleen whales - samples of stomach contents were taken from 15 fin whales and 10 sei whales at various dates throughout the season.. The size composition of the krill in four of these samples was checked during the season. Routine notes were kept on the amount of stomach contents of all whales.

Sperm whales - no complete collection of stomach contents was made

but random samples of squid beaks were taken from five whales, and additional specimens of small squids, beaks, buccal masses, tentacles, and fish remains were collected. Routine notes of the stomach contents were kept for all whales examined.

vi Personal collections.

Early in the season D.L.C. made some preliminary investigations into the anatomy of Jacobsen's Organ in adult whales and later he collected a series of specimens from foetal fin and sei whales with a view to further study.

WHALES EXAMINED

i Sexual maturity in female whales.

The numbers of sexually mature female animals in the catches of fin and sei whales were estimated in two ways. First, from the length records, assuming that female fin whales of 65 ft. or more, and female sei whales of 47 ft. or more, in length are sexually mature. Second, from the evidence of the ovaries examined and/or the presence of foetuses. The results were -

	Fin			Doubtful	%	Total
	Mature	%	Immature			
Length Records	69	67.6	33	-	-	102
Examination	58	68.2	23	4	4.7	85

	Sei			Doubtful	%	Total
	Mature	%	Immature			
Length Records	202	95.7	9	-	-	211
Examination	174	96.7	5	1	0.6	180

J.L. Bannister in the 1960/61 season obtained comparable results though the percentages of sexually mature females were lower in both fin and sei whales, 56.8% and 83.5% respectively.

ii Pregnant females and foetuses.

It has already been noted that a large number of foetuses were lost at sea. Examination of the ovaries for corpora lutea, with the addition on occasion of an examination of the remains of the uterus, provided the following evidence of the numbers of pregnant females.

	Mature females	Pregnant females	%	Possibly Pregnant	%
Fin	58	34	58.6	12	20.7
Sei	174	111	63.8	12	6.9

Bannister in the 1960/61 season obtained figures of 52.4% for fin whales and 68.9% for sei whales.

Ten fin whale fetuses were sexed and measured and 9 of them weighed. Ovary examination indicated the presence of one pair of twins which were lost at sea.

Thirty-one sei whale fetuses were measured, including one pair of twins and 27 of them (including the twins) were weighed. Two more sets of twins and one set of triplets were indicated by examination of the ovaries but they were all lost at sea. One female (SGL.375) was simultaneously pregnant and lactating.

iii Diatom film, scars, blubber thickness.

An assessment of the numbers of scars present and of the extent of any diatom film present, was made on as many whales as possible. Measurements of blubber thickness were obtained for virtually all the whales landed. No analysis has yet been made of these data.

iv Parasites.

No systematic search for external or internal parasites was made but one or two specimens of Penella and tapeworms were collected. The presence of Balaenophilus on sei whales was noted at intervals in January and February and two samples were collected.

v Stomach contents.

With the co-operation of Job officer Kawaguchi, the stomach contents of two sei whales were weighed.

In the case of SGL.599, a female 48 feet long, the first stomach was full of part-digested medium/large krill, and the second/third stomachs about half full of digested krill. The contents of the first stomach were weighed - 305 kg.

The entire stomach contents of SGL.600, a male 49 feet long, with all three stomachs full of freshish and part-digested krill, weighed 175 kg.

vi Baleen plate colouration in sei whales.

Examination of the baleen plates of sei whales to check the presence of white plates at the front of the series revealed the presence in many whales of black plates with a yellowish-white inner margin of varying width. These plates often extended for a third or more of the length of the side of

baleen. Records of the occurrence and extent of these "two-coloured" plates were kept for some 100 males and 90 females.

5. ITEMS OF INTEREST

WHALE MARKS

One whale mark No.6649 was recovered at Leith Harbour. It was found in a female fin whale 76 feet long shot on the 4th November 1963 in position 56 34'S, 39 37'W. The mark was fired on the 3rd January 1937 in position 54 25'S, 34 14'W, during marking around South Georgia in the 1936/37 season. Ear plugs were obtained from this whale and the lamination number should be of considerable interest as a check on the rate of laying down of laminations. Unfortunately the ovaries were lost.

SIGHTING RECORDS

With the co-operation of the catcher crews and watch-keeping officers of "Miyajima Maru", a record of whales sighted by the catchers during the voyage from Durban to South Georgia was kept. During the seven days when weather conditions were suitable for seeing whales, a total of 54 whales were recorded (4 fin, 40 sei, 2 right, 8 sperm).

Similar records of sightings of blue, humpback and right whales were kept during the whaling operations around South Georgia and while no blue or humpback whales were seen, at least 24 right whales were recorded. An excellent photograph was obtained of one animal.

In response to a request from L. Tickell, working on albatrosses at Bird Island, records of sightings of pink-dyed Wandering Albatrosses were kept by the four catchers from the beginning of February. 26 sightings of 33 birds were reported.

JAPANESE BIOLOGICAL WORK

During preliminary discussions on the programme of biological work with the manager, it became apparent that the Whales Research Institute, Tokyo, had asked the company to make collections of blood samples and ear plugs. In view of this it was decided not to take any blood samples ourselves and to arrange for both ear plugs to be collected from each whale where possible, one plug being kept by ourselves and the other by the Japanese. A large collection of plugs was thus obtained for the W.R.I., together with a representative series of blood samples.

One or two isolated proportional body measurements were taken at the beginning of the season by the job officers but this work was abandoned later, though a rough estimate of the length of the main meat fillets from each whale was kept during the latter part of the season for the company's records. At the close of the season, a small amount of anatomical material, together with krill samples, were taken. It was not clear whether these were destined for the W.R.I. or the company's collections.

SEALING

The sealing licence was held by the company operating from Grytviken but the Administrative Officer gave permission for 101 elephant seals to be taken by N.S.K.Ltd. during February, under the supervision of the sealing inspector Mr. W. Vaughan. One bull was shot at Stromness station on the 6th February and was weighed in pieces. It measured 13 feet nose to tail (over the curve of the back) and weighed 987 Kg. (2177 lbs.). From 23rd to 25th February inclusive a further 57 bulls were taken in Fortuna Bay and at points in Cumberland East and West Bays, yielding a total of 115 barrels of oil. One of these animals was also weighed as before; measuring 11 feet 16 inches, it weighed 943 Kg. (2078 lbs). A joint note with Mr. Vaughan detailing these weights has been written.

FISHING

A number of fishing trips were made locally in Stromness Bay and large numbers of "rock cod" and "crocodile fish" were obtained of about one foot average length. One experimental offshore fishing trip was made but the catch was disappointing, only a few similar fish of about two to three feet in length being taken. In all 5.9 long tons of frozen fish were obtained. Trials were also made with crab traps, both in Stromness Bay and offshore but without success. It is understood that further experimental fishing will be undertaken next season.

6. EQUIPMENT AND GENERAL CONDITIONS

The equipment provided was generally adequate but in the case of a few items the quantity was insufficient. If two biologists work at one station in future and it is envisaged that the greater part of the catch will be examined, it is suggested that the quantities of the following items be increased - glass tubes, string, staples, Imperitype notebooks, Paramount

punch cards.

The four barrels proved inadequate and three additional rum barrels were obtained from the station. Thanks to the help of Mr. McKenzie (Salvesen carpenter) the barrels were expertly coopered and bungs provided, but without his assistance, this would have proved a major difficulty. The perennial question of providing some form of container for large specimens and ovaries, other than barrels, seems to be worth considering again.

The provision of adequate labels for the identification of the ear plugs collected was solved by using rolls of 2" bandage obtained from the hospital at Leith, marking each with the serial number of the whale using "Magic Marker", and attaching to the palate by two small nails. It will be necessary to provide bandages and nails for this purpose if ear plugs are to be collected by the Japanese method in future and it will be of considerable assistance to the biologist if these can be prepared as labels beforehand.

The amount of formalin is more than adequate and seven drums accumulated from the present and previous seasons have been stored in the laboratory hut together with a small number of 5 lb. and 5 lb. jars which were found in the hut on arrival. A number of 5 lb. and 7 lb. jars were used for stomach samples of krill and if similar collections are to be made in future, a larger supply of these jars may be necessary.

The 20 Kg. and 300/400 lbs. balances were both invaluable. An additional even lighter balance would have been useful on occasion for weighing small foetuses, immature ovaries and testes, etc.

The publications provided were excellent but the addition of a copy of Slijper's book would be invaluable. Since Alexander's "Birds of the Ocean" is provided, biologists working at South Georgia might welcome the provision of some information on elephant seals and charts of the island and of its approaches are necessary.

The company provided a part-time assistant on each shift whose duty it was to help the job officer and biologist/inspector in measuring the whale, to collect blood samples and ear plugs for the Whales Research Institute, and to assist the biologist at intervals during his other work as meat cutter, etc. We found it most useful to employ the assistant in helping in the collection of ovaries, testes, and ear plugs, and in the measurement and weighing of foetuses.

The information obtained by the job officer relating to post-mortem times, blubber thickness, and other matters relating to inspection, was all written up on a bulletin board in his hut on the plan and was freely available. The job officers and assistants were usually reliable though the records of stomach contents were occasionally inaccurate and there were the inevitable clerical errors at times.

ACKNOWLEDGEMENTS

We both wish to record our very sincere thanks to Captain T. Miyata, Mr. S. Hirabayashi (manager), and their staffs, for the ready and friendly co-operation they gave us at all times throughout the season. In particular our thanks are due to Mr. S. Seki (whaling officer), Senior Job Officer Suda, Job officers Kawaguchi and Sasaki, and our assistants Cho and Toribami, all of whom gave us the fullest co-operation. Our thanks are also due to the captains, gunners and crews of the catchers and buoy boats for their help in recording whale and albatross sightings and we are especially indebted to Captain Nakatani of "Konan Maru No.11" for his hospitality during D.L.C.'s voyage with him.

Mr. W.F. Lynch of Salvesens helped in innumerable ways and we also much appreciate the help and co-operation we received from Captain D.J. Coleman and his staff at King Edward Point.

OBSERVATIONS MADE ABOARD WHALE CATCHER "KONAN MARU NO.11"
12-14th JANUARY, 1964.

1. INTRODUCTION

Due to the kindness of the N.S.K. management, Leith Hbr., South Georgia, I was able to make a short trip on their whale catcher Konan Maru No.11. The duration of the trip was originally intended to be about one week, unforeseen circumstances reducing the time to three days. During this time I was able to make a few observations on whales chased and caught and on the activities of killer whales round buoyed carcasses.

2. SUMMARY

Observations of respiration rates were made on three sei caught on 12/1/64.

Observations on the speed of retrieving a buoyed carcass were made on No.10 Konan Maru's sei whale on 13/1/64.

Observations on killer whale activity made on 13/1/64.

Operation	1st Sei	2nd Sei	3rd Sei
	Time in minutes		
Whole operation (sighting to resuming search)	42	60	52
Sighting to killing (i.e.chase)	27	49	39
Killing to buoying	8	11	13
Killing to resuming searching or chasing	15	12	14
Reloading whale gun	11	4	n.o.
Picking up buoyed carcass	7		

3. SUBJECT MATTER

a) Vessel.

Name : Konan Maru No.11

Captain T. Nakatani

Gross tonnage : 742.06

Light draft : 3.52 metres

Engine H/P : 3280 (single diesel)

Speed (max.) : 17.9 knots

Length O/A : 64.13 metres

Speed (loaded) : 14.0 knots

Beam : 9.7 metres

Built by : Hitachi shipbuilding
Co. Ltd.,
Mukaishima, Japan.

Depth : 4.10 metres (distance
between maindeck and
base of keel)

Date built : November 1953

Full draft : 4.27 metres

Date launched : June 1954

Date completed : August 1954

b) Observations on whales.

S.
 N.I.O. Stopwatch (No.496) was used for timing intervals between blows.

- 12.1.64
- 13.50 Left Leith harbour.
- 14.00 No.10 Konan Maru reported three Right whales 45 miles N.E. of Cape Saunders (53°40'S)(35°37'W).
- 14.40 Lookout in barrel reported a blow, searching commenced visually and by sonar.
- 15.00 Gave up.
- 17.30 No.10 Konan Maru reported a kill and informed us that sei were swimming S.W. towards us.
- 18.00 Confirmed direction S.W. speed increased to maximum, i.e. 16 knots in conditions of moderate swell.
- 18.45 Blow reported from barrel, one whale.
- 18.50 Possibly two whales.
- 18.55 Gunner on platform.
- 19.00 Possibly four sei. Range approx. two miles. The whales were blowing irregularly making it difficult to time individual respiration rates and impossible to assess that of the whole school. At a range of 300 metres the school split up whilst submerged. Time between blows 1m.11sec. 1m.3sec. alternate.
- 19.12 Hit. 19.14 Hauling in commenced.
- 19.17 Alongside. 19.20 Buoyed.
- 19.23 Gun fully reloaded. 19.27 Chasing two sei.
- 19.32 Sounded 2m.17 sec. both close together blowing within one second of each other.
- 19.39 Lost sonar contact
- 19.44 Blow relocated at one mile.
 1m.50sec. 200 metres.
 1m.6 sec. 100 metres.
 Two sei about 20 metres apart
 approx. 22 seos. to reach blow wakes.
 0m.51sec. one only.
 School split up while submerged.
 1m.18sec. one only.

- 19.56 Rejoined each other.
 0m.51sec.
 Both whales making very tight turns while submerged, at times completely reversing direction, or circling.
 1m.3sec. approx. 60 metres.
 0m.35sec. " " "
- 19.58 Fired - miss.
- 20.02 Gun completely reloaded using alternative whale line.
- 20.04 0m.41sec. }
 0m.43sec. } alternate
- Two sei blowing within one second of each other.
 2m.35sec. at 60 metres.
 Continually making tight turns and circles.
 0m.41sec., close, one sei only.
 6 seconds to blow wake.
- 20.13 Turned complete circle and continued in original direction.
 1m.9sec.
 Blow wake 10 seconds in front.
 1m.21sec.
- 20.16 Hit. 20.27 Buoyed.
 Meanwhile the other whale of the school was being observed and chased but no observations were made - tea time.
- 20.40 (app.) Hit sei still alive.
 0m.32sec. 0m.13sec. }
 0m.23sec. 1m.20sec. }
 0m.23sec. 0m.10sec. } alternate dives.
 0m.13sec. 0m.8sec. }
 0m.12sec. 0m.11sec. }
 0m.10sec. }
- During the time this series was timed the whale was being hauled in slowly by winch. Most of the time the catcher engine was stopped, occasionally slow ahead.
- 21.00 2nd harpoon either a miss, glanced off or passed through the animal as the explosion of the grenade was visible under water.

Om.11sec.	Om.13sec.	} alternates dives.
Om.15sec.	Om.16sec.	
Om.15sec.	Om.27sec.	
Om.16sec.	Om.14sec.	
Om.17sec.	Om.15sec.	
Om.14sec.	Om.15sec.	
Om.15sec.		

21.07 3rd harpoon killed the whale.
 21.20 Buoyed.
 23.00 Catcher stopped engines and drifted until 04.00 13/1/64.
 13/1/64.

One sei obtained early during breakfast.

One sperm after a short chase, lookout originally reporting two sperm, one sounded and did not reappear. Sonar was unable to locate it. Due to the activity of killer whales the Captain decided to pick up one sei shot by K.M. No.10, pick up his own sei and sperm and tow them south to meet the buoy boats returning to the fishing ground. Picking up the whales was accomplished quickly.

09.12 Flag picked up.

09.13 Buoy picked up.

The whale had to be turned through 180° into the towing position, this was accomplished by holding the tail strop on a bollard and going slow ahead, the pressure of the water turning the carcass to the required position.

09.16 Tail chain fitted and winched tight.

09.19 Body chain fitted and winched tight.

c) Sonar (asdic)

Sonar apparatus was fitted to all N.S.K. catchers; it is always used during the chase, with notable effect as on one occasion only during the time I observed it in action was the apparatus distracted by bubbles, Euphausiids or other phenomena.

The controls of the sonar apparatus were situated in a glass walled cubicle situated above and behind the compass bridge. During the chase the helm and engine were indirectly controlled by the sonarman. The

practice was for the sonarman to issue orders relating to engine speed or helm which were immediately obeyed by the quartermaster at the wheel or chief engineer at the telegraph.

The chief radio operator was sonarman.

d) Killer whales.

Killer whales were active round two sei carcasses picked up on 13/1/64. None were visible around the sperm. When both sei were alongside killer whale attacks continued both while under way and stopped to retrieve the sperm. While the catcher was moving at 11 knots a large killer whale kept pace and I was able to time blowing intervals for a short while.

16.0 15.0 18.0 15.0 12.5 all consecutive.

The killer whales were taking tongues and all blubber except belly blubber. While removing tongues the killer whales penetrated the mouths of the carcasses until only the flukes were visible at the tip of the carcass jaws.

On diving onto their prey, or feeding, the killer whales released a powerful jet of air from the blowhole, clearly visible in the clear water.

In between attacks the killer whales retired to about 60-100 metres and blew at irregular intervals before returning to feed. They eventually succeeded in removing the tongue and entire posterior blubber on one sei and the tongue and about 50% of posterior blubber on the other. No attacks on the sperm carcass were witnessed.

Assessing the length of these animals was difficult, some appeared to be 10-15 feet long while others about 25 feet; the smaller animals being more numerous than the large ones. There were about five animals round each carcass.

While feeding, the killer whales ignored all attempts to distract them, being indifferent to jabs from knives on long poles or the poles without knives. At this stage the catchers were not equipped with rifles. Towards the end of the season Chr. Salvesen's representatives lent .303 rifles to the Japanese. The rifleman on No.11 K.M. informed me that he had shot at about 50 animals and killed about 10, the others being merely wounded.

140
18
BRITISH ANTARCTIC SURVEY

BIOLOGICAL UNIT

DEPARTMENT OF ZOOLOGY,
QUEEN MARY COLLEGE,
MILE END ROAD, LONDON, E.1.
TELEPHONE: ADVANCE 4911



a.d.

Herewith copies of W.N.Bonner's papers
with the authors and our compliments.

Walter Holdgate

13.1.65

POLYGYNY AND SUPER-NORMAL CLUTCH SIZE IN THE BROWN SKUA, *Catharacta skua lönnerbergi* (Mathews)

By W. NIGEL BONNER

ABSTRACT. A nest containing three eggs of the brown skua was found at Bird Island, South Georgia, in December 1961. The nest was attended by three adult skuas, one cock and two hens, which shared in the incubation duties.

Details are given of the eggs and embryos and the measurements of the adults. Ten normal clutches of two eggs each were collected and described for comparison.

The situation is discussed in relation to the normal behaviour of skuas and a possible mode of formation of the trio is suggested.

DURING the course of biological investigations at Bird Island (lat. 54°00'S., long. 38°05'W.), South Georgia, the nest of a brown skua, *Catharacta skua lönnerbergi* (Mathews) was discovered containing three eggs. At the time of the finding the eggs were being incubated by one skua while two others were standing a couple of yards off making the typical raised-wing threat display (Fig. 1). The nest was situated about 10 m. above sea-level at the edge of a small clearing surrounded by a dense growth of tussac grass (*Poa flabellata*). The extent of the territory was not determined but it was unlikely to have been more than some 20-30 m. in diameter owing to the presence of other nesting skuas in the neighbourhood.

The nest site was visited on three occasions, 7, 9 and 10 December 1961, and on all occasions the territory was occupied by the three adults tolerating each other's presence amicably and sharing in the duties of incubation and territory defence. Their behaviour was in all respects similar to that of normal skua pairs in South Georgia, save that besides the incubating bird two other adults were on guard in the vicinity of the nest. These very brief behavioural observations were brought to a close when the author was compelled to return to base. The clutch and the three adults were collected and later examined.



Fig. 1. The skua trio at the nest (right foreground). The bird displaying is the hen (specimen 1) and bears a plastic spiral applied in the season 1958-59. The incubating bird, on the right, has been pushed off the nest to show the eggs.

TABLE I. MEASUREMENTS OF ADULTS

	1(♀)	2(♂)	3(♀)
Weight (kg.)	1.9	1.6	2.0
Wing* (cm.)	67.5	64.5	66.9
Tail (cm.)	16.7	16.2	15.5
Culmen (mm.)	57.0	57.0	56.5
Upper mandible† (mm.)	81.0	78.0	79.5
Foot‡ (cm.)	17.8	16.7	17.8
Tarsus (mm.)	94.0	92.0	94.0

* Axilla to tip of feathering.

† Tip to gape.

‡ Tip of middle claw to proximal end of tarsus.

THE SPECIMENS

Dissection of the three adults revealed that they comprised two hens and a cock (for details of measurements see Table I). In all cases the gonads were considerably involuted. The ovaries of specimens 1 and 3 weighed 0.71 and 0.84 g., respectively, and the testes of specimen 2 weighed (right) 0.21 and (left) 0.29 g. (Table II; Fig. 2). The largest follicles in the ovaries, which were but slightly vascularized, were (1) 4.3 and (3) 5.1 mm. in diameter (Table II). The state of vascularization of the testes could not be studied as both showed great suffusion of blood from the wound where the bird was shot. The only information to be gathered from the gonads is that all showed a state of involution which could have followed a period of sexual activity. As the two ovaries were closely similar, and it can be safely assumed that at least one of the hens had contributed to the clutch found, it may be concluded that both hens had ovulated.

Externally the eggs (Fig. 3) were similar in appearance; all were of an olive tinge with rather sparse brown blotching somewhat concentrated at the blunt end and with the blotches rather larger in size than is commonly observed in skua eggs from South Georgia. One egg, A, had a greener hue than the other two but the colour difference was considerably less than is often observed in normal clutches of two. The size differences were minimal and the weights

TABLE II. SUMMARY OF GONADS

	1(♀)	2(♂)	3(♀)
<i>Ovaries</i>			
Dimensions (mm.)	25.5 × 9.5		30.8 × 8.9
Weight (g.)	0.71		0.84
Largest follicle (mm.)	4.3		5.1
<i>Testes</i>			
Right, dimensions (mm.)		12.4 × 6.6	
weight (g.)		0.21	
Left, dimensions (mm.)		13.9 × 7.1	
weight (g.)		0.29	



Fig. 2. The gonads from the three adults.

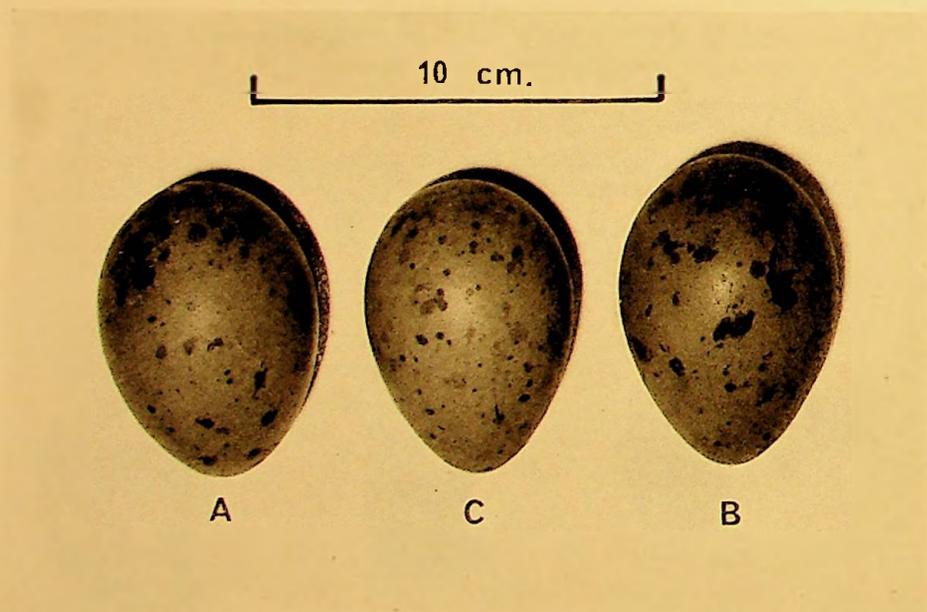


Fig. 3. The clutch of three eggs.

corresponded very closely to the measured capacity of the eggs (Table III). On opening the eggs it was apparent that there were considerable differences in the degree of incubation of the embryos (Fig. 4). The embryo from egg A weighed 12.85 g. and measured 81 mm. from the tip of the beak to the tail; embryo B weighed 19.00 g. and was 92 mm. long, and embryo C weighed 34.80 g. and was 109 mm. long (Table III). The differences in size (and,

BRITISH ANTARCTIC SURVEY BULLETIN

TABLE III. SUMMARY OF EGGS AND EMBRYOS

	A	B	C
<i>Eggs</i>			
Colour	olive (green)	olive (brown)	olive (brown)
Dimensions (mm.)	74.1 × 53.2	78.4 × 53.0	74.2 × 51.9
Capacity (cm. ³)	100	102	94
Weight (g.)	100	103	96
<i>Embryos</i>			
Weight (g.)	12.9	19.0	34.8
Total length (mm.)	81.0	92.0	109.0
Upper mandible* (mm.)	16.5	18.5	19.0
Foot† (mm.)	23.0	28.5	37.5
Wing‡ (mm.)	34.0	37.5	41.0
Head§ (mm.)	30.0	34.0	40.5

* Tip to gape.

† Tip of middle claw to proximal end of tarsus.

‡ Axilla to tip, exclusive of feathering.

§ Tip of beak to back of cranium (maximum measurement).

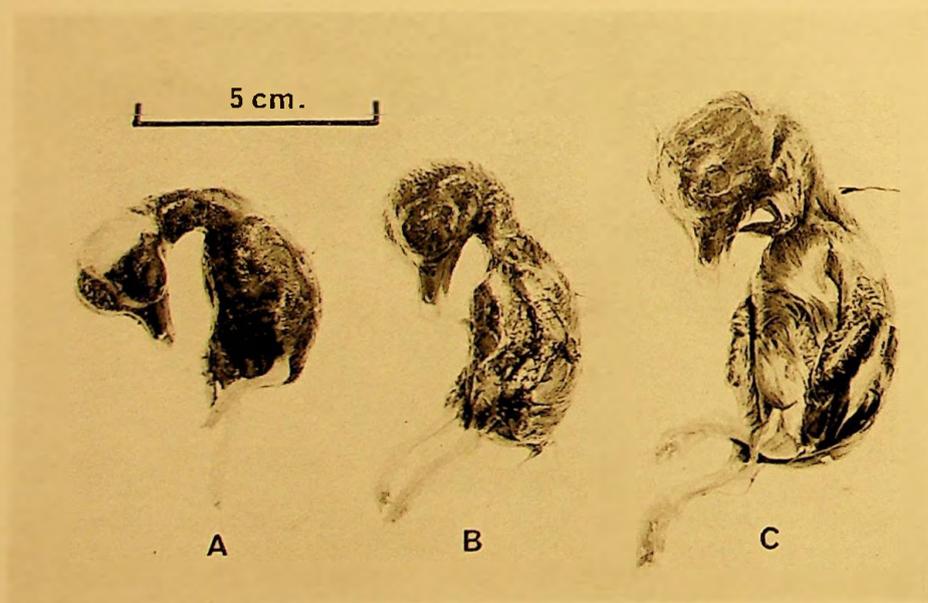


Fig. 4. The three embryos.

presumably, age) of the embryos show rather uneven stages in development, the difference between B and C being about twice as great as that between A and B.

For comparison with the clutch from the trio, ten normal clutches of two eggs each were collected in the same locality between 13 and 15 December. Details of these clutches are shown in Table IV. Of the ten clutches, three showed colour differences greater than that

TABLE IV. DETAILS OF TEN NORMAL CLUTCHES OF TWO EGGS EACH

Clutch	Egg Size			Colour
	Length (mm.)	Breadth (mm.)	Weight (g.)	
1	77.0	54.2	101.6	Dark olive, heavy spotting Paler olive, heavy spotting
	74.9	53.0	92.9	
2	76.7	52.5	96.5	Greenish, pale medium spotting Greenish, pale medium spotting
	79.7	50.9	97.2	
3	76.5	52.6	102.6	Tawny, dense large spotting Tawny, dense large spotting
	74.1	53.0	104.6	
4	73.2	48.4	84.2	Pale greenish, dense small pale spotting Pale greenish, dense small pale spotting
	72.0	48.9	83.7	
5	73.0	49.3	84.5	Pale greenish, sparse small spotting Pale greenish, sparse small spotting
	76.7	48.0	84.9	
6	78.4	52.3	108.3	Brownish, heavy apical spotting Pale brownish, sparser spotting
	78.2	52.0	107.2	
7	73.6	52.0	95.0	Brownish, dense small spotting Brownish (paler), paler spotting
	73.9	50.5	90.3	
8	72.8	52.8	100.0	Brownish, sparse large spotting Pale brownish, moderately dense spotting
	76.1	52.5	98.7	
9	74.5	54.2	96.8	Greenish, large sparse spotting Greener, large sparse spotting
	71.0	49.0	75.5	
10	71.8	49.3	82.0	Brownish, large sparse spotting Greenish, large sparse spotting
	71.0	49.6	80.0	

TABLE V. EMBRYO WEIGHTS COMPARED

Clutch	Embryo Weights (g.)		Difference (g.)	Percentage Difference
1	60.2	49.2	11.0	23.5
2	41.4	31.4	10.0	24.2
C, B	34.8	19.0	15.8	83.5
8	26.7	17.9	8.8	49.2
10	26.0	16.0	10.0	62.5
7	25.2	15.0	10.2	68.0
B, A	19.0	12.9	6.1	47.3
5	2.6	1.2	1.4	46.2

Numbers in the left-hand column refer to normal clutches; the letters refer to eggs from the clutch of three.

between egg A and eggs B and C. In three of the normal clutches either one or both of the eggs was infertile and thus only seven pairs of embryos are available for comparison. The results set out in Table V show the weights of the embryos and the percentage differences between them. The three eggs from the super-normal clutch have been divided into two pairs and included in Table V. There seems to be no very constant difference in size between embryos from the same clutch but the difference between eggs C and B is considerably greater than that between any other pair: on the other hand, eggs A and B show a smaller difference than that between the eggs of the normal clutches 10 and 7 which lie nearest to them in embryo size.

The evidence from colour and embryo size thus conflicts. From the close similarity in colour and patterning, it is tentatively assumed that one hen was responsible for egg A and the other for eggs B and C, and that the large difference in embryo size in the latter pair was due to irregularities of incubation caused by the presence of two hens.

DISCUSSION

The brown skua in South Georgia is an intensely territorial species showing no sign of colonial behaviour during the breeding phase, in contrast to its behaviour in some other parts of its range and that of the closely allied great skua (*C. skua skua*), which Jourdain (1941, p. 124) states "nests by preference in colonies, but not very close together". Pairs are usually formed within a week or two from the first arrival of one of the partners at the territory and not infrequently the pairs are composed of the same birds as in the previous season (Stonehouse, 1956). Members of a pair will individually and collectively defend the territory against newcomers and drive off other skuas.

Bird Island maintains an extremely dense breeding population of skuas, several nests frequently being found within a few yards of each other. In contrast to the situation in the Bay of Isles (South Georgia), where the skuas described by Stonehouse were feeding principally on debris from penguin and seal rookeries, at Bird Island the diet consists mainly of whale birds (*Pachyptila desolata*) and diving petrels (*Pelecanoides georgicus*), which nest in tens of thousands throughout the tussac-covered hills of the area. It may be noted here that the skuas of Bird Island generally rear both chicks from the normal clutch of two, while elsewhere on South Georgia the author has encountered only two instances of such successful rearing. Murphy (1936) considered that only one chick elicited parental care, the other being regarded as food. Stonehouse (1956), in discussing this, came to the conclusion that Murphy's suggestion implied a lack of plasticity in the behaviour, which is uncharacteristic of the species. He suggested that the rearing of one chick only might be related to feeding difficulties. In view of the conditions at Bird Island, only 45 km. distant from the population studied by Stonehouse (and Murphy), this seems almost certainly the correct explanation, two chicks being reared if sufficient food is available. Breeding whale birds are absent from the Bay of Isles in the area studied by Stonehouse and are nowhere in that locality so abundant as they are at Bird Island. Both records of two chicks being reared come from an area where breeding whale birds abound.

Murphy (1936) states that the eggs usually number two, but sometimes only one and still more rarely three. Matthews (1929) says of the eggs "usually two, sometimes three". Perhaps both these authors were influenced by Lönnberg's (1906, p. 60) statement that Sörling, a biologist who was stationed at South Georgia in 1904-05, found usually two eggs, sometimes three but more seldom only one. No actual examples or details of the frequency of clutches of three eggs are given by these authors and the instance under discussion is the only case known to the present author from many hundreds of skua nests. In view of the presence of two hens at the nest, it seems almost certain that both contributed to the clutch; the state of the ovaries is consistent with this view but no definite support can be obtained from the appearance of either the eggs or the embryos. If this is so, and had laying followed a normal pattern, four eggs might have been expected, though the possibility that once three eggs reposed in the nest both hens might be stimulated to incubate, rather than continue laying, should be considered: alternatively, four eggs might have been laid and one lost.

It is not known which, if either, sex establishes the territory at the beginning of the

breeding season. Stonehouse's account from the Bay of Isles indicates that it is probably the female, though his records are rather few and the sexes given are only provisional. As a general rule the skua is a summer visitor to South Georgia though at least part of the summer population is resident throughout the year. It is thus remotely possible that the smaller hen (specimen 3) may have been a chick of the other hen and the cock the previous year and had kept company with them during the winter, and was tolerated in the territory and on the nest for that reason. It is not thought that this is a likely explanation, however, as it is highly improbable that skuas breed in their first year and, as stated above, it is believed that both hens contributed to the clutch.

It is tentatively suggested that the formation of the breeding trio observed might have been on the following lines. One of the hens arrived first and established a territory where she was joined by the cock, which in the previous season had bred in or near the same territory. Soon after this the mate of the cock in the previous season arrived and was accepted by the cock. In the initial stages of courtship and nest-building the two hens became habituated to each other through the intermediary of the cock which had formed an attachment with them both. When one hen laid in the final nest the other was stimulated by the sight of the eggs to lay there also, and once the clutch had been completed and incubation started the change-overs, which involve little ceremony, were made with whichever partner first presented itself.

Stonehouse (1956) quotes unpublished observations by Richdale on the skuas of Stewart Island and neighbouring islands off New Zealand. Richdale reported having seen three adults, of unknown sex, in one territory on more than one occasion. Richdale (personal communication) has estimated that about two-thirds of the nests he had studied were attended by three adults, all of which would defend the nest. The clutch was invariably two eggs and he assumed that the three adults comprised two cocks and a hen. It would seem that the circumstances described by Richdale in New Zealand are not similar to the case in South Georgia. Jourdain (1941, p. 124) states of the great skua that the eggs are usually two, sometimes only one, and occasionally three, perhaps due to two females, but as Bannerman (1963, p. 11) pointed out, in Iceland (the stronghold of this sub-species) clutches of three had never been recorded.

With the exception of the reference by Jourdain, it would seem that the case at Bird Island is the first record of polygyny in the brown skua. Where further examples of clutches of three are observed it would be useful to check the birds attending at the nest to determine whether the clutch represents hyperovulation in one female of polygyny as in this case.

It is greatly to be regretted that further behavioural observations could not have been made on this interesting three-sided association in what has previously been regarded as a strictly monogamous species in South Georgia.

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My thanks are due to Mr. R. W. Vaughan for drawing my attention to this nest and finally collecting the specimens for me, and to Mr. Vaughan and Mr. D. Bashford for collecting the normal clutch series.

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NOTES ON THE SOUTHERN FUR SEAL IN SOUTH GEORGIA

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(With 3 plates and 2 figures in the text)

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INTRODUCTION AND HISTORY

The southern fur seal, *Arctocephalus australis*, Zimmermann, is widely distributed about the coast of South America. The type locality is the Falkland Islands but examples occur also in the Galapagos Islands, off the Chilean coast and on several islands off the coast of Uruguay, in particular Lobos Island. Some are to be found at South Georgia, which is the eastern limit of their range.

The species has long been hunted for the sake of the pelts. Between the discovery of South Georgia by Cook in 1775 and 1822, Weddell (1825) calculated that not less than 1,200,000 fur seal skins had been taken there and the species was practically extinct. The emphasis on sealing in South Georgia changed to elephant-oiling though a few fur seals were taken in the latter half of the nineteenth century. Some were taken in 1905 and Larsen (1920) stated that 170 were taken in 1906. This was apparently the last commercial kill of fur seals and since that time until recent years the species has been of scattered occurrence only. Harrison Matthews (1929) mentions that two were seen together on the Willis Islands in 1927 and one of the elephant sealers recollects that about sixty fur seals were seen on Bird Island some twenty-five years ago, though he is unable to remember the time of the year.

In recent years odd fur seals have turned up at various places on the coast of South Georgia. Rankin (1951) reported about twenty ashore in the

summer of 1946-47 though he gives neither the place nor the month. A member of the South Georgia Expedition 1954 (personal communication) reported fur seals at Cooper Bay, at the south east end of the island. The elephant sealers do not know of any fur seals in this locality but they rarely visit it after October which may be too early for the seals.

Yearling fur seals are not uncommon round the coast. During fourteen months of observation in 1953 and 1954 on three miles of beach in the Bay of Isles four yearling fur seals were seen, three in December and one in the autumn. One was found at Maiviken in January 1955 and during the winter of 1956 one hauled out at the Government Station in King Edward Cove.

From the 17th-21st December 1956 a detailed search was made for fur seal rookeries round the islands of the Willis Group, Bird Island and the coast of the mainland adjacent to Bird Sound. A large rookery was found in Bird Island just to the west of Bird Sound. Flanking this on either side were two smaller rookeries, the one to the south-west being situated at Johnson Cove. Another small rookery was found on a spit extending from Main Island in the direction of Trinity Island in the Willis Group. These are the only breeding colonies of fur seals definitely established on South Georgia.

METHODS

Landings were made at the main rookery on Bird Island on three occasions. Owing to the changeable nature of the weather in this locality it was not possible to spend more than two to three hours ashore at one time and consequently observations had to be limited. So far as was possible all the pups on the main rookery and the one at Johnson Cove were counted; two sample counts of harem bulls were made. General observations on the behaviour of the seals were made and a series of photographs taken.

When searching the coast for rookeries the ship, a disused whale-catcher, would steam at about three knots as close to the coast as possible while the shore was scanned with binoculars. It is exceedingly unlikely that any breeding community could have been overlooked under these conditions. All the rookeries found were first detected by the presence of seals in the water around them.

No specimens were killed but two damaged skulls were obtained from skeletons found on the beach. These have been deposited at the British Museum (Natural History).

HABITAT

The seals of the main rookery are established on three small coves and the headlands limiting them. The beaches, at the heads of the coves, are composed of pebbles and cobbles with many large rocks while the headlands are entirely rock. Extending out from the shore in many places is a rock-platform, just awash at high tide. A belt of kelp, *Macrocystis pyrifera*, girdles the shore and extends into the coves. Behind the beach are grassy hills, the tussac grass, *Poa flabellata*, covering these growing exceedingly luxuriantly, frequently up to waist-level. Between individual tussacs are deep boggy channels filled

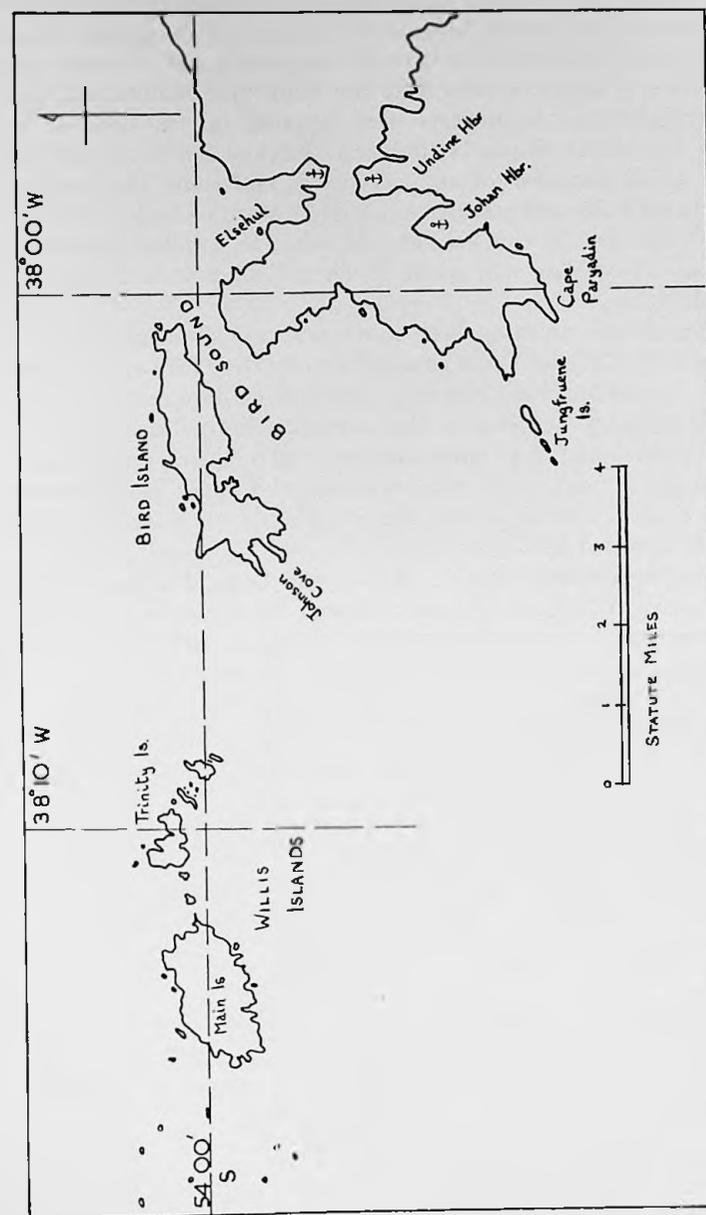


Fig. 1.—Map of the north-west end of South Georgia with off-lying islands.

with peaty mud. Above about 300 feet the vegetation becomes sparser until bare rocks rise up to the spine of the island.

The breeding seals are confined to the beach and the tussac immediately behind it. At the time of the visit, in mid-December, the harems were not easily distinguishable; harem bulls were surrounded by groups of pups and cows without sharp demarcation between one group and the next though on closer inspection it could be seen that the bulls were maintaining territories. The great majority of the harems were situated on the beaches but some occurred on the tussac slopes behind and one was found on the top of the coastal hills at an elevation of about 150 feet and some 150 yards from the shore. Bachelor bulls and resting harem bulls were to be found on the rock-platforms to seaward of the harems and also, in greater numbers, on the tussac slopes. Here they will go as much as half a mile inland and climb several hundred feet.

This distribution is an interesting contrast to the situation on Lobos Island (Uruguay), where the harems are situated among the rocks and the spare bulls are confined to the beaches (Ferreira, personal communication). The coast of Uruguay probably represents the northern temperature limit for this species and the breeding cows there choose to have their pups in places where shade is afforded by rocks. In South Georgia the upper limit of temperature is unlikely to affect the seals and the cows avail themselves of the better landing places afforded by the beaches.

At the smaller rookery visited, in Johnson Cove, the seals were mostly grouped around a rocky spit at the west side of the cove. The beach was relatively deserted though some harems had been established on it. The beach at Johnson Cove is far more exposed to the sea than those of the main rookery and is probably neglected for that reason. The rookery at the Willis Islands could not be inspected closely owing to high seas but appeared similar to that at Johnson Cove.

BEHAVIOUR OF THE HAREM BULLS

The harem bulls generally stood raised up on their outwardly turned fore flippers with the head pointing nearly vertically in the air. Occasionally they were seen lying asleep on their sides with the back slightly flexed and the hind flippers brought forward and partly covered by the fore flippers. The bulls were very pugnacious and would menace an observer with a high-pitched whimpering sound if he approached in the direction of their harems. On three occasions when landings were made from the sea, a number of harem bulls left their territories and combined to drive off the human intruder. This is a similar action to that described as "group aggression" by Bartholomew (1953) in the Pribilof fur seal, *Callorhinus ursinus*, though in the case of *Arctocephalus* it is not apparently necessary for the intruder to be immobilised. Group-aggression behaviour was not apparent while the observer moved through the harems; it is evidently directed against intruders attempting to enter the rookery. Observed fighting between bulls was limited to minor territorial squabbles. If one bull approached too near another's harem the harem bull would threaten the intruder with the whimpering sound mentioned

above and then advance rapidly towards him. If that did not put the other to flight the harem bull would snap fiercely at the interloper's muzzle. All observed encounters terminated at this stage, or earlier, though fighting must have been common earlier in the season, judging from the amount of scarring on the bulls. Most of the wounds are received on the head and neck where the heavy mane of the mature bulls must afford a considerable measure of

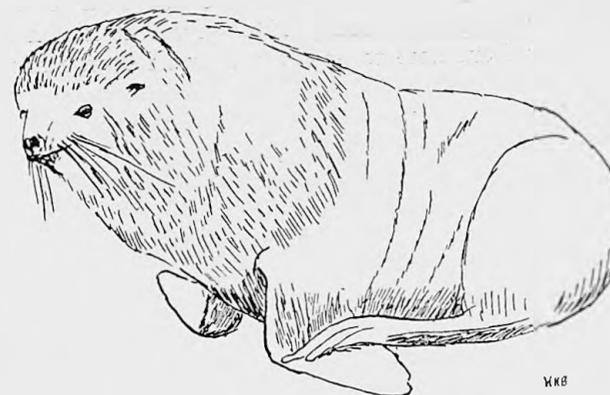
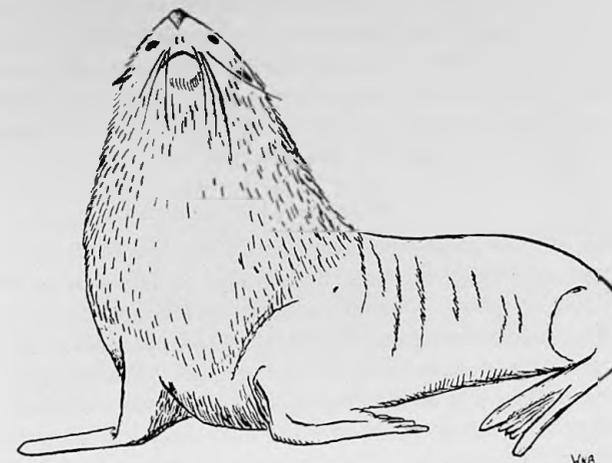


Fig. 1.—Typical attitudes of harem bulls showing the very heavy manes of the older bulls (From photographs.)

protection. Several corpses of bulls, two of them recent were seen on the rookery; these had presumably succumbed to wounds received in sexual fighting earlier in the season.

Only one copulation was seen, and that was in progress when observation started. The bull straddled the cow with his fore flippers, her head and neck

appearing between them. The bull made vigorous and rapid pelvic thrusts but it could not be seen whether the cow made reciprocating movements, as her hind quarters were completely hidden beneath the bull. During copulation the cow lay on her back, gripping the chest of the bull with her teeth. Rand (1955) says that in the Cape fur seal, *Arctocephalus pusillus*, the dorso-ventral position is normal but ventro-ventral copulation may occur if the cow is in a difficult position. The gripping of the bull's chest by the cow in this species occurs only after copulation is finished and the cow is trying to extricate herself. This may have been the case in the copulation observed but pelvic thrusts continued for about five minutes during which the cow was biting the bull continuously. Without any outward sign of ejaculation the bull dismounted and retracted his penis. There was no after-reaction, the cow lying where she was and the bull wandering a few feet off.

BEHAVIOUR OF THE COWS

Nearly all the cows ashore were lying beside their pups; many were feeding them. During nursing the cow lies on her side exposing the two pairs of abdominal nipples. During suckling and immediately after it the nipples are strongly erected and surrounded by a raised areola. Normally the nipples are almost entirely concealed by the pelage. While feeding their pups the cows were surprisingly docile and would permit close approach. When resting or sleeping the cows lie on their side with the hind flippers tucked up in the same manner as the bulls. The cows snap fiercely at the harem bull when he moves among them. The snapping is directed towards the bull's muzzle in the same fashion as the threat behaviour between bulls.

The cows are very much smaller than the bulls. Under field conditions no measurements could be obtained but King (1954) gives the length of an adult bull as 5 feet 6 inches from nose to end of tail and for an adult cow 4 feet. Ferreira (1950) gives 1.8 metres (5 feet 11 inches) for nose to tail length of the male and 1.45 metres (4 feet 9 inches) for the female; the weight of the adult male in November, at the beginning of the breeding season, is 136 kilograms, falling to 100 kilograms in April, while the cows weigh between 33 and 48 kilograms.

THE PUPS

The pups were all clad in black woolly fur. They measured about 15 inches in length and the milk-teeth were well developed. From their appearance, and the fact that only one copulation was observed they were judged to be about three weeks old. No pups were seen with attached umbilical cords. When disturbed the pups uttered a surprisingly deep growl. This sound is also made by the adults and indicates alarm. The pups showed marked gregarious tendencies, pods of from ten to thirty pups congregating on parts of the rookery not occupied by other seals. This grouping habit is commented on by Ferreira (1956) in the same species and by Bartholomew (1953) in the northern fur seal. It is probably due to the pups moving from the harem areas so they will not be disturbed by the bulls as they lumber about. Many pups find shelter under projecting rocks or in the clefts between tussacs. As

the ground of the rookery, except where it is bare rock, is covered with about two inches of mud, most of the pups were very wet but they did not appear to be suffering from the cold in the fashion of elephant seal pups. They are very much more active than the latter species and are, of course, born later in the year. A number of dead pups lay about but no count was attempted as many had been trampled flat and were concealed by the mud.

NON-BREEDING SEALS

Non-breeding males and yearlings were mostly to be found on the tussac hills behind the beach, which they would ascend to considerable heights. The seals evidently preferred to lie on the tops of tussacs, many of which had been worn quite bare and flat. A number of bachelor bulls sported in the water just off-shore. Resting harem bulls, recognised by their great size and heavy scarring, were also to be found in the tussac. These seals would rarely charge the observer, but neither would they retreat. Evidently the pugnacity of the harem bulls is only an expression of the territorial behaviour.

INTERSPECIFIC RELATIONSHIPS

Several specimens of the southern elephant seal, *Mirounga leonina*, were to be found on the main rookery. They lay about in groups, as is their habit during the moulting season, and paid little attention to the fur seals. It was noticed, however, that when disturbed they were a good deal more bad-tempered than is usual with elephant seals at this season. This may have been due to frequent disturbance by the fur seals. I had previously observed a yearling fur seal on a beach in the Bay of Isles in the summer of 1955-56 which drove into the water five bull elephant seals by its persistent snapping and charging. An adult male elephant seal is some 100 times as heavy as a yearling fur seal. Several weaned elephant seal pups were present on the fur seal rookery. All were marked with scars which looked as though they had been inflicted by fur seals.

The fur seal occasionally comes in contact with the leopard seal, *Hydrurga leptonyx*, Rankin (1951) records finding the remains of a fur seal pup in a leopard stomach. Leopard seals are uncommon in South Georgia during the summer and it is unlikely that they are an important predator at that season though it is possible that they may take a number of fur seals in the winter.

The usual scavengers were to be found on the rookery. Sheath-bills, *Chionis alba*, strutted about feeding on faeces and pecking at dead pups; skuas, *Catharacta skua*, were also to be seen feeding on corpses. One was noticed pecking at the umbilicus of a living pup; it is possible that some pups meet their deaths in this way as elephant seal pups are occasionally killed by skuas dragging out the entire intestine through the umbilicus. On the tussac hills many giant petrels, *Macronectes giganteus*, and wandering albatrosses, *Diomedea exulans*, were nesting. The albatrosses seemed completely indifferent to the fur seals but the giant petrels would hiss fiercely and vomit at seals that approached too closely. One giant petrel had built a nest and successfully reared a chick on the beach at the edge of a harem, despite constant interruptions from the seals. A largely colony of gentoo penguins, *Pygoscelis*

papua, was established behind the small rookery at Johnson Cove; the penguins were quite successful at driving off intruding seals by pecking at them.

FOOD

No observations were made on feeding. The majority of faeces seen were composed almost entirely of krill (*Euphausia* sp.) fragments and were coloured bright pink. Rand (1956) found nototheniid fishes and cephalopods besides euphausiids in the stomachs of *Arctocephalus gazella* from Marion Island and it is likely that the feeding habits of the South Georgia fur seals are the same.

COLOUR VARIATION

Two albino pups and one albino cow were seen on the main rookery. Another albino was seen swimming in Bird Sound; it may have been a cow or juvenile male. This relatively high incidence of albinism, about 1:1,500 for the pups, is not so surprising in a population such as the South Georgia fur seals, which is rapidly increasing after reduction to a very low level.

POPULATION SIZE

A count of pups was made on the main rookery and on the smaller one at Johnson Cove. These represent the main stock, both the other colonies being of minor importance. Owing to the ferocious nature of the bulls it was necessary to do most of the counting from the cliff-tops using binoculars. Inevitably a large number of pups was missed in this way. To the total number counted an arbitrary correction factor of 15 per cent was allowed for undercounting and dead pups. A rounded total of 3250 pups was obtained in this way.

From the total number of pups born on the rookery it is possible to calculate the size of the adult population given three factors; (a) the pregnancy rate of the females, (b) the age at which the females have their first pups, and (c) the mortality rates of the juveniles. Assumptions that the sex-ratio is near equality and that the males and females have equal mortalities are also necessary.

The calculation then appears in this form.

Total number of pups counted, December 1956	.. ..	2809
Allow 15 per cent undercount (dead and missed pups)	.. ..	3231
Round to	.. ..	3250
This equals the number of breeding females.		
Suppose 80 per cent of adult females are pregnant each year	.. ..	(1)
Then total adult female population is		
	$\frac{3250 \times 100}{80} = 4063$	

Suppose the cows have their first pup in their third year (2)
 The first and second age classes are not estimated.
 If sex-ratio equals unity and first year mortality is 60 per cent yearling female class is

$$\frac{3250}{2} \times \frac{40}{100} = 650$$

Let second year mortality be 30 per cent (3)
 Second year female class is

$$650 \times \frac{70}{100} = 475$$

So for these two classes add 1125

Then total females, excluding pups, equals 4063 + 1125 = 5188.

Round to 5200

Suppose mortality of males is equal to that of the females

Then total herd, excluding pups, is 2 × 5200 10,400 (4)

Notes.

(1) Kenyon *et al.* (1954) give the following incidences of pregnancy for various seals:—

<i>Callorhinus ursinus</i> (Pribilovian)	.. ..	69 per cent
<i>Callorhinus ursinus</i> (Asian)	.. ..	80 per cent
<i>Arctocephalus pusillus</i>	.. ..	70 per cent
<i>Phoca groenlandica</i>	.. ..	80 per cent

For the Pribilov fur seal commercial sealing tends to remove males to such an extent that the reproductive potential of the females is lowered. The other examples are probably not affected in this way. The higher value has therefore been selected as if the value taken is too low, then the total number of females, and thus of all seals, in the estimation will be too high.

(2) Rand (1955) states that pregnancy typically occurs in the Cape fur seal for the first time when the cow is in its second year, the pup being born when the cow is three years old. It is assumed that conditions are similar in the South Georgia fur seal.

(3) The sex-ratio is unknown but is unlikely to depart far from unity. The mortalities used are approximately the same as those given in the life-table of the female Pribilov fur seal by Kenyon *et al.* (1954).

(4) Bulls are not exposed to the hazards of parturition, but a number are killed in sexual fighting. Mortality from other causes probably affects both sexes equally.

The only firm figure in this estimation is the number of pups actually counted. The correction of 15 per cent used for undercounting is probably fairly accurate and the figure of 3250 pups born in 1956 could be used as a basis for further estimation. The total number in the herd is very much less certain, but it could be said with some assurance that the herd numbers between eight and twelve thousand animals excluding pups.

Two representative counts of harem bulls were made. These were compared with the pup counts in the same areas to give the ratio of harem bulls to breeding cows (assuming again that the number of pups equals the number of breeding cows).

TABLE 1.

Ratio of harem bulls to breeding cows. Bird Island, December 1956.		
Harem bulls	Pups = Breeding cows	Ratio
40	327	1 : 8.18
13	118	1 : 9.08 (Johnson Cove)
Totals	53	445
		1 : 8.40

The actual figure is probably slightly larger than the one calculated, 1 : 8.40, allowing for dead pups and pups not counted though every endeavour was made to account for all pups in the localities where the counts were made. Kenton *et al.* (1954) give forty to fifty as the average harem size in *Callorhinus* under commercial exploitation and suggest twenty-six or twenty-seven as the size of the primitive harem. Bartholomew and Hoel (1953) give 1 : 39.1 as the mean ratio of harem bulls to breeding females in the same species.

FUTURE PROSPECTS OF THE HERD

The fur seals are well established on Bird Island and are in no danger of extermination. All available beaches on Bird Island contain some breeding seals. It is unlikely that the population on the Willis Islands, estimated at about 300 seals, excluding pups, could increase much further as there are no beaches available on this group, the coast consisting of sheer cliffs with occasional rocks.

The establishment of breeding colonies on the mainland of South Georgia may be expected if the seals are not disturbed. The chief difficulty is likely to be the gregarious tendencies of the female fur seal. Bartholomew (1953) states that in *Callorhinus* a single cow and bull form an unstable group and three or four cows are required to satisfy their gregariousness. Thus, if conditions are similar in *Arctocephalus*, a simultaneous colonisation by a bull and at least three cows would be required in order to establish a new rookery.

Rand (1956) regarded the elephant seals on Marion Island as a possible barrier to the spread of *Arctocephalus gazella*. While the fur seal can hold its own with the elephant seals in the summer (see above) it is possible that during the breeding season of the elephant seals (September to November) the fur seals are unable to land on beaches occupied by elephant seals. The coast of South Georgia now supports a dense population of elephant seals on all the beaches but there are a number of rocky places and islands not much used by the larger species which would seem quite suitable for the fur seals. The slow recovery of the fur seals from the last commercial sealing in 1906 is something of a puzzle compared with the very rapid rise of the elephant seal population. The reproductive potential of the fur seal herd can only be determined in the light of further research.

FUR SEALS IN THE SOUTH ORKNEYS

In an unpublished report Hall (1957) draws attention to the occurrence of fur seals in the South Orkneys in 1956 and 1957. Fur seals have been sighted on all the main islands of this group, the largest number of records coming from Signy Island. This more probably represents the distribution of observers than of seals. As many as twenty-eight fur seals have been seen at one time on the Gourlay Peninsula in 1957 while the largest number seen in the same locality in 1956 was fourteen. In 1957 fur seals occurred on the South Orkneys between January 14th and March 30th. There are no undoubted breeding records but one seal was seen on Fredriksen Island which, in the opinion of the observer, was too small to have undertaken a long sea voyage and so presumably had been born there.

The South Orkneys lie about equidistant from South Georgia and the Falkland Islands, hence the seals might be a migrant population from either place. However, the increase in recent years in both the South Georgia and South Orkney populations might indicate a connection between these.

SUMMARY

The occurrence of a colony of fur seals in South Georgia is recorded and the observed habits and interspecific relationships of the seals described. The colony is estimated to consist of between 8,000 and 12,000 seals, excluding pups. The ratio of harem bulls to breeding cows was found to be 1 : 8.4. The future prospects of the herd are discussed and it is suggested that expansion and increase in numbers may be expected to take place. The occurrence of fur seals in the South Orkneys is noted.

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EXPLANATION OF PLATES

PLATE 1

- Fig. 1.—The first landing place on Bird Island. The harem bulls can be seen on the shingle beach; most of the cows are away feeding but the pups indicate the sizes of the harems. On the tussock hills (background) and on the raised rock-platform many bachelor bulls are to be found. The islands in the distance are the Jungfruen.
- „ 2.—A view of part of the beach from the cliff. Three harem bulls are shown in this picture but sixty-nine pups are present giving an average harem size of at least twenty-three. Three bachelor bulls can be seen on the rock-platform (right, centre and left-centre). An albino pup is lying on the rocks at bottom centre.

PLATE 2

Fig. 3.—A harem group at Johnson Cove. The bull is surrounded by ten cows. Most of the pups have strayed away into the shelter of the rocks.

4.—A collection of pups high up on the beach.

PLATE 3

Fig. 5.—Two cows with a pup in the tussac.

6.—A cow feeding her pup. The flattened condition of the tops of the tussacs can be seen well.

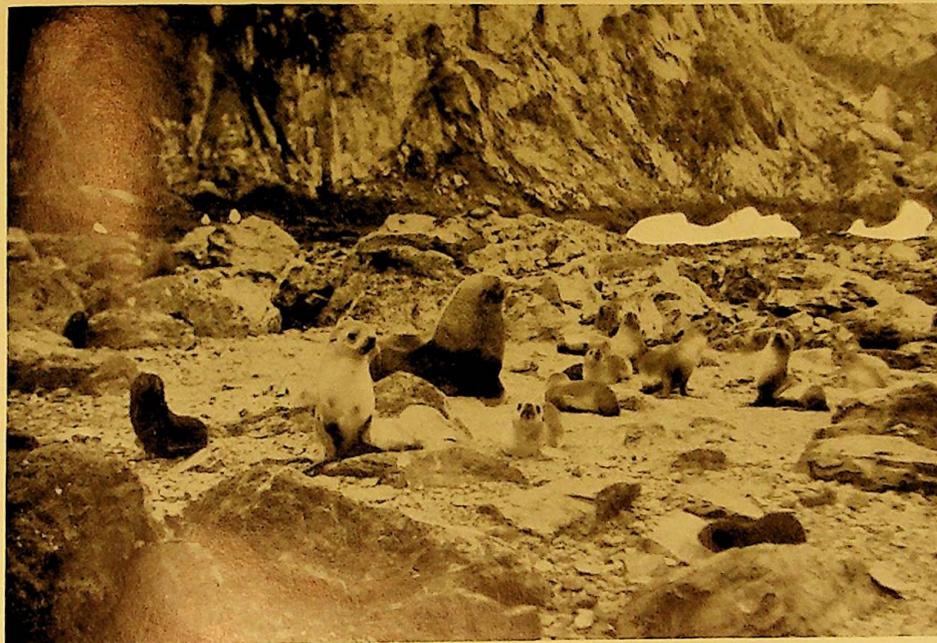
7.—A yearling fur seal photographed at the Bay of Isles. Young fur seals are fairly frequently to be seen round the coast of South Georgia, usually in the early part of the summer.



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The southern fur seal in South Georgia.



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The southern fur seal in South Georgia.

C

POPULATION INCREASE IN THE FUR SEAL
ARCTOCEPHALUS TROPICALIS GAZELLA,
AT SOUTH GEORGIA

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Les otaries du Scotia Arc furent détruites par des phoquiens, peu après leur découverte, au début du XIX^e siècle. Des expéditions sporadiques empêchèrent toute repopulation au cours de ce siècle mais, actuellement, les troupeaux paraissent en voie de reconstitution.

Un groupe résiduel se maintient sur les îlots rocheux à l'Ouest de South Georgia. Une colonie de Bird Island visitée vers 1930, comptait un petit nombre d'individus. Depuis 1956 des visites annuelles ont montré un fort accroissement et la colonie principale comptait environ dix mille jeunes en 1961.

Outre l'augmentation locale en South Georgia, de petites colonies reproductrices ont été signalées ces cinq dernières années, dans les South Sandwich, South Orkney et South Shetland Islands. L'on peut penser qu'elles se sont formées à partir de l'excédent des populations des colonies de South Georgia.

La densité de la population de la colonie principale de South Georgia est actuellement très forte, aussi trouve-t-on des phoques reproducteurs sur une gamme variée de plages, allant de la crique rocheuse, aux larges plages sablonneuses et même aux espaces fangeux couverts de touffes de graminées qui les bordent. Les femelles reproductrices montrent une préférence marquée pour un type de plage défini et le succès des mâles reproducteurs est fonction de l'emplacement qu'ils y occupent.

The islands of the Scotia Arc were first visited in 1775 when Captain James Cook landed at Possession Bay, South Georgia. His account of the landing included the observation that seals (by which he meant fur seals) were « pretty numerous » and that the beach swarmed with young cubs, in January (Cook, 1777). Cook did not pause in his voyage to exploit his discovery but pressed on to higher latitudes. Although fur sealing was being actively pursued around the coasts of South America and at the Falkland Islands it was another fifteen years before South Georgia was visited by commercial sealers. In 1790 two Connecticut sealers, Daniel Greene and Roswell Woodward, fitted out for a

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sealing voyage to the Falklands and during the course of the voyage Woodward, and possibly Greene as well, obtained a part cargo of furs from South Georgia. Around the same time an English scaler, Pitman, was also at South Georgia (Roberts, 1958), and possibly there were other unrecorded voyages. Thereafter sealing expeditions became more frequent, reaching a climax in or about the season 1800-1801 when Fanning (1924) reported that a total catch of 112 000 fur seals had been made at South Georgia by seventeen American and British vessels. The destruction continued with diminishing returns till by 1822 Weddell calculated that not fewer than 1 200 000 fur seals had been slaughtered at South Georgia and the species was virtually extinct there (Weddell, 1825).

The discovery of the South Shetland Islands by William Smith in 1819 disclosed fresh sealing grounds to the eager hunters and in the following season, 1819-1820, three vessels all obtained good cargoes. In 1820-1821 a fleet of at least forty-four vessels, mostly British and American, flocked to the group and slaughtered the seals in thousands. The crews of five vessels are reported to have secured 95 000 seals from Cape Shirreff (Livingstone Island) alone (Bruce, 1920), and the total catch reached a figure of about a quarter of a million with thousands of seals killed and lost. The subsequent year, only the third after the discovery of the South Shetlands, saw the almost complete annihilation of the fur seals there; forty vessels arrived to seal but many returned almost empty. In all Weddell estimated that during the years 1821 and 1822 not less than 320 000 seals had been killed at the South Shetlands. In 1829 the group was visited by the sloop CHANTICLEER and Webster (1830) reported:

«The harvest of the seas has been so effectually reaped, that not a single fur seal was seen by us, during our visit to the South Shetland group; and, although it is but a few years back since countless multitudes covered the shores, the ruthless spirit of barbarism slaughtered young and old alike, so as to destroy the race. Formerly 2 000 skins a week could be procured by a vessel; now not a seal is to be seen.»

These two regions, South Georgia and the South Shetlands, comprised the headquarters of the fur seals in the Scotia Arc and by the time the slaughter was over at the South Shetlands the major interests of the sealers in the Atlantic section of the Antarctic were exhausted. The South Orkney and South Sandwich groups, together with Bouvetøya, were visited by the sealers but none of these areas yielded harvests similar to those obtained at South Georgia or the South Shetlands. For about half a century the sealers let the colonies lie undisturbed apart from a few sporadic expeditions to South Georgia, as for example when 250 furs were obtained by the schooner PACIFIC in 1829 and 600 by the schooner MARY JANE in 1838-1839. In the 1870's, however, there was a brief recrudescence of sealing activity. In 1871-1872 three vessels secured 8 000 skins at the South Shetlands and the following season eight vessels took 10 000. In all, between 1871 and 1888 a catch of rather less than 45 000 seals was made at the South Shetlands, the final season yielding the pitiful return of only

35 skins, which probably represented the very last survivors at this group (Williams, 1888). At South Georgia in 1874 the schooner FRANKLIN took 1450 furs, the following season five vessels took 600 and in 1876 the total catch for four vessels was only 110. This probably indicated the extermination of a local population for Buddington, who visited the island again in 1892, secured 135 furs but stated that none of them was taken at the old colonies. At the same period the South Sandwich Islands were subjected to scrutiny by the sealers. Buddington records that 2 000 seals were taken there in 1875-1876 and 4 000 in 1876-1877; less than 100 were taken in the subsequent season. No seals were seen in 1880 but in 1891-1892 a catch of 400 was made (Buddington, in Allen, 1899). The last commercial catch of fur seals from the Scotia Arc seems to have been made in 1907 when an American vessel took 170 furs from South Georgia (Larsen, 1920).

The resumption of commercial elephant sealing in South Georgia in 1910 resulted in regular inspections of the coast which might have been expected to have revealed any fur seals that were present. However, it was not until 1915 that the first specimen was discovered on the mainland coasts and this, a juvenile male, was promptly killed. In 1919 a group of five fur seals was reported from Bird Island, a small island off the western tip of South Georgia and separated from it by a narrow sound. From then onwards fairly regular sightings of isolated individuals and small groups of fur seals were made and in 1933 a party landed at Bird Island with the specific object of searching for fur seals, of which 38 were found, and from which a total population of at least 60 individuals was deduced (Rayner, 1933). Bird Island was again visited in 1936 when a total of 29 seals was reported ashore in late October (Marr, 1936). Although further reports of fur seals continued to be made (Laws, 1953; Bonner, 1958) it was not till 1956 that another systematic search for breeding colonies was organized, when the author discovered well-established breeding colonies on Bird Island and on Main Island, Willis group, about 8 kilometres further westward. Since that time regular visits have been made to Bird Island during the fur seal breeding-season for the purpose of making censuses of the pups born and carrying out general observations on the biology of the seals. These annual censuses have revealed that the population of fur seals on Bird Island has increased dramatically since 1956 though the rate of increase has been declining steadily.

The censuses were made by direct counting using as few arbitrary corrections as possible though as pup density increased and the pups became more active the accuracy of the counts inevitably declined and it was occasionally necessary in certain areas to resort to sample counting or to applying corrections for under-counting. For a variety of reasons, chief of which are the length of the birth season (which extends from the third week of November to the first week of January) and the active life led by the older pups, it is impossible to carry out a complete and absolute census of all the fur seal pups born on Bird Island in any one year. Assistance in carrying out the field counts was always limited

and occasionally lacking entirely, and several difficulties were encountered when attempting to count the pups single-handed. Techniques were, however, evolved which enabled estimates to be made of the size of the final pup crop which, if not of absolute accuracy, are at least comparable year by year. In the first two years of the present series of counts, 1957 and 1958, the absolute numbers of pups in the colonies were much smaller than they are at present and advantage was taken of this to carry out consecutive counts of a high degree of accuracy from which curves representing the build-up of pup population could be constructed. Although counting was not carried far enough into the season in 1957, the last count being made on 13 December, the counts made in 1958 indicated that pup numbers are near maximal on 19 December and this was subsequently taken as the final date for counting, other evidence having shown that there is little variation of the temporal location of the season. As some pups undoubtedly are born after this date in each season it has been necessary to increase the total obtained at the final count by a small amount. This correction (approximately 2.7 per cent) was determined graphically from the 1958 series of counts and applied to the totals for other years.

The estimate of pup numbers made at the first visit in 1956, 3 250, was obtained from a counted total of 2 809 pups to which was added an arbitrary correction of 15 per cent for undercounting. The accuracy of this count is doubtful and it is not comparable with those of the series starting in 1957; it can be assumed that both the actual count and the correction applied to it were considerably too low.

During the five breeding seasons from 1957 to 1961, the total crop in the various colonies on Bird Island was 5 350, 6 800, 8 300, 9 400 and 9 900 pups each year, and the annual increases since 1959 were 27.1, 22.1, 13.3 and 5.3 per cent. Thus, although the total number of pups born has continued to increase, the rate of increase has declined from the startling figure of 27.1 per cent to one quarter of that rate only three years later.

Apart from the five years 1957-62 covered by the present survey, firm data on population size are almost completely lacking. The only estimates are those made by Rayner and Marr in 1933 and 1936, and the report of one to three thousand fur seals at Bird Island made by one of the sealing captains and relating to about the year 1950 (Laws, 1953). Although great reliance cannot be placed on these, it is of interest to note that if the herd is assumed to have increased at a steady rate of 25 per cent per year, then taking 1958 with a pup crop of 6 800 as a year of reference, we find that the corresponding pup totals in 1950 would be 1 140, and in 1936 and 1933 would be 56 and 29 respectively. These totals fit the observed, or estimated, values very well indeed and while it is not suggested that the fur seals have in fact rigidly followed such an increase, a general trend of this dimension over the years would account quite satisfactorily for the pattern of fur seal sightings in the last forty years.

While the differences between 1957 and 1958, and 1958 and 1959 fit this pattern of a regular increase of about 25 per cent the two subsequent years show a sharp decline in the rate of increase, and it is apparent that after a period of rapid expansion the numbers of the total herd at Bird Island are reaching a plateau. The greater proportion (about nine-tenths) of the breeding seals on Bird Island are congregated in one colony (by which is meant a continuous distribution of breeding seals along the coast) centered on Jordan Cove and the bay next west of it. The remainder of the breeding seals are to be found at two smaller colonies separated by fully a mile of unpopulated coast, mostly cliff, and to a lesser extent, on a rocky stretch of coast which represents a westward extension of the main colony. These subsidiary beaches are places of very recent active colonization, and show a rather different pattern of population increase during the last five years from that of the population as a whole (Fig. 1).

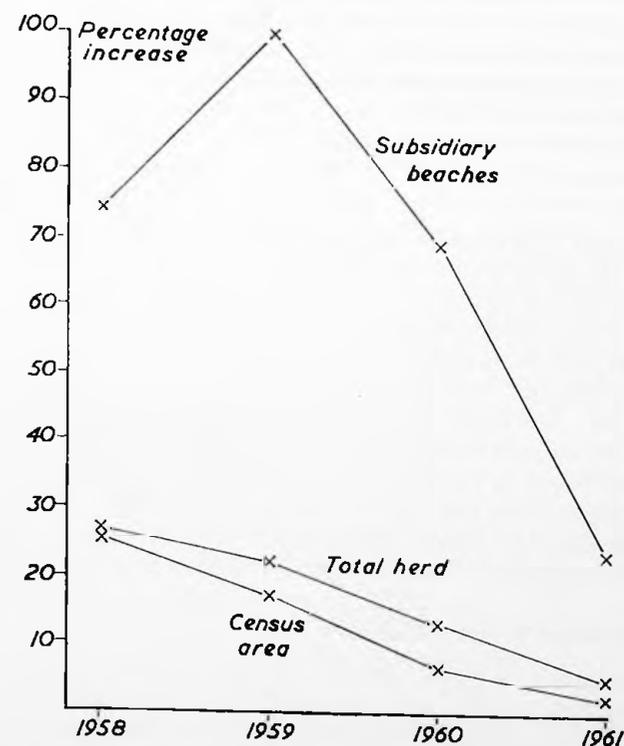


FIG. 1. — Percentage increases of pup populations on various beaches, Bird Island, South Georgia, 1958-1961.

The percentage rate of increase on the subsidiary beaches, though it has shown a decline in the last two years, has been very much higher than that of the total population, the increase of 1959 over 1958 being 99.3 per cent. Such increases can only be the result of re-inforcement of the colony from an outside source, for it can be shown on theoretical grounds that the maximum rate of increase of a closed population of fur seals, which have but one pup yearly and produce their first pup at 3 years old, is around 30 per cent. In fact, it is obvious that the subsidiary beaches are being re-inforced from the main colony where the population is reaching, or has reached, saturation point. Pup tagging at the main colony has shown that cows have produced pups at 3 years of age, and has confirmed the movement to the subsidiary beaches.

The exodus of seals from the main colony is not however, confined to the subsidiary beaches of Bird Island. Investigations in January, 1961, showed that small numbers of fur seals had started to breed on the mainland of South Georgia for the first time in recent years. These tiny colonies, which together amounted to not more than fifty pups, cannot yet be regarded as securely established centres of repopulation, but when one of them was re-visited in 1962 an encouraging increase was revealed. There is no reason to doubt that if they remain undisturbed a considerable measure of repopulation of the coasts of South Georgia with fur seals will take place in the course of the next decade or so.

The establishment of permanent bases on and expeditions to the various islands of the Scotia Arc by the Falkland Islands Dependencies Survey (now the British Antarctic Survey) has led to the collection of data on the occurrence of fur seals elsewhere than at South Georgia. Isolated specimens were noted at the South Orkneys as early as the late forties but it was not till 1959 that Øritsland confirmed breeding on Michelsen Island, near Powell Island, in this group (Øritsland, 1960). Øritsland reported a single harem bull and 11 cows with their pups in the autumn of the 1959-1960 season, and a further 111 fur seals of both sexes were found in the vicinity. In the South Shetlands another minimal breeding community of a bull and one cow and her pup (together with another dead pup indicating the previous presence of another cow) was discovered at Cape Shirreff, Livingstone Island, in 1959, and another thirty-two fur seals were counted nearby (O'Gorman, 1961). Unfortunately more recent information from these localities is not available.

It is from the South Sandwich Islands that the greatest number of fur seals has been reported in recent times. In early 1960 a colony estimated to comprise about 400 breeding animals (about 200 pups) was noted on Visokoi Island (O'Gorman, 1961). This area was again visited in the middle of March, 1962 (Holdgate, 1963) and counts made from oblique aerial photographs indicate a total of about 600 fur seals on the beach. Unfortunately the quality of the photographs is not sufficiently high to allow the seals to be classified, and owing to the late date of this visit the possibility that some of them were non-breeding

migrants from another colony cannot be dismissed. Under these circumstances it is not possible to compare the figures for the seasons 1959-60 and 1961-62. A further small colony, said to consist of breeding animals, has been identified on Saunders Island (Holdgate, 1963).

Although observations have not been made at the South Sandwich group until recently, both the South Orkneys and the South Shetlands have been fairly well investigated and it is believed that the breeding of fur seals revealed there actually represents a recolonization by the species from a non-indigenous reservoir, so it is interesting to speculate on their origin. Owing to the regular sightings of fur seals at South Georgia it is assumed that extermination of the species there was not complete and that a relict population remained, probably on the exceedingly inaccessible Willis Islands. It is a peculiarity of the seals of South Georgia that a small proportion (about 0.1 %) of the animals have white coat colouration, the normal pigment being lacking from the guard hairs and greatly diluted in the underfur. One of the fur seals seen by Øritsland on Michelsen Island and figured by him (Øritsland, 1960, fig. 2) shows this colour anomaly. As this form of colour variation has not been reported for other populations of *Arctocephalus tropicalis* (nor indeed for any other member of the genus) it seems reasonable to suppose that the white animal seen on Michelsen Island originated from the South Georgia stock, and, by analogy, probably its companions as well. Whether or not the South Sandwich seals also originated from South Georgia is considerably more doubtful. Owing to the isolation of this group and the difficulties of landing there it is quite possible that the early sealers overlooked a few specimens which have formed a breeding nucleus. The much more advanced state of the colony at the South Sandwich Islands indicates that repopulation (if it has not arisen indigenously) has taken place at an earlier date than at either the South Orkneys or South Shetlands. The South Sandwich Islands are very much nearer South Georgia than the other groups of the Scotia Arc and they might well be expected to be the first to be recolonized if it is assumed that South Georgia provided the parent population. Should further investigations reveal the presence of white animals amongst the seals at the South Sandwich Islands it will provide strong corroborative evidence that they have in fact been derived from the South Georgia stock.

The fact that the repopulation of the South Orkneys and South Shetlands, at least, has taken place in the last decade at a time when the South Georgia population was reaching considerable numbers furnishes perhaps the strongest evidence that the new colonies are derived from the South Georgia stock. The decline in the rate of increase of the Bird Island population could be attributed to three factors :

- (a) Lack of available food,
- (b) Increased mortality not connected with (a),
- (c) Shortage of breeding space.

The staple diet of the South Georgia fur seal is the schizopod crustacean *Euphausia superba* which occurs in great abundance in the waters off South Georgia. Probably the number of available euphausians has never been an important limiting factor of the populations of the various species that feed on them and with the virtual disappearance of the balcen whales from the coastal waters of South Georgia there is little doubt that an abundant supply of food is available for a population of fur seals many times the size of that known to exist today, so lack of food can be discounted as a limiting factor.

A sudden increase in mortality of the seals sufficient to account for the fall in rate of increase observed is, of course, possible but is not very likely. Although mortality has almost certainly increased in the colony, largely in association with breeding in inland sites, no epidemics have been observed and pup mortality on the beaches is generally low (of the order 5-6 %).

The remaining suggestion, that there is a shortage of breeding space, is certainly true. The much higher rate of increase on the subsidiary beaches when compared with that of the main colony is only attributable to the shortage of breeding space at the latter. The population in the main colony is within a few per cent of maximal, and even when the subsidiary beaches are considered the opportunities for further expansion on Bird Island are greatly limited. All the available beaches on Bird Island and the Willis group are now occupied by breeding seals, and competition for space has become acute on all but some stretches of the subsidiary beaches.

A lack of breeding sites in one particular area will result in a check to expansion in that area but need not affect the total numbers if the population is sufficiently mobile. The census work on Bird Island has been done by regarding the fur seals there as a « closed population », i.e. one which does not exhibit either outward or inward migration of breeding animals. This concept was known never to be strictly true, as it was early supposed that the Bird Island seals had originated from the Willis Island colony, and the discovery of the small mainland colonies was sufficient evidence of outward migration. Although fur seals in general show a homing reaction, returning to the colony of their birth (Scheffer, 1950; Kenyon, 1960), increasing population might well be expected to result in certain animals, probably those breeding for the first time, pupping on more remote beaches and subsequently returning there in later years. Colonization of the remaining islands of the Scotia Arc could then be expected to take place in inverse order of their remoteness from South Georgia. This is indeed what seems to have happened, with the largest breeding colony on the South Sandwich Islands, historically a poor locality for fur seals, and the smallest colony (if it can be called one at all) on the South Shetlands, once one of the most populous breeding grounds of the species. This argument is weakened by the very small amount of colonization that has taken place at South Georgia, other than at Bird Island. This is indeed one of the most puzzling aspects of the increase in the seal population. The distance (by sea)

of the furthest of the subsidiary beaches from the main colony, about 3 km, is about the same as that to the nearest part of the mainland coast, and while there is no very suitable beach in that region, apparently perfectly adequate sites exist not more than 6 km away, but are not used by the seals. A possible explanation of this apparent anomaly of distribution is that the homing reaction of the seals may be intensified in the vicinity of their birth-place so that if, as is likely, the ultimate mechanism of homing is by visual recognition, the seals within sight of known landmarks will continue to home until they land at their natal colony. Small displacements laterally along the coast, such as have occurred at the subsidiary beaches, would then be possible but colonisation at medium distances would be less likely.

In general it seems that (except at the South Sandwich Islands where a relict population may have persisted), the recolonization of the Scotia Arc by fur seals has taken place from South Georgia and that there is a steady recruitment from this population, which may be expected to be intensified in the course of the next few years when the female pups born during the period of fall-off of the rate of increase of the Bird Island population, i.e. from 1960 onwards, mature. It is to be hoped that future research programmes will allow of a close check being kept on the re-establishment and growth of populations of fur seals in the Scotia Arc.

The same sub-species of fur seal, *Arctocephalus tropicalis gazella*, is found also at Bouvetøya and Iles de Kerguelen. Very little is known of its status at either place; Olstad estimated a population of about one thousand animals at Bouvet in 1928 (Sivertsen, 1954) after some commercial killing the year before, and a few individuals have been seen at Kerguelen in recent years (Paulian, 1956). Although Bouvet, at least, must be considered as a potential reservoir which may have contributed to the Scotia Arc stocks, the distance involved is great and the probability correspondingly low.

Since the time of the first visit of the present series to Bird Island the number of pups born at the main colony has nearly doubled and as the lateral limits of the colony have hardly altered, this has resulted in an increase of density of the seals on the beaches coupled with an inland extension of the area occupied by the breeding seals. The beaches on which the seals breed vary in nature. The main colony comprises three bay systems connected by rocky headlands; the heads of the bays consist of more or less open sandy or shingle strands flanked on either side with narrow strips of rocky foreshore culminating at their seaward extremities in raised rock platforms. These rocky stretches are backed by low cliffs and wherever a watercourse descends a small triangular shingle beach, set in a miniature cove, is developed.

The census data collected in 1958 indicated a preference for the « rocky » type of habitat compared with the open beach. Areas of the main colony typical of the two habitat types were selected with approximately the same number of

harem bulls (after the establishment of the majority of territories) and the average harem size for the two types was calculated for various dates. Since harem size is dependent on the number of cows that choose to haul out in a given area (when a sufficiently large sample is taken), and it is found that the rocky habitat has consistently larger harems than the open beaches, it can be concluded that the breeding females show a preference for the former type.

TABLE I. — COMPARISON OF AVERAGE HAREM SIZE AT VARIOUS DATES IN DIFFERING HABITAT TYPES. BIRD ISLAND, SOUTH GEORGIA, 1958

Date	25 Nov.			30 Nov.-1 Dec.			5-6 Dec.		
	Bulls	Cows	Average harem	Bulls	Cows	Average harem	Bulls	Cows	Average harem
Rocky beaches	57	209	3.667	91	651	7.189	123	1.209	9.827
Open beaches	42	110	2.620	93	483	5.192	122	974	7.981
Total colony	195	739	3.790	332	2.163	6.516	474	4.034	9.025

The inland extension of the colony has resulted in a number of cows breeding on the grass-covered flats behind the beaches at the head of the bays. These territories were unoccupied by cows in 1957 and even now are always the last to fill up. Pup mortality there is high; the pups become saturated with mud which clogs their fur, and suffer much from exposure. Owing to the rapidity with which the corpses are trampled into the deep ooze between the tussocks it has not been possible to collect quantitative data on this mortality.

Although it has not been possible to arrive at Bird Island early enough in the breeding-season to witness the arrival of the first harem bulls, there are some indications that the bulls also exhibit a tendency to occupy the territories in the rocky habitat preferentially, as can be seen from the considerably greater number of bulls in such territories on the census of 25 November, though later in the season this distinction disappears.

Kenyon (1960) found that in the Alaska fur seal the earliest-arriving bulls did not necessarily select the most advantageous sites with respect to the places that would later be occupied by the females and this is true also for the South Georgia fur seal. Harem bulls are early to be found occupying inland territories deep

in the tussock grass which may remain without females throughout the breeding season. These inland bulls, though not generally of the largest size, are adult and compare favourably with many of the harem bulls on the most congested parts of the beaches. Before about 1957 such bulls had a negligible reproductive success (measured in terms of observed copulations), but under present conditions the overspill of cows from the main breeding areas provide them with a better chance of securing harems and their reproductive success is thus correspondingly higher.

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Exploitation and Conservation of Seals in South Georgia

BY

W. NIGEL BONNER

EXPLOITATION AND CONSERVATION OF SEALS IN SOUTH GEORGIA

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Biologist, South Georgia

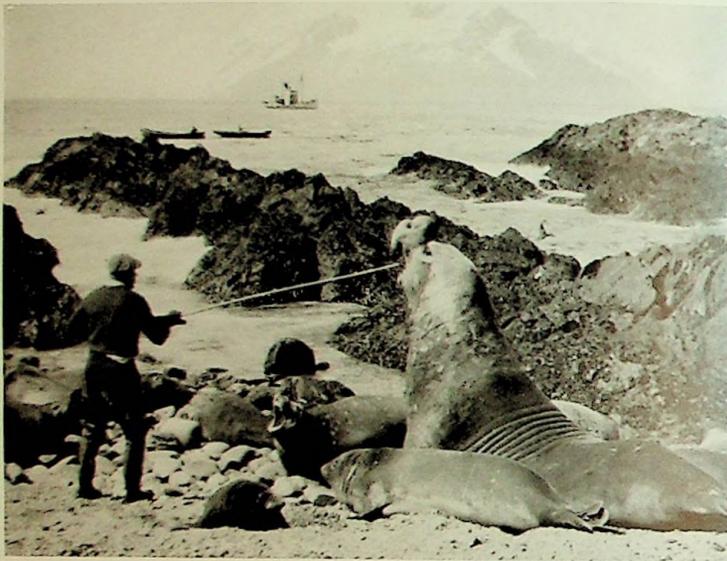


Photo: W. N. Bonner.

ELEPHANT SEALING—DRIVING A BULL.



Photo: W. N. Bonner.

FUR SEAL COWS AND PUPS AT BIRD ISLAND, SOUTH GEORGIA.

Almost from the date of their discovery by Captain Cook in 1775 the seal stocks of South Georgia have formed the basis of a lucrative, though initially sporadic, industry.

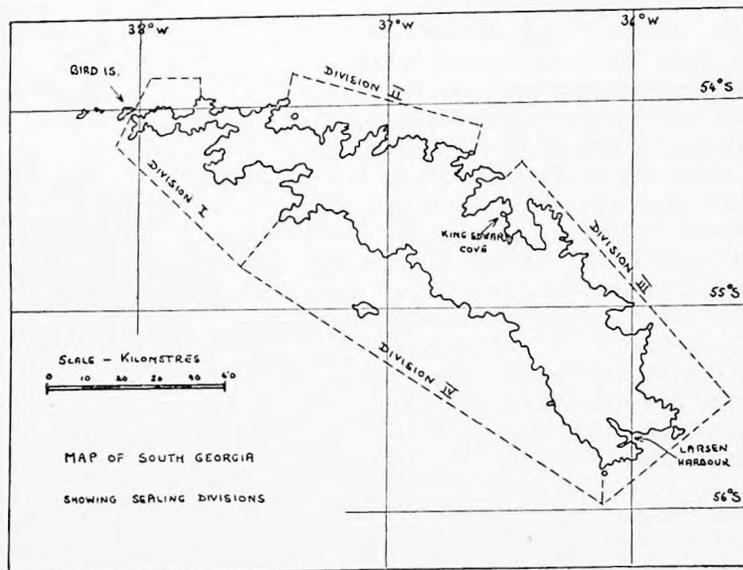
South Georgia lies between 54 degrees and 55 degrees South and between 36 degrees and 38 degrees West. Despite its low latitude it has an antarctic climate, being south of the Antarctic Convergence at all seasons of the year. True sea ice is probably never formed on any of its coasts though enormous quantities of brash ice from the many glaciers may frequently obstruct access to certain beaches. Meteorological observations are made at King Edward Cove, a sheltered spot on the north-east coast, which does not perhaps represent truly the severity of the climate. In 1953 the average temperature throughout the year was 35.6 degrees F. and the extreme minimum recorded was 10 degrees F. in July. Almost certainly the exposed parts of the coast, particularly on the south-west side, frequently experience temperatures below zero. Violent winds are common. In 1953 the mean wind-speed was 8.9 knots and precipitation, mostly in the form of snow, amounted to 1,257.6 mm. The pattern of the climate of South Georgia is delineated by the relatively low temperatures, the prevailing high winds and the heavy precipitation.

Captain Cook's account of the seals of South Georgia soon attracted attention and in 1790 two American sealers visited the island and obtained part cargoes of fur seal skins. By 1801 the sealing fleet at South Georgia numbered thirty-one vessels and the rookeries were being rapidly exhausted. One vessel alone, the corvette *Aspasia*, Captain Fanning, took 57,000 skins in that season. By 1822 Weddell (1825) calculated that not less than 1,200,000 fur seal skins had been shipped from South Georgia and the species was practically extinct there. The rookeries were, in the words of the sealers, "abandoned by the seals"; more truly, their inhabitants had been exterminated. A few more furs were forthcoming from South Georgia—in 1830 the *Elizabeth Jane* took 600 and in 1870 the *Flying Fish* secured 500. The last considerable catch seems to have been 170 in 1906 (Larsen, 1920) but all this activity was incidental to the

second phase of exploitation of the seals—elephant oiling. Sea elephants, or elephant seals, provide a valuable oil from their thick investment of blubber. These animals had been generally ignored by the early fur-sealers who were fully occupied with clubbing and skinning the fur seals and were not prepared to spend time flensing and trying out (boiling) elephant blubber. However, as the fur seals declined in number so the sealers turned their attention to the abundant elephant seal rookeries. Few records exist of elephant oiling in South Georgia, but if one is to judge from similar conditions on Heard Island in the Indian Ocean the technique was to put a number of men ashore with stores and equipment for trying out blubber and to leave them there till the casks were full or the sealing ship had to return to her home port. In several of the natural harbours in South Georgia are still to be found the iron pots and brick try-works used by the sealers. The commonest form of try pot, shaped like a traditional witch's cauldron, 3 feet in height and holding about seventy gallons, seems to be of British origin, refuting the generally advanced theory that elephant oiling was a monopoly of the Americans. Indiscriminate slaughter soon reduced the elephants in exactly the same way as it had the fur seals, though as they yielded a less profitable product, the slaughter was not carried so far. Eventually, by the end of the nineteenth century, South Georgia was visited only by Yankee whalers who hoped to obtain part cargoes of elephant oil and perhaps a few fur skins. The last of these vessels was the brig *Daisy* of Massachusetts, which visited the island in 1913. On board was Robert Cushman Murphy of the American Museum of Natural History, later to become famous as one of the leading ornithologists of the New World, who published the only well-documented account of the activities of the old-style elephant sealing in South Georgia (Murphy, 1947).

In the first decade of the present century the modern steam whaling industry of the Antarctic was established in South Georgia by C. A. Larsen. The arrival of the whalers was soon followed by the setting up of a British Administration on the island. At that time fur seals were believed to be extinct but the elephant seals had recovered somewhat from previous depredations and it was realized that rational cropping of the herds would result in a large and continuing return. A series of regulations was laid down designed to ensure the conservation of the elephant seal stock. Killing was to be licensed and restricted to adult males only, reserves were set up and reports on the condition of the rookeries were made yearly. The licence

to take seals was initially granted to the Compañia Argentina de Pesca, the first whaling company to be established in South Georgia, which has held it ever since. From 1910, when licensing was first introduced, to 1957—227,942 elephant seal bulls have been taken yielding nearly 73,000 tons of oil. These figures do not include the seals taken by the *Daisy* in 1913–14. The master of this vessel was licensed by the British Magistrate to take bull elephant seals but the conditions of the licence were



flagrantly ignored. The minimum kill of the *Daisy* was 1,534 seals; by 26th January, 1914, 1,094 seals had been taken but "the larger proportion has been made up of cows, and no negligible number have been babies which could be killed only by men capable of crushing the skull of a friendly puppy" (Murphy, 1947). *Daisy* left South Georgia without making returns of the number of seals killed or the quantity of oil produced from them.

A close season from 1st October to 31st December was originally stipulated in the sealing licence, but this was subsequently extended to 1st March; in 1914 September was also included in the close season as it was noticed that numerous females were seen with young in the latter days of that month. This extended close season hardly allowed the sealers to take their permitted quota of seals and it was later abandoned, sealing

being permitted from the 1st March to the 31st October. The breeding season of the seals has gradually fallen later in the year, and every season since 1938 the company has successfully applied for an extension of the season into November. Recently it has been pointed out that the original purpose of the close season, to protect the seals from molestation while breeding, was not being served by allowing killing in November and it has been decided that from 1958 onwards no sealing will be permitted in that month.

The coast of South Georgia is divided for sealing into four Divisions, and two reserves where no sealing is allowed. In addition, sealing is not permitted in one of the large bays of the north-east coast where two whaling companies have their shore-stations. Three of the Divisions, which are roughly equal in coastline, are worked each year. The number of seals permitted under the terms of the licence was originally distributed equally between the three Divisions but R. M. Laws, a biologist of the Falklands Islands Dependencies Survey, who worked in South Georgia in 1951-52, drew attention to the fact that the stocks in the different Divisions were by no means equal. Laws carried out a census of the pups born and from these figures calculated the quotas that could be contributed from each of the Divisions in the five years from 1952 to 1956. At the time that Laws was working in South Georgia one of the Divisions had suffered considerably from over-sealing, but it now appears that this damage has been largely repaired and the position of the stocks in all three Divisions currently gives no cause for alarm. Laws was able to put the conservation of the seals on a scientific footing for the first time by his discovery (Laws, 1953) that the age of elephant seals could be determined by examination of the structure of the canine teeth. Cross-sections of the teeth show a series of patterns of concentric rings of different types of dentine which correspond to yearly periods in the life of the seal. Sample teeth are now collected from the commercial kill and from these the average age of the seals killed in each Division is worked out. Any increase in the average age of the kill is an indication that the stock is increasing and vice versa. Most of the seals killed to-day are six or seven years old. Seals less than 3.5 metres in nose to tail length are not allowed to be killed, which excludes from the kill seals less than five years old. Few male seals reach an age of over twelve years in South Georgia, though in an undisturbed population such as that at the South Orkney Islands, bulls over twenty years old have been recorded (Laws, 1953).

The total number of seals permitted to be killed in each year was for a long time fixed at 6,000. In 1948, on the recommendation of the Magistrate at South Georgia, this quota was increased to 7,500. The kill fell off after this but in 1951 the quota was raised to 8,000 of which only 7,877 seals were actually taken. This was clearly more than the stock would stand and from 1952 to the present date the quota has remained at 6,000 which has been consistently attained till 1957 when only 5,408 seals were secured. This low figure was due to the appalling weather of that season rather than to any lack of seals.

Current sealing practice is to employ three small obsolete whale catchers each equipped with a motor boat and a pram dinghy which can be hoisted inboard. These vessels operate independently but wireless communications are maintained to ensure that two boats do not visit the same beach in rapid succession. On arrival at the sealing beach the catcher anchors and lowers the boats. The motor boat tows the pram to the shore where the sealing crew lands. One man remains in the pram as it is rarely calm enough to pull the boat ashore. The shore gang consists of a gunner, who shoots the seals and is in charge of the party, a beater, three flensers and three haulers. The gunner selects the seals to be killed and the beater drives them down to the water's edge one by one by striking them lightly about the head with a metal tube some 6 feet long. Skillfully done this causes scarcely any suffering to the seals though the stimulus of receiving repeated blows about the head, a vulnerable spot, is sufficient to drive even the biggest bulls from their harems. At the water's edge the seals are shot and rapidly divested of their blubber by the flensers assisted by the haulers, who pull the carcass away from the skin as the flensers cut through the connective tissue. Next a rope strop is then threaded through the skin which is then towed off-shore by the pram which delivers the skin to the motor boat. The skins float in the water and attract the attention of hundreds of Cape pigeons, *Daption capense*, which nibble at the blubber. When about six skins have been floated off the motor boat tows them out to the catcher where they are hoisted aboard and stowed in the hold. When one beach has been thoroughly worked the boats return to the catcher which then steams to the next. On making a full cargo, the blubber of about eighty to one hundred and twenty seals, according to the time of the year, the catcher returns to the whaling station where the skins are minced up mechanically and boiled out. The yield of oil per skin averages about 2.28 barrels in September when the

seals first arrive, but drops off to 1.99 barrels by the end of October. It thus pays the sealers to get as much of their quota as possible at the beginning of the season. At the present no use is made of the rest of the carcasses of the seals killed, which are left to rot on the beaches after flensing. The wastage of oil and protein is considerable and it is greatly to be hoped that improved methods of operation will permit their use in the near future.

The future of the South Georgia elephant seal herds is assured. The present sealing regulations, with which the sealing company willingly co-operates, are sufficient to ensure the careful control of the stock so necessary for rational harvesting. It even seems probable that the number of elephant seals on South Georgia is greater than ever before.

Besides the elephant seal, *Mirounga leonina*, three other species of pinnipede breed on South Georgia. These are the leopard seal, *Hydrurga leptonyx*, the weddell seal, *Leptonychotes weddelli*, and the fur seal, *Arctocephalus gazella*, previously erroneously described as *A. australis*, e.g. Matthews 1929, Bonner, 1958. Originally the taking of weddell and leopard seals was allowed under the terms of the licence, but since 1916 weddell seals have been absolutely protected and no leopard seals have appeared on the returns since 1927. Weddell seals have never been numerous in South Georgia; there is a small breeding colony at the south-east end of the island in Larsen Harbour which produced twenty-six pups in 1956 and twenty-seven the following season. In 1914 about thirty seals altogether were seen at this colony so it seems to have expanded slightly. These animals are worthy of protection as they represent the extreme northern breeding limit of the species, which is more typically found near the pack ice. Leopard seals are the only species of pinnipede in the Falkland Islands Dependencies which are afforded no measure of protection. This is probably due to their habit of preying on those favourite birds, penguins; a leopard seal nearly always being found in the waters off penguin rookeries. It was stated in 1929 that "the sea-leopard . . . is a ferocious pest, which preys on penguins as well as fish, and any diminution in its numbers may, perhaps, be viewed with equanimity". As Harrison Matthews (1929) pointed out, no reasons are given for preferring fish and penguins to leopard seals. Some few leopard seals are shot each year, mostly in the winter, by the whalers who covet their beautifully marked skins. In many cases the preparation of the pelt is too much trouble for the hunter and the animals are killed in vain. The main

headquarters of the species is further south, the South Georgia population consisting mainly of winter migrants. Being a solitary animal that spends most of its time in the water the leopard seal is relatively inaccessible to molestation and protective measures are perhaps unnecessary.

In recent years fur seals have been seen again round the coasts of South Georgia. Rankin (1951) reported about twenty ashore in 1946-47 and the present author encountered several in the summer of 1953-54. In December, 1956, I was able, by the courtesy of the manager of the sealing company, to visit Bird Island at the extreme north-west end of South Georgia. Here a large colony of fur seals was established. Owing to lack of time only a rough count of pups could be made; this amounted to 3,250, from which a total population of between 8,000 and 12,000 animals excluding pups was calculated (Bonner, 1958). In 1957 another visit was made to the colony and a much more accurate count revealed 4,500 pups. These figures are not strictly comparable, owing to different methods used, but it is believed that some at least of the apparent increase is real. The total population calculated from 4,500 pups amounts to about 15,000 animals. So far no exploitation of this potentially exceedingly valuable resource is contemplated. Some animals are being killed to obtain the scientific information so necessary for the firm biological background without which no conservation programme can hope to be a success and it is considered essential to obtain this information before any licence to kill is granted. It is hoped that the fur seals will spread from Bird Island to the mainland and repopulate the old rookeries that were exterminated in the nineteenth century but there are difficulties in the way of this. Female fur seals are gregarious and will not haul out to have their pups alone. The minimum group of cows to form a stable unit in the nearly allied northern fur seal, *Callorhinus ursinus*, is three or four (Bartholomew, 1953), thus simultaneous colonization by at least that number and a bull is required to initiate another rookery. It is possible, also, that the elephant seals, which the fur seals tolerate rather badly, have appropriated some of the old fur seal haunts. Nevertheless, it is expected that colonization will take place in the not too distant future and it may even be possible to expedite this by penning pregnant cows on suitable sites on the mainland until their pups are born.

The early history of sealing in South Georgia has been of uncontrolled exploitation leading to the near-extinction of the animals concerned. By judicious use of control measures

the remnant stock of elephant seals has recovered to provide a yearly harvest of edible oil, worth at current prices about £150,000. Moreover, it now appears that the fur seal stock is building up and in the course of the next decade or so will provide its quota to the resources of an island which, with the decline of the whaling industry, are severely limited.

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Secretariat,
Port Stanley,
Falkland Islands.

Colonial Secretary
Port Stanley
Falkland Islands.

4th. March 1965.

Sir,

Please find attached two copies of my report,
"Report on the sealing industry at South Georgia,
Season 1964 - 1965" for submission to His Excellency
the Governor.

A handwritten signature in black ink, reading "R. W. Vaughan". The signature is written in a cursive style and is underlined with a single horizontal line.

R. W. Vaughan, B.Sc.

Biologist/Sealing Inspector.

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REPORT ON THE SEALING INDUSTRY

AT SOUTH GEORGIA

SEASON 1964-1965

By

R. WILLIAM VAUGHAN, B.Sc.

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FEBRUARY, 1965.

REPORT ON THE SEALING INDUSTRY AT SOUTH GEORGIA

SEASON 1964-65

I. INTRODUCTION

The 1964-1965 season brought the continuation of Japanese sealing in South Georgia. The same three companies operating under the combined name of International Fishery Company were granted the sealing licence. They arrived in South Georgia a little earlier than last year and the first seal boats started fishing on 25th September. The weather was generally good throughout the season and the exceptional heavy snow cover in Cumberland and Stromness Bays was not found elsewhere on the island, but this is typical of a winter with a lot of easterly weather. Trouble with the boats themselves and their equipment caused the loss of a few days sealing, as did the sickness of one of the skippers, this is dealt with more fully in a later section.

This year saw a further reduction in the number of Norwegian personnel on the catching boats, only the captain and the mate/gunner being retained on Albatros and Dias and these together with the chief engineer on Petrel. This arrangement worked quite well in general although in the early stages the communication between bridge and engine-room left something to be desired, the only real difficulties were encountered by the pram men who have to row the heavy prams ashore. This latter job was found to be beyond the capabilities of any of the Japanese personnel tried at this job.

The crews were almost entirely new to sealing, out of the total of about thirty men ashore only four had had experience last year, and the first two trips were needed to teach the new men how to flense the seal, and handle the heavy skins from beach to sea. At this point it may be of advantage to give a brief account of how the sealing is carried out.

The seal boats themselves are converted whale catchers, all of which are more than twenty five years old, three boats are used and they each have a total crew of about twenty men, half of whom work ashore on the seal beaches. The seal boat leaves Grytviken, which is the whaling station, and steams to the most convenient seal beach. This is determined by the weather and which beaches still have their quota of seal to be taken. Once arrived at the beach the seal boat drops anchor as close as possible to the beach, and the motor boat and the pram are lowered. The shore crew climb into the pram and are towed to the beach by the motor boat, the pram is then used to put the men ashore. The first man to go to work is the driver, who with a long metal pole drives the bull seals down to the water's edge by tapping them on the nose and shouting at them. Once the seal has reached the water's edge the gunner shoots it in the head with a rifle firing soft nosed bullets, these ensure rapid death. Once the seal has been shot the flensing crew take over, first of all the animal is stabbed in the heart to make sure that it is dead and more important, to let the gallons of blood flow into the body cavity, rather than spout into the air in great fountains when the flensing commences. The first cuts are made around the head and the tail and the fore flippers. Then a long cut is made from head to tail right down the dorsal side and the skin is peeled off until the animal is lying on the almost circular skin. The men with hooks then pull the body off the skin, while the flensers cut it free. In the shore gang there are usually three flensers with knives on long five foot handles, six hookers armed with steel hooks about three feet long, the driver with his metal pole, and the gunner who is in charge.

Once the carcass has been completely removed from the skin and blubber a rope strop is threaded through the hole where the flipper once protruded and the skin is rolled into the sea. This latter task is not easy since the skin may weigh anything up to one ton. Once six seals have been flensed and the skins are floating in the sea, they are all tied together on a long line and the end of this is passed to the pram man, who then rows out to the

motor/.....

motor boat, the line of skins is then towed back to the seal boat. Once alongside the skins are hoisted one by one into the hold, and later, once the hold is full, the skins are put on deck.

On shore, sealing will continue until about 90% of the seals have been killed and then the sealing gang re-embark on the pram and return to the seal boat, the boats are heaved up, then the anchor, and the seal boat then makes it's way to the next bay where the process is repeated. This will continue until the seal boat has a full cargo, usually between 140 and 200 skins. The boat will then return to Grytviken with the skins probably having been out for three or four days depending on the weather and how far they have had to travel. Back at the station the skins are unloaded and hauled onto the plan where the whales are flensed, here they are cut up into small pieces and passed through a giant mincer and then put into a large boiler under pressure to extract the oil.

II. PROGRESS AND PRODUCTION.

Sealing commenced on 25th September, ten days earlier than in the previous season, and continued to the end of October, a total of 37 days. The high rate of catching of 45.6 seals per catcher's day's work (C.D.W.) was very slightly less than last year (46.3), and the oil production was higher, but still not as high as might be expected. Early in the season some seal meat was taken, this was used to obtain seal meat extract, but the experiment was not a great success, and is dealt with more fully in Section IX.

Week	Seals	%Catch	Production	Barrels/Seal
1	897	17.5	9702	1.89
2	1135	23.0		
3	818	15.9		
4	953	18.5		
5	1209	23.4		
6*	85	1.7		
TOTAL	5147	100.0	9702	1.89

*= pup count trip

TABLE I - Catch and Production by weeks, 1964.

The average oil production has been disappointingly low for the season as a whole. Last year the low production was partially due to the fact that a large quantity of oil was pumped away, but no such mishaps occurred this year. Unfortunately figures for the weekly oil production are not available.

WEEK	I	II	III	IV	TOTAL
1	0	130	767	0	897
2	178	132	875	0	1185
3	231	266	157	164	818
4	50	261	218	424	953
5	524	106	22	557	1209
6*	12	19	54	0	85

*= pup count trip

TABLE II - Catch by Weeks and Divisions, 1964.

The average seasons oil production of only 1.89 barrels/seal is rather low when compared to the average October production of 2.07 barrels/seal over the past ten years. There are a number of ways in which a lower oil production can be explained but in this case none are entirely satisfactory. An earlier haul out than usual of the seals would mean they would be thinner and thus there would be less oil, this year however there is no evidence to suggest that the seal had in fact hauled out any earlier. Alternatively if the average age of the catch had been greatly different one would expect a difference in production, but the average has only changed by 0.014 years. The only other way in which the production drop may be explained is by a loss in the factory. It is certain that oil was not pumped away, as last year, but it is thought that the cooking time may have been inadequate on some occasions. When there were a large amount of whales in, as happened on some occasions, the blubber cookery had great piles of blubber waiting to be tried out, and on these occasions the cooking time was reduced in order to try and clear the backlog, and thus all of the oil may not have been boiled out.

The weekly catch was generally satisfactory, the low catch in the third week was due to trouble with the boats, and bad weather, but a good catch in the fifth week made up for this. The very small number of seal taken in the last week when the tagging trip was made was due to the fact that on many of the beaches visited there were no surplus bulls available, and the ratio of cows to bulls was in some cases very high indeed. The final total of 5147 seal can be regarded as highly satisfactory in the time available, if only the company are able to arrive a little earlier next season there is no reason why they should not obtain the full quota, as well as benefiting from the higher production an earlier start will give them. The total oil production of 9702 barrels is worth £121,275 at current world prices.

III. CONDUCT OF SEALING OPERATIONS

This year there were two Sealing Inspectors at South Georgia, Dickenson as assistant this year, will take over for the 1965 season. The inspectors accompanied the sealing vessels on a total of 14 trips covering 45 days altogether, this excludes the tagging trip at the end of the season. The sealing was carried out in an efficient manner, so far as the existing equipment allowed. Section I of this report gives details of how the sealing is carried out and mentions the reduction in the number of Norwegian personnel employed. The only place this reduction was seriously noticed was with the pram, used to land on the beach. The Japanese men employed at this task found the heavy boat quite impossible to handle if there was much wind or if the sea was at all rough. Initial difficulties were encountered in communication between a Norwegian skipper on the bridge and a Japanese engineer in the engine room, neither man speaking the other's language. But this seemed to resolve itself by the end of the season without any vessels running aground. With an almost totally inexperienced crew on shore the same problems arose as last year, all the men having to be taught their particular jobs afresh. As in the previous season the hookers and flensers soon became quite proficient at their jobs, but driving the seal still caused a great deal of difficulty. At one stage in the season poor driving caused the flensing gang to be kept waiting, and it was at this time that a lot of carelessness occurred when several men were driving the seals. Altogether sixteen instances were noted when seals were blinded by careless driving, if this happened the gunner was instructed to shoot the seal where it lay, and the heavy skin then had to be dragged to the sea, sometimes as much as one hundred yards away. This method of dealing with seal being blinded by careless driving was found to be the most effective, and by the end of the season the standard of driving had improved.

During the course of the season eleven seal were lost, six of these were lost at Sacramento Bight when the sea suddenly became very rough and the sealing gang had to abandon the beach with the skins already flensed, had they delayed any longer it is doubtful whether they would have been able to leave the beach. The remaining lost seals were all animals that were not killed by the first shot and escaped into the sea. The rifles used this year

differed/.....

differed from those used in previous seasons, last year the rifles were so worn that they were not killing properly, but it was found impossible to replace the 7.6mm as the firm had stopped manufacturing them, so in place 6.5mm rifles were supplied as are used on the smaller Harp and Ringed seal of northern waters. These were found to be not so effective at killing the larger Elephant seal and in many cases more than one shot was required, all of the gunners said that they much preferred the larger calibre rifle.

A new innovation this year was that of synthetic ropes and strops for handling the seal skins. Nylon rope was used for the strops for lifting and towing the skins, while the actual tow ropes were of 'Kuralon', a Japanese synthetic fibre that is not only extremely light but also buoyant. Being light is of great advantage when carrying the lines ashore, and heaving the end out to the pram, since it obviates the necessity of a separate heaving line, and the fact that the rope floats makes it much easier to handle among surf and rocks, since it tends to float over the latter rather than become jammed underneath.

Radio communication this year was even worse than last, the equipment on the catching boats was not altered in any way, and the nightly talk to the station was more often than not, quite unreadable, or just not heard at all.

This lack of radio communication was especially badly missed when the manager decided to send a whale catcher round to the south side of the island to collect a load of skins from 'Petrel', so that she could have an extra few days catching on the south side while the weather was favourable. The whale catcher spent the greater part of one day cruising up and down off the coast looking for 'Petrel' but was unable to find her, and had no idea of where to look, since she had not been heard for two days. The radar sets with which the boats are equipped merely take up cabin space that could be used for other things, on 'Petrel' and 'Dias' the sets are completely non-functional, and on 'Albatros' the set would only pick up an object at about a quarter of a mile.

The motor boats had been thoroughly overhauled during the winter and in general gave little trouble, although 'Dias' did return on one occasion to change her boat, but a spare one was kept in readiness at all times.

Trouble with the anchor winch on 'Dias' was frequent, she often had difficulty in raising or lowering the anchor, and on one occasion when the chain broke free it injured two men and 'Dias' had to return immediately to Grytviken to take the injured men to hospital.

The heavy Norwegian prams were found to be too much to handle by the Japanese, and it is hoped that next year they might try to replace these with a boat of similar handling qualities, but much lighter, possibly a boat of glassfibre construction might fulfil these conditions.

Gunnar Nilsen, the skipper of 'Dias' had an infected hand in the latter part of the season and this caused 'Dias' to miss one day's sealing while he had hospital treatment, he continued for the rest of the season with his arm in a sling, as there was no one else capable of taking over from him as captain of 'Dias'.

	<u>ALBATROS</u> (Bogen)	<u>DIAS</u> (Nilsen)	<u>PETREL</u> (Hauge)
1960 catch	1998	1517	2060
% age	35.8	27.2	37.0
1961 catch	1564	1375	1654
% age	34.1	30.0	35.9
1963 catch	1276	1052	1411
% age	34.2	28.1	37.7
1964 catch	1740	1461	1861
% age	34.3	28.9	36.8

TABLE III - Proportion of catch by vessels 1960-1964. (Catch for pup count trip not included)

On October 21st, the company asked for an extension of the sealing season of two weeks, and gave four reasons for so doing. There was no seal catch in 1962, less than 4000 seal were caught in 1963, a heavy snowfall in the winter had caused the seal to haul out later, and seal meat experiments resulted in the catchers bringing in smaller loads. Dealing with these in turn, it is true that the 1962 cessation of sealing allowed reserves to build up, but this is no reason for sealing at a time when it may cause heavy mortality on the breeding beaches. Only 4000 seal were caught in 1963, this again builds up the reserve a little, but the reason for catching so few was that the company had arrived in South Georgia much too late to be able to attain the quota. Counts showed that the seal had not hauled out any later. The final excuse that seal meat was taking up valuable cargo space on the catchers was just dishonest. Seal meat was only brought in to the station on the first trip by 'Albatros', and then the total amount was only 250 kilograms, equivalent in weight to about half a seal skin, and at the time the letter was written there was no seal meat at all being brought in to the station. The extension was not granted.

During the course of the season no short seals were noted as having been killed. Two cows were shot, one accidentally when a bull moved rapidly as the shot was fired, in this case the animal was included in the quota. The other was a badly injured animal shot on the inspector's orders.

IV. TOOTH COLLECTION AND AGE STUDIES

The standard of tooth collection this season was still not as good as one would hope, altogether there were nine infringements, four of teeth being returned that were too short for examination, and five instances of the incorrect number being returned.

Results of the age determinations are shown in Tables IV and V overleaf, and these show that the average age of the catch as a whole has dropped very slightly from 7.703 to 7.689, this change is shown to be statistically insignificant at the 5% level. Age changes in the various divisions were less marked than last year, although Divisions I, II and III all showed slight decreases in average age these were very small, and Division IV rose from 7.517 to 7.982 but this change, as all the other divisional changes, was insignificant.

The average age of the catch will reflect the average age of the breeding seals left on the beaches, and over the past three seasons this has remained quite stable at around 7.7 years, and at this level gives no cause for concern. The age changes in the different divisions have been more marked, especially in Division IV, but here the catch has been relatively small, so only a small sample of teeth have been available, and the results of the analysis show a high standard error. An average age of 7.5 years is the minimum that should be allowed and should there be any drop below this, the quota should either be redistributed or reduced until the age rises. This year Division III is down to 7.573 and has reached the stage when it must be very carefully watched in the coming season, but a consideration of the numbers of available bulls at the time of the census shows that there is an average of 15.6 cows to each bull, and this figure is the lowest of all divisions. Division II has shown a slight drop in average age, but most worrying is the ratio of cows to bulls of 43:1 which is far too high. Fortuna Bay is by far the worst with an average of 64:1, and in the coming year will have to be watched most carefully. If the same high average occurs next year it may be necessary to sub-divide Division II as was done with Division III a few years ago, to prevent overfishing in one part of the Division.

Divisions I and IV are quite satisfactory, especially the latter, but this is to be expected since the full quota has not been taken from this division since 1960.

Last year it was noted that the average age had not risen as high as might be expected due to a year's cessation of sealing, and this was attributed to the fact that the sealing crews had selected the smaller seals

TOOTH COLLECTION AND AGE STUDIES - TABLES IV & V.

	DIV I		DIV II		DIV III		DIV IV		TOTAL	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Number	9	46	45	45	102	103	29	54	185	248
Average Age	7.778	7.630	7.933	7.667	7.647	7.573	7.517	7.982	7.703	7.689
± 2 S.E.	0.754	0.291	0.130	0.392	0.224	0.023	1.618	0.316	0.182	0.150
Var.	1.285	0.164	1.885	0.080	1.257	0.026	1.974	0.093	1.565	0.013
S.D.	1.133	0.987	0.434	1.316	1.115	1.179	0.444	1.162	1.251	1.180

TABLE IV - Results of Tooth Analysis by Divisions, 1963 - 64.

	1954	1955	1956	1957	1958	1959	1960	1961	1963	1964
	Number	311	330	269	269	290	264	266	251	185	248
Average Age	7.31	7.32	7.51	7.41	7.46	7.23	7.32	7.71	7.70	7.69
± 2 S.E.	0.16	0.13	0.14	0.10	0.13	0.13	0.16	0.19	0.18	0.15
S.D.	1.41	1.18	1.15	1.16	1.14	1.03	1.34	1.42	1.25	1.18

TABLE V - Tooth Analysis, 1954 - 1964.

on the beach because they were unable to drive the largest animals, this was in fact also the case this year.

The present quotas for each division would seem to be quite satisfactory, but it is hoped that the company will make some effort to catch in Division IV earlier in the season, instead of almost finishing their quota in III before making a start on IV. They are totally dependent on the weather to operate in IV, but whatever the weather there is almost always somewhere they can catch in III.

V. POPULATION STUDIES

This year 'Petrel' was used after the end of the season to make a round trip of the island for the purpose of making the annual census and tagging pups. With plenty of assistance available it was possible to get a large number of tags applied and to carry out an accurate census. In return for this trip 'Petrel' was allowed to take an extra load of skins, altogether 85 being taken from those beaches with a surplus of bulls. The approximate value of this cargo was £2,000. Apart from this census trip, counts were made during the course of the season on other beaches around the island, and these figures give quite a good picture of both the total seal population and its build up.

All the census beaches were visited this year between 2nd and 5th November and only at Ranvik was it impossible to land due to the very heavy swell, however all the seal were easily visible on the narrow beach and it was possible to count the cows and bulls from the catcher lying close in-shore, the number of pups was later calculated by direct comparison with the figures obtained from Dias Cove, which lies in a similar situation a little further down the coast. The census gave a total of 439 bulls, 9078 cows and 12,694 pups which is an average of 25 cows per bull and 1.45 pups per cow at the time of the census. (Full census details are given in Appendix 1.)

In most cases the totals are down on last year's figures and it is proposed to comment on each of the beaches in turn.

NILSHUL (Division I)

This was the first time a count has been made at Nilshul since 1960, and since that date the number of pups has increased from 173 to 264. There were an adequate number of bulls on the beach in spite of two sealing visits to this small beach during the course of the season.

WILSON HARBOUR (Division I)

Wilson Harbour has shown large fluctuations in pup populations in the last few years, census figures prior to 1961 show a steady figure of about 600 pups, in 1963 after a year's cessation this had increased to over 900, and this year there is only half that amount at 455. There were very small numbers of cows ashore and very few bulls with them. Sealing vessels had taken 144 bulls from this beach which accounts for the smaller number of bulls but there is no obvious reason why the number of cows should be so much less than previous years.

UNDINE HARBOUR (Division I)

This is a very small beach at the north western end of the island and has never held more than about 150/200 pups. This year there were only 110 pups counted, but this beach did have the lowest cow/bull ratio of 7:1. Thirty bulls were taken from this beach during sealing operations.

RIGHT WHALE BAY (Division II)

Previous to 1960 this beach had been included in a reserve area, but for the past four seasons it has been sealed. A count in 1959 revealed a total of 1444 pups, but with the advent of sealing this figure dropped to 6/700, rising again in 1963 to 1104, only to drop again this year to 714. This would seem to be typical of the population as a whole, when sealing is taking place, the total numbers are less, but remain relatively stable.

BRUNONIA BEACH (Division II)

This was one of the few beaches that has shown a small increase in pup total since last year, rising from 1045 to 1277, in past years it has been generally about this number. The number of cows per bull on this beach was 44 at the time of the census, and during the season not a great number of seal were taken, and it is difficult to explain this high ratio.

FORTUNA BAY (Division II)

Fortuna is one area that shows signs of having been over-sealed this year, the cow/bull ratio at the time of the census was 64:1 and this can hardly be regarded as satisfactory. 192 seal were taken from this beach during the course of the season. The pup total is down by 73 to 1341, a small decrease but generally the number of pups on this beach has fallen in the past five years. In the coming season Fortuna will have to be watched very carefully and it may be necessary to split the Division as has been done in Division III to safeguard the easily sealed Westfjord area.

LILLE JASON (Division III)

Pup totals on this beach are down 30% on last year and show an even larger drop over previous years, the numbers usually having been about 3 - 400 are now down to 169. In view of the fact that the pup/cow ratio was much lower than on any other beach it seems that pupping has taken place rather later on this beach, which may be attributed to the fact that Westfjord was one of the areas mentioned earlier as having had a heavy winter snowfall.

ST. ANDREWS BAY (Division III)

As last year the beach counted was that known as Monday Beach or Long Beach, and is the northernmost in St. Andrews Bay. The beach has shown a slight decrease in population since last year, of just under 300, to a pup total of 3096. The number of bulls on the beach, 163, can be regarded as most satisfactory, and the ratio of cows to bulls remains the same at 16. 318 bulls were taken from this beach during the season.

GOLD HARBOUR (Division III)

Gold Harbour is another beach showing a slight increase in the number of pups this year, having risen by 59 to 1935. The cow/bull ratio of 19 is satisfactory, even though one hundred and sixty bulls were taken from this beach in the season, it always has been a beach capable of withstanding a high catch.

RANVIK (Division IV)

As mentioned earlier it was impossible to land at Ranvik, but a count was made from the sealing vessel which lay close inshore. It was possible to count the cows quite easily with binoculars and from this total the pup total was calculated assuming the same proportion of cows to pups as at Dias Cove. The number of pups has increased since the last census of this area in 1960 but only to a small extent, and the number of cows to each bull at the time of the census was 23.

DIAS COVE (Division IV)

This beach was also last counted fully in 1960, when the pup total was 298, this year there were 558 pups to be seen. There were a satisfactory number of bulls per cow left on the beach, 10:1, but only 24 seal had been taken from this beach during sealing operations.

HOLMESTRAND (Division IV)

Holmestrand has shown little change in the number of pups over the last five years, this year was very slightly down on 1963. However the number of bulls left on this beach indicates that some over-sealing has taken place, the sealers find that Holmestrand is one place on the south-west coast they can almost always take seal, and consequently it tends to suffer. This year 429 bulls were taken, and it seems that on occasions less than the required number have been left on the beach, as ratio at the time of the census was 46:1.

The total number of pups counted on the census beaches was 12,694, but in addition during the course of the season many other beaches were counted and by taking the number of cows on the beach at the time of the count, it is possible to work out with a fair degree of accuracy how many pups would be born on that beach by the end of the season. In some cases counts have been used that were carried out last season, for those beaches that were not visited this year. In all cases the number of pups quoted is the minimum one might expect from the number of cows seen earlier in the season. Tabulated results of this pup census are given in Appendix ii. Consideration of these figures gives the total seal population of South Georgia at about a quarter of a million, including the pups of the year, however it may be necessary to revise this figure at a later date when further information concerning life expectancy and mortality is available.

VI. TAGGING

This year the tagging programme was carried out most successfully, and altogether 3,000 tags were applied to elephant seal pups. Some tagging was carried out during the actual sealing season, but the majority were put on during the census and tagging trip at the end of the season. Once more extra assistants were available to help with the tagging on this trip, including Dr. T. Ichihara from the Tokyo Whale Research Institute who kindly offered his assistance, and Mr. John Dye, one of the whaling inspectors from Grytviken. As mentioned last year the additional help at this time is extremely valuable, and it is hoped that in future years such help will be forthcoming.

Of the 3,000 tags applied only four were recorded as 'lost', in each case this was the result of a lively pup evading the tagger, with the result that the tag clinched firmly without contacting a flipper. Also recorded are two instances of tags being applied to the wrong flipper. The high efficiency of 99.86% may be partly attributed to the new American made tags, which are far superior to the 'Ketchum' type used in previous years, these new tags were used for the first time last season.

DIVISION	I	II	III	IV	RESERVE	TOTAL
Tags used	450	950	865	450	285	3000
Losses	1	0	2	1	0	4
Tags applied	449	950	863	449	285	2996

TABLE VI - Distribution of Tags. 1964.

It will be noted in the table above that 285 tags are recorded as having been applied in a reserve area, these were put on mostly in Stromness Bay and a few on Dartmouth Point. Section X of this report mentions seal reserves in greater detail.

In the past there have been considerable supply difficulties with seal tags, leading to an inadequate reserve at South Georgia, and in 1962 only 600 tags were put on before the stock was finished. It is hoped that these earlier difficulties have now been cured, as there will be at least 7,000 tags in stock at South Georgia at the beginning of next season.

VII. TAG RECOVERIES

This season again it is possible to report on some tagged elephant seals having been found, two at South Georgia and perhaps rather more interesting, two from the South Orkneys.

1. Tag number 11211. Tagged in Fortuna Bay, South Georgia on 30.10.60. Seen at Borge Bay, Signy Island, South Orkneys on 21.11.64.

This was a male animal that had hauled out to moult.

2. Tag number 14152. Tagged in Possession Bay, South Georgia on 22.10.61. Seen at Borge Bay, Signy Island, on 17.11.64. This was also a male animal which had hauled out to moult.

3. Number unknown. Tag reversed. Right Flipper. Seen at Husvik Harbour, South Georgia on 4.9.64. Female.

4. Number unknown. Tag reversed. Left Flipper. Seen on several occasions in Stromness Bay, South Georgia in December, 1964. Also female.

The recoveries of tags in the South Orkneys is most interesting, because this confirms Laws' theory that breeding animals at South Georgia move to the South Orkneys to moult. It is also interesting because in the past year or so, four tags have been recovered away from South Georgia, two of which were from South America, this would seem to indicate a westerly trend in the winter migration of the South Georgia herd.

The tags mentioned above as reversed, are tags which have turned over after having been applied, so that the number cannot be read. It is necessary to wait until the animal is asleep before attempting to turn over the tag, and often it is not possible to wait that long. It was hoped that numbers could be stamped on both sides of the tag, but the company say they cannot do this, as there would be no room for the return address.

It is hoped that in the coming season some tags will appear in the commercial catch, since tagging has now been taking place for 8 years. Next year it is proposed to institute a reward system for any tags recovered by the sealers. This is done in the whaling industry, any worker who finds a whale mark during processing, hands it over to the inspectors, and is given a small cash reward. It is thought that some small incentive such as this might encourage the sealers to keep a more careful watch on the animals they are flensing. At the beginning of next season a circular will be sent to the sealing crews telling them about the tags and any rewards, the company have kindly agreed to translate any such circulars into Japanese.

VIII. QUOTA RECOMMENDATIONS

It is not proposed to change the quota in the coming year as the age studies show the herd to be in a generally good condition, but in the coming year it will be necessary to watch division III carefully and should the age drop any lower it may be necessary to alter the quota. Also Division II may have to be subdivided if the situation in Fortuna Bay does not improve.

The present quota of 6000 would seem to be the maximum that stocks can stand at the present time, and it seems that the herd has stabilised at the present level of utilisation.

The possibilities of two company operation in South Georgia in future seasons is dealt with more fully in a later section of this report.

IX. WHOLE CARCASE UTILISATION

In spite of the interest expressed by International Fishery Company last year, in whole carcase utilisation, they did not attempt to take any whole seals back to the station. They did however take a very small amount of seal meat during the first trip on 'Albatros', which was processed for seal meat extract, a product not unlike 'Bovril', which is used in the manufacture of soups and the like. The extract produced although of a good chemical composition, had a most disagreeable smell and alone would have been unsuitable for inclusion in edible matter, but this problem was solved by mixing it with a much larger quantity of whale meat extract to hide the smell. In view of the undesirable smell of the product and also because of the time taken to remove the meat from the carcase, this experiment was not continued beyond the first load of meat brought to the station.

Analysis of the extract showed it to have the composition shown:-

Moisture	25.2%
Salt	7.4%
Ash	6.8%
Fat	0.2%
Creatin	5.1%

The approximate losses involved by not taking whole carcasses was mentioned in the previous year's report, and had been calculated at about 40% of the amount obtained from the oil. In view of the interest expressed by both companies operating in South Georgia at the present time it would be desirable to try and persuade a company to take whole carcasses. Whaling legislation requires that the complete animal should be used and it seems a great omission that the same thing should not apply to the sealing industry.

The problems associated with company competition and ways of dealing with the allocation of the licence are dealt with more fully in Section XI of this report.

X. SEAL RESERVATIONS.

After the end of the season it was possible to visit two of the seal reserves in South Georgia, only a brief visit was possible at the Dartmouth Point Reserve when tags were applied and a rough count made. Stromness Bay however was under intermittent observation throughout the season due to the presence of Messrs. Smith and Atkinson, the Leith Harbour Whaling Inspectors. They kindly carried out counts at intervals and applied 200 tags to pups, they were also responsible for finding two of the seal tags reported earlier. Comparative counts of the seal reserves are always of great help, this year the average number of cows per bull in the reserve area at Stromness was 8, a great deal lower than that around the remainder of the island. Stromness Bay is quite isolated from the heavily sealed areas of Westfjord and Fortuna which lie on either side of it, and probably there is very little interchange of breeding animals, thus it is an ideal area as a reserve, and also it is easily visited. Another thing noticed in the seal reserves is that pupping takes place noticeably earlier than the rest of the island. Over the past forty years the date of pupping has gradually become later and later, due to the sealing operations, and the November sealing which took place in the past was mainly responsible, it is hoped that now this practice is totally forbidden the situation will improve.

XI. THE FUTURE OF SEALING

Between the years of 1903 and 1961 all the sealing at South Georgia has been carried out by the Compania Argentina de Pesca (Latterly known as Albion Star), with the exception of about 1500 taken in the 1912-1913 season by an American sealer, the 'Daisy'. In 1963 the arrival of Japanese sealers started a new era although methods have remained virtually unaltered since 1903. Last year the rival company at Leith Harbour, Nippon Suisan Kaisha (N.S.K.) expressed interest in sealing operations. The company with the licence, International Fishery Company (I.F.C.) had leased the whaling station and apparently the sealing licence with it. During the winter of 1964 Salvesens, who lease Leith Harbour to N.S.K., applied for a sealing licence on their behalf. However at this time the licence had already been given to I.F.C., who had applied rather earlier. Salvesens then expressed interest in the sealing licence for the 1965 season, but at this stage the licence has yet to be allocated. It seems that both I.F.C. and N.S.K. will be interested in getting the licence, so some means must be found of dealing fairly with the situation. Probably offering the licence to tender will be the only answer, but also the question of utilisation ought to be taken into consideration. Should one of the companies offer to utilise the whole carcase, this should be given every encouragement, in view of the high degree of wastage at present.

Splitting the seal quota between two companies is undesirable, apart from the fact that a smaller amount would not really be profitable to the company, it would raise the problem of adequate inspection, and would also make the possibility of poaching more likely. The seal stocks at present certainly would not allow the quota to be increased so that two companies would have a reasonable number of seal.

XII. SUMMARY

1. The number of seal caught in the 1964 season was 5147 which produced a total of 9702 barrels of seal oil, which at current prices is worth £121,275.

2. International Fishery Company, of Tokyo, held the sealing licence as they had done in the 1963 season.

3. The average age of the catch dropped very slightly from 7.703 to 7.689, an insignificant change, and there is no reason for the quotas to be altered in the coming year.

4. Three thousand seal pups were tagged during the season, and also a census of pups was carried out which gave a total of 64,800 pups on those beaches counted. The seal population of South Georgia has been calculated at approximately 250,000 animals.

5. The problems of licence allocation, having two interested companies is discussed.

XIII. ACKNOWLEDGEMENTS

I should like to thank the following for assistance with the tagging programme during the season, Messrs. Dye, Smith, Atkinson, Tamura and Dr. Ichihara. My thanks also to Captain Ole Hauge and the crew of 'Petrel' for their assistance during the census trip, and to Manager Muraji for making the results of the seal meat analysis available.

DATE	BEACH	BULLS	COWS	PUPS	P/♀	♀/♂
<u>DIVISION I</u>						
4.11.64	Nilshul	14	160	264	1.65	11
4.11.64	Wilson Harbour	10	290	455	1.57	29
4.11.64	Undine Harbour	12	80	110	1.37	7
<u>DIVISION II</u>						
4.11.64	Right Whale Bay	23	437	714	1.64	19
5.11.64	Brunonia	14	621	1277	2.05	44
5.11.64	Fortuna	13	833	1341	1.61	64
<u>DIVISION III</u>						
5.11.64	Lille Jason	15	171	169	0.99	11
2.11.64	St. Andrews Bay	163	2640	3096	1.17	16
2.11.64	Gold Harbour	77	1497	1935	1.29	19
<u>DIVISION IV</u>						
3.11.64	Ranvik	21	483	613	1.27	23
3.11.64	Dies Cove	46	1340	558	1.27	10
3.11.64	Holmestrand	51	1426	2126	1.52	46
TOTAL/AVERAGE		439	9078	12694	1.45	25

Appendix (i) Elephant Seal Census, 1964.

Kjaeringskaede	350	
Jason Harbour	200	
Lille Jason	200	
West Fjord, remainder	2500	
Maiviken	400	
Dartmouth Point	1900	
East Cumberland	2500	
Ocean	200	
Penguin, Godthul	500	
Bikkjebukte	2000	
St. Andrews, Theatre	4000	
St. Andrews, Sunday	2000	
St. Andrews, Monday	3100	
Sacramento	400	
Royal Bay	5000	
Bjørnstadt	1200	
Gold Harbour	2000	
Iris Bay	300	
Wirik Bay	1200	
Cooper Bay	900	
Hamilton Bay	300	
Drygalski	300	
	<hr/>	DIVISION III = 31,450
Donner Beach	500	
Paradis	700	
Trollhul	450	
Rabvik	600	
Dias Cove	600	
Undine South Harbour	1200	
Rocky Bay	200	
Annenkov and Reef	1000	
Sandefjord, Larvik	1500	
Horten	1400	
Borre	600	
Holmestrand	2200	
	<hr/>	DIVISION IV = 10,950
Dronning Maud	1000	
Haakon	2000	
Cheapman	1300	
Nilshul	300	
Elephant	200	
Wilson Harbour	500	
Isafjord	3000	
Schlieper	400	
Johanhavn, Kulhavn	200	
Undine North Harbour	100	
Elsehul	100	
	<hr/>	DIVISION I = 9,100
Right Whale Bay	700	
Welcome	1200	
Rosita	150	
Haugehul, Koppervik	350	
Brunonia	1300	
Long Beach, BI	1700	
Bay of Isles islands	200	
Sea-Leopard	1200	
Beckmann	600	
Prince Olav Harbour	100	
Possession	1500	
Blue Whale Harbour	200	
Antarctic	1100	
Fortuna	1500	
Stromness	1500	
	<hr/>	DIVISION II = 13,300

TOTAL POPULATION = 64,800

Appendix (ii) Census of elephant seal pups. 1964.

Week	1	2	3	4	5	6	Total
<u>DIVISION I</u>							
King Haakon	-	75	107	-	186	-	368
Cheapman	-	-	30	-	84	-	114
Nilshul/Elephant	-	-	-	20	24	9	53
Wilson Harbour	35	-	55	-	51	3	144
Ice Fjord	-	44	51	69	72	-	236
Schlieper Bay	-	-	-	-	38	-	38
Undine Harbour	24	-	6	-	-	-	30
Elsehul	-	-	12	-	-	-	12
TOTALS	59	119	261	89	455	12	<u>995</u>
<u>DIVISION II</u>							
Right Whale Bay	18	-	15	-	-	17	50
Welcome	-	-	-	76	-	-	76
Bay of Isles	43	-	82	134	5	-	264
Sealeop/Beckman	22	-	28	11	-	-	61
Possession/Clav	41	68	-	61	10	-	180
Antarctic	33	-	19	39	-	-	91
Fortuna	37	77	45	16	15	2	192
TOTALS	194	145	189	337	30	19	<u>914</u>
<u>DIVISION III</u>							
West Fjord	190	64	56	-	22	8	340
East Cumberland	42	88	-	-	-	-	130
Gåthl/Ocn/Pengn	31	8	8	-	-	-	47
Bikkjebukte	51	126	101	11	-	-	289
St. Andrews Bay	193	110	-	-	-	15	318
Royal Bay	109	143	-	147	-	-	399
Bjornstadt	-	50	-	-	-	-	50
Sacramento	-	15	-	-	-	-	15
Gold Harbour	87	42	-	-	-	31	160
Iris Bay	64	39	-	33	-	-	136
Wirik Bay	42	34	-	-	-	-	76
Cooper Bay	44	35	-	27	-	-	106
Drygalski	-	27	-	-	-	-	27
TOTALS	853	781	165	218	22	54	<u>2093</u>
<u>DIVISION IV</u>							
Paradis	-	-	-	79	73	-	152
Trollhul	-	-	-	35	8	-	43
Ranvik/Don/Alb	-	-	-	210	86	-	296
Dias Cove	-	-	-	-	24	-	24
Undine South	-	-	67	-	24	-	91
Annenkov	-	-	-	40	30	-	70
Sandefj/Larvik	-	-	-	-	25	-	25
Borre/Horten	-	-	-	-	15	-	15
Holmestrand	-	-	97	60	272	-	429
TOTALS	0	0	164	424	557	0	<u>1145</u>
<u>WEEKLY TOTALS</u>	1106	1045	779	1068	1064	85	<u>5147</u>

	NUMBER OF SEALS TAKEN					YIELD OF OIL					AVERAGE OIL PRODUCTION PER SEAL				
	March	Sept.	Oct.	Nov.	TOTAL	March	Sept.	Oct.	Nov.	TOTAL	March	Sept.	Oct.	Nov.	AVERAGE
1952	161	410	2539	2890	6000	293	892	4949	4673	10,807	1.82	2.18	1.95	1.62	1.80
1953	363	592	2754	2291	6000	669	1334	5504	3968	11,475	1.84	2.25	2.00	1.73	1.91
1954	177	388	3199	2236	6000	316	897	6376	3836	11,425	1.79	2.31	1.99	1.72	1.90
1955	-	1048	3342	1610	6000	-	2383	6730	2955	12,068	-	2.27	2.01	1.84	2.01
1956	-	994	3443	1563	6000	-	2218	6926	2661	11,805	-	2.23	2.01	1.70	1.97
1957	-	1406	2926	1076	5408	-	3189	6066	1765	11,020	-	2.27	2.07	1.64	2.04
1958	-	994	3245	1625	5864	-	2174	7327	2975	12,476	-	2.19	2.26	1.83	2.13
1959	-	917	4253	617	5787	-	2353	9030	1169	12,562	-	2.53	2.12	1.90	2.18
'60/61	57	1656	3417	502	5632	98	3843	7332	1108	12,381	1.72	2.32	2.15	2.21	2.20
'61/62	-	1414	2784	567	4765	-	2535	6102	1029	9,666	-	1.79	2.19	1.81	2.03
1963	-	-	3739	200	3939	-	-	7042		7,042	-	-	1.82	1.74	1.79
1964	-	897	4168	85	5147	-	-	9702		9,702	-	-	1.89		1.89

Appendix (iii) Catch Statistics 1952 - 1964 Value for oil in barrels (six barrels = 1 ton).

Secretariat
Port Stanley
Falkland Islands.

Colonial Secretary
Port Stanley
Falkland Islands.

9th March 1965.

Si.
sb.

Sir,

Please find attached one copy of my report,
"Report on the Fur Seal Investigations at Bird Island,
South Georgia. 1963 - 1964." H.E. the Governor has
one copy in his office at present.

R. W. Vaughan

R .W .Vaughan, B.Sc.
Biologist.

REPORT ON THE FUR SEAL INVESTIGATIONS

BIRD ISLAND, SOUTH GEORGIA

1963 - 1964.

by

R. William Vaughan. B. Sc.

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AUGUST 1964.

REPORT ON THE FUR SEAL INVESTIGATIONS AT BIRD ISLAND

SOUTH GEORGIA 1963-1964

I. INTRODUCTION

In the 1963-1964 season, field work on the fur seal herd at South Georgia was confined to a short visit to Bird Island from December 18th to 10th January 1964. In the comparatively short time available, which was due to the restricted availability of suitable shipping, the annual census and tagging programmes were carried out most successfully.

Transport to the island was by means of the R.R.S. "John Biscoe" which left Grytviken on December 17th and called first at Husvik to leave a field party, and continued to Bird Island the following day. The weather was suitable for an immediate landing, and a small quantity of stores and mail for the USARP party was put ashore at the same time. This year the Biologist was accompanied by an assistant, Mr. A. J. Smith, who had been whaling inspector at Grytviken until the beginning of December. In view of the nature of the work at Bird Island an assistant is a necessity, especially with the tagging.

The Biologist and assistant left Bird Island on 10th January onboard the R.R.S. "Shackleton" and were returned to King Edward Point, and then to the Barff Peninsula on the east side of Cumberland Bay to carry out further work on the reindeer, at this time many fur seal were seen around the coast, which matter is discussed in a later section. During the month of March the Biologist accompanied H.M.S. Protector on an investigation of the South Sandwich Islands, many fur seal were seen in this group, but this work will be the subject of a separate report.

II. ORGANISATION

This season the same living arrangements as the previous year were used. The Biologist and assistant lived in the main hut with the USARP party, which consisted of two men, and shared all cooking and cleaning duties with them. Food supplies were taken from King Edward Point to supplement the existing USARP rations, especially in the way of fresh fruit and vegetables. Radio contact was maintained every few days with South Georgia radio station, using the USARP radio equipment. In the coming season it is expected that there will be no USARP personnel on Bird Island but arrangements have been made for the Biologist and party to make full use of the USARP facilities. The future of the buildings and equipment is in doubt at the present, but it seems that the administration of them will pass to British Antarctic Survey, with USARP retaining the right to send personnel there, if they require to do so. It is presumed that the Government Biologist will still be able to make use of facilities, especially since he will be able to act as caretaker, and maintain the huts and equipment in working order.

Transport to and from Bird Island this year was carried out on both occasions by BAS vessels, but in future years the situation may not be so easy. However should the administration of the base pass to BAS they will have some responsibility for its maintenance.

A detailed inventory of all the USARP property has been prepared so there should be no doubt as to who is responsible for what. Government owned equipment at Bird Island at the present time consists of the one small living hut, small amounts of food supplies and some domestic equipment, also one radio set which is normally kept at King Edward Point.

III. POPULATION STUDIES

This year it was possible to carry out a full and accurate census of pups in spite of the lateness of arrival on the island. This was achieved by making a complete count of the main census area between December 19th and 21st. This was spread out over three days because

there / . .

there were so many seal on the beaches, and considerable time had to be spent on each beach in order to arrive at an accurate and consistent figure. After this full count had been made, a small party of the main census area, comprising about 15% of the total, was counted at intervals until all the pups were observed to have been born. This point is in fact reached when the pup counts no longer show an increase. The area used for this sample count was the area known as Beaches beyond Landing Beach (BBLB), marked as areas 1 - 4 on the appended map. These beaches are a series of rocky platforms under high cliffs, and the pups are unable to hide in the tussac to any great extent, therefore it is possible to account for all the pups on the beach. Later on in the season as the pups become more active they start to swim and move away from BBLB, but this point was not reached before all the pups had been born.

The increase in number of pups in the sample area from the time of the full count to the time when no more pups were born, was used as the basis for calculating the number of pups in the entire census area.

In addition to the counts of the main census area, all the subsidiary breeding beaches such as Johnson Cove, Sound Beaches and Extra Beaches were visited and careful counts carried out. (These places and the main census area are marked on the map, Appendix I)

The results of the main counts of the census area and subsidiary beaches are given below. In most cases the places mentioned were visited more than once, but only the most recent count is included.

<u>DATE</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>	<u>♀/♂</u>	<u>P/♀</u>
19.12.61	696	3943	8058	5.7	2.04
12.12.62	783	4937	6743	6.3	1.37
9. 1.63	-	-	8520	-	-
21.12.63	673	3598	8001	5.3	2.22
26.12.63	572	2950	9146	5.2	3.10

TABLE I. COUNTS OF MAIN CENSUS AREA 1961 - 1963

<u>DATE</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>	<u>♀/♂</u>	<u>P/♀</u>
19.12.63	99	399	978	4.0	2.45
23.12.63	95	398	1066	4.2	2.68
25.12.63	86	384	1022	4.5	2.66
26.12.63	84	326	1118	3.9	3.43

TABLE II. COUNTS OF SAMPLE AREA 1963

<u>DATE</u>	<u>PLACE</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>
21.12.63	Extra Beaches/20*	39	195	446
27.12.63	Pearson Inlet/21	9	31	43
23.12.63	Johnson Cove/22	45	186	711
6. 1.64	Sooty Cove/23	2	0	3
6. 1.64	Cobbler Beach/24	17	43	145
22.12.63	Sound Beaches/25	<u>124</u>	<u>546</u>	<u>1362</u>
	TOTALS	<u>236</u>	<u>1001</u>	<u>2710</u>

TABLE III. COUNTS OF SUBSIDIARY AREAS 1963/4

(20* these numbers refer to locations on map)

Using the figures shown in the tables above it is now possible to calculate the final pup total on Bird Island. No allowance will be made for any pups born in the subsidiary areas after they had been counted.

Complete / . .

Complete count of the main census area on 19th/21st December gave a total of 8001 pups. At this date the number of pups in sample area was 978.

The final number of pups in sample area was 1118.

Therefore percentage increase in sample area is -

$$\frac{1118 - 978}{978} \cdot 100 = 14.3\%$$

So assuming that whole census area will increase by the same proportion the total pup number may be calculated as -

$$\frac{8001 \cdot 14.3}{100} = 1145$$

Actual increase in complete census area is 1145 pups, therefore final number is -

$$8001 + 1145 = 9146$$

The total pup population of Bird Island may now be added -

Total pups main area	9146
Total pups subsidiary areas	2710
<u>TOTAL PUPS BIRD ISLAND</u>	<u>11856</u>

Now allowing for the fact that a few more pups would almost certainly be born in the subsidiary areas, after the time that they were counted, the pup total may be safely rounded to 12,000 without fear of over estimation.

This calculation was checked by calculating the increase for certain smaller and easily counted beaches and then going out and counting them, results are given below.

<u>BEACH</u>	<u>CALCULATED</u>	<u>COUNTED</u>
Freshwater Bay East	463	466
Freshwater Bay West	181	195
Iceberg Point	134	139
<u>TOTAL</u>	<u>778</u>	<u>800</u>

This represents an error of less than 3%, also it should be noted that the calculation was less than the counted total. The final figure of 12,000 is given with the fullest confidence.

The final pup total of 12,000 shows a 15% increase over the 1962/63 total of 10,200. The greater part of this increase has been in the subsidiary areas, as the increase in the main census area was only 7.4% as shown in table iv.

<u>YEAR</u>	<u>PUP TOTAL</u>	<u>%AGE INCREASE</u>
1957	5100	-
1958	6400	25.5
1959	7500	17.2
1960	8600	14.7
1961	8400	- 2.3
1962	8520	1.2
1963	9150	7.4

TABLE IV. NUMBER OF PUPS IN CENSUS AREA 1957 - 1963

YEAR / . .

<u>YEAR</u>	<u>PUP TOTAL</u>	<u>%AGE INCREASE</u>
1959	797	-
1960	1337	67.7
1961	1643	22.9
1962	1829	11.3
1963	2710	48.2

TABLE V. NUMBER OF PUPS, SUBSIDIARY AREA 1959 - 1963

Consideration of tables iv and v show that the increase in the subsidiary areas has been much greater than in the main breeding beaches, this indicates that the herd is expanding, because the main beaches are reaching a point where they cannot hold many more seal. This year the increase has been rather greater than in the previous three years, but the figure for 1960 must almost certainly have been too high.

It had been hoped to visit the Willis Islands and other areas around the north end of the island, but this was not possible due to transport difficulties.

One thing that was particularly noticed was that there were quite a large number of seal seen around South Georgia, during the sealing season and while the reindeer field work was being undertaken. This shows that the seal are spreading further afield from Bird Island than they have done in the past, most of the animals seen have been juvenile non-breeding seal, but it is hoped that in the not too far distant future these animals will move away from the Bird Island area and recolonise some of the areas they have done in years gone by. This expansion is dealt with more fully in section VI of this report.

IV. TAGGING

In the 1962-63 season a total of 1800 tags was applied to fur seal pups on Bird Island. This is rather more than were put on in the previous season but is still not a satisfactory amount. Once more supply difficulties were the cause of the trouble, 1800 tags being the total stock in South Georgia. It is intended to order more than one years supply for the coming season so that there will be an adequate reserve in case of any future supply difficulties, at the present time there are 5,000 tags on order, and it is intended to order another 5,000 before the beginning of next season. This should mean that at the start of next season there will be 10,000 tags on hand, and any subsequent delays in supply will not affect the tagging programme

The tags which are of American design and manufacture have been found to be much superior to the previous "Ketchum" type. They are easier to apply and there have been very few instances of tags failing to clinch properly due to faulty manufacture.

The nylon "Rototags" mentioned in last years report have been further investigated and found to be unsatisfactory, they cannot be marked with a return address, and thus would only be of use as colour markers for identifying a particular animal. It is not intended to pursue this topic any further.

It was hoped that a modification to the monel tags could be made, that the tag number could be stamped on both sides, so that even if the tag was reversed in the flipper the number could be read. The manufacturers were unfortunately unable to do this, so one is still left with the precarious task of trying to turn a tag over to read it.

<u>SEASON</u>	<u>TAGS APPLIED</u>	<u>LOSSES</u>	<u>PUP POPULATION TAGGED</u>
1957	1718	5.4%	33.0%
1958	1185	6.6%	18.5%
1959	1395	0.5%	18.7%
1960	1195	0.4%	13.9%
1961	1294	0.5%	15.4%
1962	823	0.25%	8.2%
1963	1797	0.17%	15.0%

TABLE VI. TAGGING DATA 1957 - 1963

V. TAG SIGHTINGS

In the twelve months following March 1963 a large number of tagged fur seal have been seen at Bird Island. Altogether 209 tags have been recorded and these are listed in Table VII. From these tag sightings it is possible to derive a great deal of useful information about the seal herd, factors such as age at first pregnancy, age at which bulls first breed actively, and movements of the herd as a whole as well as of individual animals.

One interesting movement noticed was that of the yearling animals, these are not seen on the island until after Christmas. They are born in December and stay on and around the island until April or early May, then leave for feeding grounds, and finally return in the January of the following year. Of the 44 tagged yearlings seen only six were seen before January, and these were seen at the very end of December. This indicates that the animals go a considerable distance during the winter, since not one was seen between April and November.

The two year old class is not quite so consistent, of a total of 63 seen, forty-two did not return until the following year, 18 were seen in late December, and six were seen in the winter, 3 in August and 3 in September.

The three year olds present a rather more complex picture, they have been seen during every month of the year at Bird Island, although the majority are seen during the breeding season. Of the 16 identified as females during the breeding season, all but one were confirmed as breeders. All the males seen were definite non breeders.

Four year old females seen in the breeding season amounted to 20, of which 17 were confirmed as breeding, the remaining three were seen in the tussac and may well have been going back to a pup, or going to sea to feed.

Only one animal of the five year old class was seen, last year none from this group (then 4 year olds) were seen at all. In the 1958/59 season only 1185 tags were put on, and with these considerable difficulty was encountered, the tags failed to clinch properly and in all 6.6% were useless. It is thought that perhaps many of these tags have since fallen out due to their faulty construction.

Six 6 year old animals were seen but only two of them in the breeding season one female was in a harem but was not seen with a pup, and the one male was seen on Landing Beach but did not hold a harem in the season, this animal was also seen last year in the same place.

TABLE VII. SUMMARY OF TAGS SEEN MARCH 1963 - MARCH 1964.

<u>TAG NUMBER</u>	<u>PLACE</u>	<u>TAGGED DATE</u>	<u>PLACE</u>	<u>SIGHTED DATE</u>
0209	BBLB	2.1.58	Landing Bch	26.12.63
1914	BBLB	6.1.58	BBLB 3	6.1.64
1459	Main Bay	5.1.58	FW Bay	22.2.63

1790	Point Beach	6. 1. 58	Landing Beach	3. 5. 63
1852	BBLB	6. 1. 58	Johnson Cove	5. 9. 63
1892	BBLB	6. 1. 58	Square Pond	1 5. 63
5069	Stinker Cape	16.12. 58	Cave Crag	7. 1 64
7018	BBLB	8. 1. 60	Wanderer Valley	20. 2. 64
7029	BBLB	8. 1. 60	BBLB 2	19.12. 63
7047	BBLB	8. 1. 60	Landing Beach	19.12. 63
7146	BBLB	8. 1. 60	" "	6. 7. 63
7148	BBLB	8. 1. 60	" "	6 1 64
7194	BBLB	8. 1. 60	Sooty Cove	6. 1. 64
7246	BBLB	8. 1. 60	Landing Beach	22. 8. 63
7282	BBLB	8. 1. 60	BBLB 2	26.12. 63
7323	BBLB	8. 1. 60	Landing Beach	4. 2. 64
7368	BBLB	8. 1. 60	" "	26.12. 63
7403	BBLB	9. 1. 60	Sooty Cove	22.12. 63
7425	BBLB	9. 1. 60	Landing Beach	1. 1. 64
7430	BBLB	9. 1. 60	" "	1. 1. 64
7439	BBLB	9. 1. 60	FW Bay	24.12. 63
7463	BBLB	9. 1. 60	BBLB	23.12. 63
7524	Landing Beach	9. 1. 60	BBLB	19.12. 63
7553	" "	9. 1. 60	BBLB 2	19.12. 63
7585	" "	9. 1. 60	FW Bay	14. 2. 63
7657	" "	9. 1. 60	Landing Beach	19.12. 63
7691	" "	9. 1. 60	" "	1. 1. 64
7707	" "	9. 1. 60	Wanderer Ridge	19. 2. 64
7725	Iceberg Point	9. 1. 60	Landing Beach	28.12. 63
7730	" "	9. 1. 60	" "	6. 7. 63
7736	" "	9. 1. 60	BBLB	6. 1. 64
7748	" "	9. 1. 60	Landing Beach	6. 1. 64
7763	" "	9. 1. 60	Wanderer Valley	24. 2. 64
7785	" "	9. 1. 60	FW Bay East	19.12. 63
7817	Point Beach	10. 1. 60	Landing Beach	19.12. 63
7869	" "	10. 1. 60	" "	27. 8. 63
7871	" "	10. 1. 60	Main Bay	21. 3. 64
7882	" "	10. 1. 60	FW Bay	31. 1. 64
7892	" "	10. 1. 60	Stinker Cape	4 4. 63
7980	" "	10. 1. 60	Gentoo Point	8. 3 64
10122	Selected Bch	10. 1. 60	Pearson Inlet	15. 1 64
10156	" "	10. 1. 60	Selected Bch	20.12. 63
10172	" "	10. 1. 60	BBLB 4	19.12. 63
10181	" "	10. 1. 60	Main Bay	20.12. 63
10222	Main Bay	10. 1. 60	Main Bay	20.12. 63
10231	" "	10. 1. 60	Main Bay	16. 1. 64
10244	" "	10. 1. 60	Mountain Cwm	30 8. 63
10250	" "	10. 1. 60	Stinker Cape	18. 3 64
10261	" "	10. 1. 60	Cave Crag	21.12. 63
10282	" "	10. 1. 60	Landing Beach	10. 9 63
10294	" "	10. 1. 60	Square Pond	20. 9. 63
10324	" "	10. 1. 60	Stinker Cape	23.10 63
10325	" "	10. 1. 60	Main Bay	20.12. 63
10356	" "	10. 1. 60	Landing Beach	6. 9. 63
10391	" "	10. 1. 60	Square Pond	3. 2. 64
10403	" "	10. 1. 60	Round How	16. 1. 64
10438	" "	10. 1. 60	Square Pond	9. 1. 64
10467	" "	10. 1. 60	FW Bay West	21.12. 63
12803	BBLB	24. 1. 61	Wanderer Valley	20 1. 64
12821	BBLB	24. 1. 61	BBLB 3	19.12. 63
12835	BBLB	24. 1. 61	Landing Beach	16. 8. 63
12839	BBLB	24. 1. 61	BBLB Rocks	6. 1. 64
12974	BBLB	24. 1. 61	Sooty Cove	22.12. 63
12944	BBLB	24. 1. 61	Landing Beach	5. 5. 63

13000	BBLB	24	1.	61	BBLB 3	19.12.	63
13019	BBLB	24.	1.	61	Main Bay	5. 1.	64
13021	BBLB	24.	1.	61	Landing Beach	8. 1.	64
13053	Landing Beach	26.	1.	61	BBLB Rocks	19.12.	63
13085	" "	26	1.	61	Landing Beach	23.12.	63
13100	" "	26.	1.	61	BBLB Rocks	6. 1.	64
13142	" "	26.	1.	61	BBLB 2	19.12.	63
13161	" "	26.	1.	61	Landing Beach	4. 2.	64
13162	" "	26.	1.	61	" "	19. 1.	64
13173	" "	26.	1.	61	Pearson Inlet	11. 9.	63
13178	" "	26.	1.	61	BBLB Rocks	23.12.	63
13189	" "	26.	1.	61	Landing Beach	26.12.	63
13231	" "	26.	1.	61	Stinker Cape	9. 1.	64
13252	" "	27.	1.	61	Iceberg Point	11. 1.	64
13269	" "	27.	1.	61	Johnson Cove	11. 9.	63
13273	" "	27.	1.	61	" "	26.10.	63
13274	" "	27.	1.	61	Landing Beach	17. 6.	63
13277	" "	27.	1.	61	FW Bay	8. 1.	64
13282	" "	27.	1.	61	Landing Beach	1. 1.	64
13284	" "	27.	1.	61	" "	7. 1.	64
13304	Iceberg Point	27.	1.	61	Wanderer Valley	3. 2.	64
13308	" "	27.	1.	61	FW Bay	27.12.	63
13331	" "	27.	1.	61	FW Bay East	19.12.	63
13337	" "	27.	1.	61	FW Bay	1. 1.	64
13354	FW Bay	27.	1.	61	BBLB 3	26.12.	63
13369	FW Bay	27.	1.	61	North Valley	18. 3.	64
13395	FW Bay	27.	1.	61	FW Bay	24.12.	63
13399	FW Bay	27.	1.	61	North Valley	5. 3.	63
13467	FW Bay	28.	1.	61	FW Bay	29. 1.	64
13485	Stinker Cape	28.	1.	61	BBLB 1	19. 1.	64
13524	" "	28.	1.	61	Landing Beach	16. 8.	63
13505	Main Bay	28.	1.	61	Sooty Cove	22.12.	63
13637	Main Bay	28.	1.	61	Main Bay	11. 1.	64
13667	Main Bay	28.	1.	61	Wanderer Valley	19. 4.	63
13681	Main Bay	28.	1.	61	Kep Bay	13. 9.	63
13695	Main Bay	28.	1.	61	Square Pond	3. 7.	63
13729	Main Bay	30.	1.	61	Kelp Bay	11.10.	63
13814	Main Bay	30.	1.	61	Cave Crag	29.12.	63
13846	Main Bay	30.	1.	61	Mountain Cwm	25. 1.	64
15310	BBLB	20.	1.	62	FW Bay	27. 2.	63
15337	BBLB	20.	1.	62	Wanderer Valley	15. 2.	64
15347	BBLB	20.	1.	62	Stinker Cape	27. 1.	64
15352	BBLB	20.	1.	62	FW Bay	24. 3.	64
15370	BBLB	20.	1.	62	BBLB	7. 3.	64
15383	BBLB	20.	1.	62	Landing Beach	16. 8.	63
15394	BBLB	20.	1.	62	FW Bay	25.12.	63
15399	BBLB	20.	1.	62	Landing Beach	16.12.	63
15413	BBLB	20.	1.	62	FW Bay West	31.12.	63
15424	BBLB	20.	1.	62	BBLB Rocks	2. 1.	64
15443	BBLB	20.	1.	62	FW Bay	27.12.	63
15462	BBLB	20.	1.	62	Pearson Inlet	27.12.	63
15465	BBLB	20.	1.	62	Landing Beach	19. 1.	64
15528	BBLB 1	21.	1.	62	Square Pond	8. 3.	64
15602	BBLB 1	21.	1.	62	Landing Beach	19. 1.	64
15617	BBLB 1	21.	1.	62	FW Bay	28.12.	63
15623	BBLB 1	21.	1.	62	FW Bay	18. 3.	64
15677	Landing Beach	21.	1.	62	North Valley	20. 3.	64
15688	" "	21.	1.	62	Pearson Inlet	15. 1.	64
15713	Iceberg Point	21.	1.	62	Wanderer Valley	10. 3.	64
15724	" "	21.	1.	62	FW Bay	1. 1.	64
15765	" "	21.	1.	62	FW Bay	27.12.	63
15767	" "	21.	1.	62	Main Bay	9. 1.	64
15774	" "	21.	1.	62	Wanderer Valley	25. 2.	64
15779	" "	21.	1.	62	FW Bay	11. 4.	63
15784	" "	21.	1.	62	Iceberg Point	24. 2.	63

15787	Iceberg Point	21.	1.	62	Wanderer Valley	18.	2.	64
15798	" "	21.	1.	62	BBLB Rocks	23.	12.	63
15826	FW Bay	22.	1.	62	Square Pond	19.	9.	63
15881	FW Bay	22.	1.	62	Wanderer Valley	18.	3.	64
15909	FW Bay	22.	1.	62	Landing Beach	4.	9.	63
15946	FW Bay	22.	1.	62	" "	16.	8.	63
15954	FW Bay	22.	1.	62	Johnson Cove	11.	1.	64
15959	FW Bay	22.	1.	62	Landing Beach	19.	1.	64
15968	FW Bay	22.	1.	62	FW Bay	24.	12.	63
15975	FW Bay	22.	1.	62	North Valley	7.	3.	64
16000	FW Bay	22.	1.	62	Extra Beaches	21.	12.	63
16014	FW Bay	22.	1.	62	BBLB Rocks	19.	12.	63
16082	FW Bay	22.	1.	62	Stinker Cape	5.	3.	64
16229	Main Bay	23.	1.	62	Landing Beach	19.	1.	64
16232	" "	23.	1.	62	FW Bay	20.	3.	64
16241	" "	23.	1.	62	FW Bay	28.	12.	63
16253	" "	23.	1.	62	FW Bay	25.	12.	63
16258	" "	23.	1.	62	Square Pond	22.	2.	63
16298	" "	23.	1.	62	Kelp Bay	11.	1.	64
16306	" "	23.	1.	62	Cave Crag	31.	1.	64
16309	" "	23.	1.	62	Johnson Cove	11.	1.	64
16319	" "	23.	1.	62	Wanderer Valley	5.	2.	64
16327	" "	23.	1.	62	Square Pond	27.	12.	63
16344	Point Beach	23.	1.	62	FW Bay	20.	2.	63
16367	" "	23.	1.	62	Landing Beach	11.	1.	64
16398	" "	23.	1.	62	BBLB	4.	9.	63
16407	" "	23.	1.	62	Main Bay	20.	12.	63
16439	Next Beach	23.	1.	62	Square Pond	27.	1.	64
16454	First Kill	24.	1.	62	FW Bay	20.	12.	63
16480	" "	24.	1.	62	Round How	22.	2.	63
16546	Rock Platform	24.	1.	62	BBLB 4	26.	12.	63
16593	" "	24.	1.	62	Square Pond	20.	12.	63
16645	Kelp Bay	24.	1.	62	FW Bay	12.	2.	63
16651	Kelp Bay	24.	1.	62	Square Pond	7.	2.	64
16663	" "	24.	1.	62	Mountain Cwm	30.	8.	63
16674	" "	24.	1.	62	Square Pond	16.	2.	63
17218	BBLB 4	4.	1.	63	FW Bay	20.	3.	64
17219	BBLB 4	4.	1.	63	FW Bay	19.	3.	64
17224	BBLB 4	4.	1.	63	BBLB	7.	1.	64
17250	BBLB 4	4.	1.	63	Round How	21.	3.	64
17282	BBLB 4	4.	1.	63	FW Bay	24.	12.	63
17309	BBLB 3	4.	1.	63	Wanderer Valley	7.	3.	64
17320	BBLB 3	4.	1.	63	FW Bay	5.	3.	64
17389	BBLB 3	4.	1.	63	FW Bay	26.	3.	64
17458	BBLB 1	4.	1.	63	Wanderer Valley	10.	3.	64
17482	BBLB 1	4.	1.	63	" "	3.	3.	64
17491	BBLB 1	4.	1.	63	" "	24.	2.	64
17494	BBLB 1	4.	1.	63	BBLB Rocks	19.	12.	63
17495	BBLB 1	4.	1.	63	Wanderer Valley	4.	3.	64
17505	Landing Beach	4.	1.	63	FW Bay	5.	3.	64
17510	" "	4.	1.	63	FW Bay	24.	12.	63
17520	" "	4.	1.	63	FW Bay	24.	3.	64
17521	" "	4.	1.	63	Landing Beach	7.	3.	64
17528	" "	4.	1.	63	North Valley	24.	3.	64
17564	" "	4.	1.	63	FW Bay	20.	3.	64
17638	Main Bay	5.	1.	63	Landing Beach	19.	1.	64
17665	Point Beach	5.	1.	63	FW Bay	1.	2.	64
17676	" "	5.	1.	63	Mountain Cwm	25.	1.	64
17678	" "	5.	1.	63	FW Bay	20.	3.	64
17697	" "	5.	1.	63	BBLB	4.	2.	64
17730	" "	5.	1.	63	Landing Beach	9.	3.	64
17774	" "	5.	1.	63	Wanderer Valley	17.	2.	64

17783	Point Beach	5. 1. 63	Iceberg Point	8. 6. 63
17785	" "	5. 1. 63	FW Bay	23. 2. 64
17815	Next Beach	5. 1. 63	FW Bay	20. 3. 64
17832	" "	5. 1. 63	Wanderer Valley	26. 3. 64
17853	Selected Beach	5. 1. 63	Stinker Cape	5. 3. 64
17871	" "	5. 1. 63	Gentoo Point	8. 3. 64
17875	" "	5. 1. 63	Stinker Cape	8. 3. 64
17878	" "	5. 1. 63	FW Bay	20. 3. 64
17887	" "	5. 1. 63	Rock Platform	30.12. 63
17948	First Kill	5. 1. 63	FW Bay	20. 3. 64
17961	FW Bay	5. 2. 63	Wanderer Valley	4. 3. 64
17962	FW Bay	5. 2. 63	Selected Bch	31.12. 63
17963	FW Bay	5. 2. 63	Main Bay	7. 2. 64
17965	FW Bay	5. 2. 63	Wanderer Valley	6. 1. 64
17984	FW Bay	5. 2. 63	Sooty Cove	22.12. 63
17995	FW Bay	5. 2. 63	FW Bay	25. 2. 64
20008	FW Bay	6. 2. 63	North Valley	10. 1. 64
23527	Kelp Bay	29.12. 63	Pearson Inlet	21. 3. 64

TABLE VII. SUMMARY OF TAGS SEEN MARCH 1963 - MARCH 1964.

Members of the USARP party who spent the winter at Bird Island were able to make many useful observations on the fur seal, a few of which are noted below.

The pups of the year began to leave the island in April and by the end of the month they had virtually all gone as had most of the adults. May was generally a month with few seal about, but by June many bulls had hauled out again and were occupying the breeding beaches, many of these bulls were younger animals who would not have harems in the season when the larger bulls return to take up their places. In July there were less bulls on the beaches and it was thought that the smaller numbers were due to large patches of ice on the beaches and the generally cold weather which tends to keep the seal in the water, where they probably find it warmer than in the wind on an exposed beach.

An interesting feature is that during the months of July and August quite large numbers of leopard seals were seen on the beaches at Bird Island. Many of these were obviously pregnant females but none were seen to pup. They did not show any particularly aggressive tendencies towards the fur seal.

VI. EXPANSION OF THE FUR SEAL HERD

It is now apparent that the main breeding beaches at Bird Island have about reached the level of maximum population. The numbers of pups born in the last couple of years has decreased quite sharply, and the rate of increase in the subsidiary areas has increased. Now when animals return to breed towards the end of the season they find that the beaches are quite full, and they probably move to a less congested area in the vicinity. Evidence suggests that the three year old animals return to pup a little later than the older cows, and since this younger group will have less attachment to a particular beach than the adult animals, they will be more likely to move to new ground. The rate of increase in population in the subsidiary areas this year was seven times as great as that in the main census area. Eventually these other areas will become fully populated and then the seal will be forced to move elsewhere, as there are no more suitable areas on Bird Island. On the mainland just a mile from Bird Island there are a number of quite suitable spots for the establishment of fur seal rookeries, these areas at the present time have small populations of fur seal, but they form a quite insignificant part of the total herd. The last time these areas were visited was in January 1962 and at that time several small groups of breeding seal were found in Johannhavn, it had been hoped that it

would be possible to revisit these areas this year, but transport difficulties prevented this. The area is visited during the course of the elephant sealing, but that is in September and October which is too early for breeding fur seal to be seen, although at that time there may well be quite a large number of bulls holding territory. Willis Islands are one of the main overspill areas but these islands have not been visited for a number of years now, however there is not enough suitable ground there for the establishment of a large breeding colony.

It is hoped that within the next few years there will be a large overspill of breeding seal onto the mainland, and once small stable groups are established there should be a population explosion such as there has been on Bird Island.

Fur seal have been seen during the past year in many areas around South Georgia, especially in the Cumberland Bay area, but this probably represents distribution of observers rather than of fur seal. The Biologist spent part of January and February, altogether about six weeks, studying the reindeer on the Barff Peninsula, and during the course of these investigations many fur seal were seen around the Cumberland Bay area. These were almost always juvenile non-breeding animals which are more prone to wander at that time of the year. Fur seal were also seen at Cooper Bay and Fortuna Bay during the elephant sealing operations.

During March the Biologist went to the South Sandwich Islands to investigate the spread of fur seal to that group, and a small but thriving population was found there. They were found to be breeding on two of the islands, and were seen on several others of the group. Altogether about two thousand fur seal were found in the islands, but it is doubtful if there will ever be a really large population due to lack of breeding space. The early nineteenth century sealers never found many seal on these islands, the greater part of their catch coming from South Georgia and the South Orkneys. The results of the work done at the South Sandwich Islands will be reported separately. Skulls collected there showed the seal to be of the same sub-species that occurs at South Georgia, Arctocephalus tropicalis gazella. Bouvetoya was also visited and a small group of fur seal were found there, these have also been found to belong to the same sub-species.

VII. EXPERIMENTAL WORK

During this season it had been intended to try to carry out a detailed analysis of the proteins of fur seal milk, but due to the short stay, and also the fact that the wrong equipment and chemicals had been supplied this was not possible. The routine census and tagging were carried out most successfully, and three animals were collected for specimens of skin, reproductive material and stomach contents. In the coming season it is hoped that a long visit can be made to Bird Island over the Christmas period, from late November to late January at least. During this time it is proposed to carry out the usual census and tagging, and special emphasis will be placed on the checking of tagged animals. The protein analysis will be carried out, together with further studies on feeding habits and the collection of blood sera.

It is hoped that it may be possible to carry out a search for further breeding colonies on the mainland but it is doubtful if transport will be available.

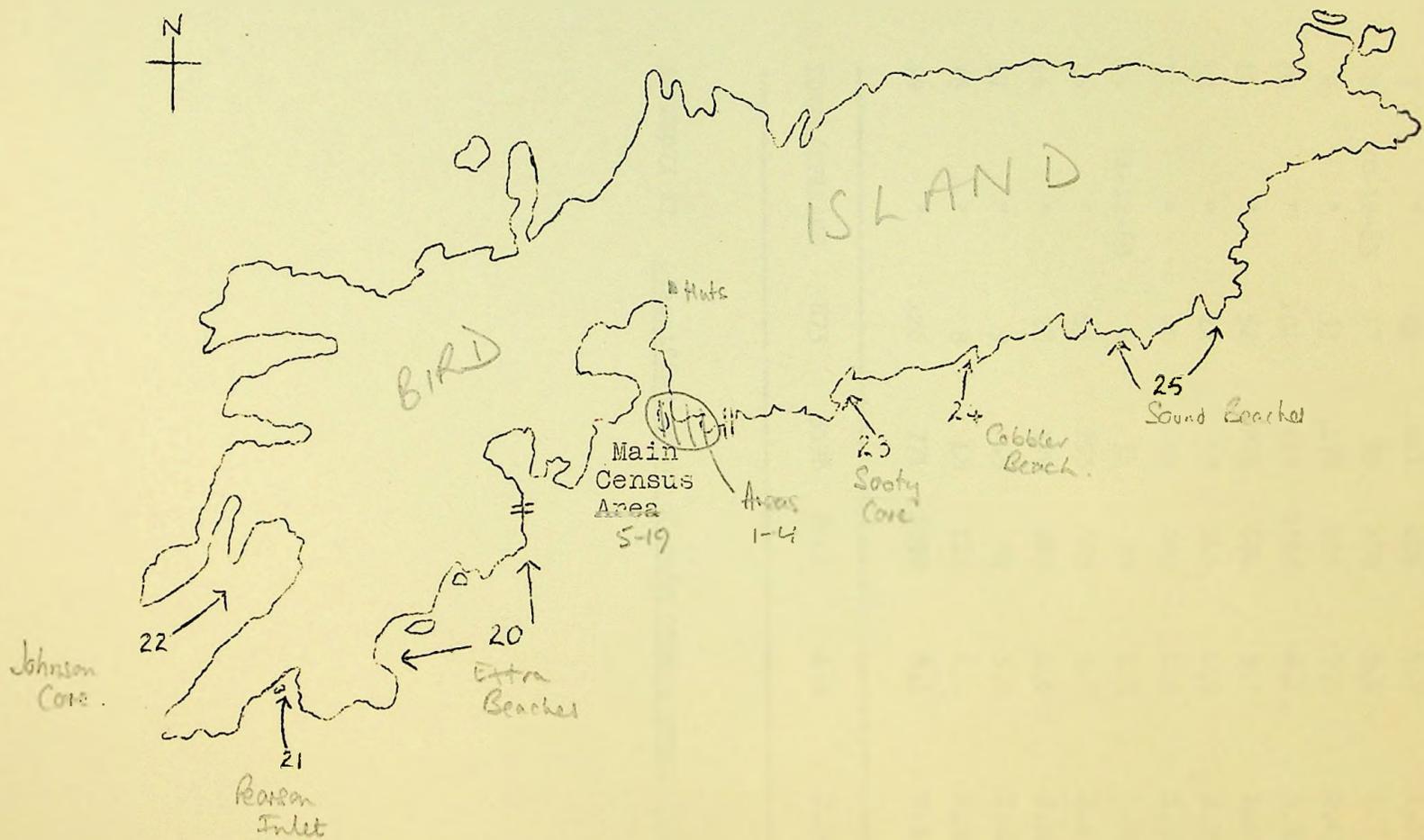
Other work that will have to be done will include maintenance of the huts and it is hoped that extra assistance will be available for this work.

VIII. ACKNOWLEDGEMENTS

I should like to take this opportunity to record my thanks to Mr. A.J. Smith for his assistance at Bird Island, to Messrs Tickoll and Pinder for their very useful information about fur seals in the winter and for a very large number of tag sightings. Also to Captain Turnbull of R.R.S. "Shackleton" and Captain Johnston of R.R.S. "John Biscoe" for transport to and from Bird Island.

RV/LH

APPENDIX I. MAP OF BIRD ISLAND SHOWING FUR SEAL
CENSUS AREAS.



AREA	DATE	BULLS	COWS	PUPS	♀/♂ ^a	PUPS /♀
1	19-12-63	10	30	104	3.0	3.46
2	"	30	134	263	4.5	1.96
3	"	24	107	355	4.5	3.32
4	"	35	128	256	3.7	3.00
5	"	65	324	593	5.0	1.83
6	"	10	50	117	5.0	2.34
7	"	45	211	405	4.7	1.92
8	20-12-63	17	89	158	5.2	1.77
9	"	33	176	426	5.3	2.42
10	"	102	619	1366	6.1	2.20
11	"	52	275	684	5.3	2.48
12	"	12	59	140	4.9	2.38
13	"	20	99	200	4.9	2.38
14	21-12-63	4	11	20	2.2	1.82
15	"	43	293	625	6.8	2.13
16	"	28	129	287	4.6	2.22
17	"	9	45	92	5.0	2.04
18	"	8	48	112	6.0	2.34
19	"	126	771	1798	6.1	2.33
TOTAL/AVERAGE		673	3598	8001	4.9	2.26

APPENDIX II. Classified count of main census area. 1963.

As I expect that there is a copy of this in
secretariat but I suggest that we find a
home for it too - or with BBS or Bats Land S.G.

02/10/70
LH

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THE BIOLOGICAL LABORATORY,
KING EDWARD POINT,
SOUTH GEORGIA,
DECEMBER, 1965.

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INTRODUCTION.

The cessation of the whaling industry at Grytviken during the 1965-season meant that consequently there was no commercial sealing taking place this season.

It was thought that Nippon Suisan Kaisha operating from Leith Harbour might take up the vacant licence, but this they did not do.

Consequently, the 1965 seal research programme was limited to an Elephant Seal census in the East Cumberland Bay area, in areas previously examined by Laws in 1951, and Vaughan in 1962. In addition, a few counts were carried out in the seal reserves.

The annual tagging programme was carried out with a fair degree of success, considering the lack of transport.

CENSUS AREAS.

The main census was carried out between Grytviken and Discovery Point (Map I). The majority of the seals in this area are to be found on the seaward side of the extensive moraine plain known locally as Hestesletten, and also on the flat ground of Discovery Point. Relatively few seals are to be found on the long Hestesletten Beach between Penguin River and Discovery Point, due to the fact that it consists almost totally of large stones, which are not favoured for hauling out purposes.

The secondary census programme was carried out on the Dartmouth Point reserve. It was intended to make weekly visits to the reserve, and thus obtain a good picture of the population build-up there, but unfortunately a period of inclement weather resulted in the production of too great a swell to enable landing from a small pram. In all a total of five visits was made to Dartmouth Point, and although this was not as many as I would have liked, it did yield some interesting results.

The majority of the seals haul-out on the flat tussac covered point, and on the shingle/sand Sudan Beach. Balsam Beach is similar to Hestesletten Beach and supports fewer seals.

In addition to the above, several counts were made of seals in the Stromness Bay reserve, through the kind co-operation of the Leith Harbour Whaling Inspectors.

When carrying out the census, only harem bulls were included in the bull count.

CENSUS RESULTS

Table I..... Elephant Seal census figures for Hestesletten, 1965.

<u>DATE.</u>	<u>BULLS.</u>	<u>COWS.</u>	<u>PUPS.</u>	<u>COW/BULL.</u>	<u>PUPS/COW.</u>
Sept 1	8	0	0	0	0
Sept 5	11	1	0	.09	0
Sept 7	10	1	0	.10	0
Sept 10	18	2	0	.11	0
Sept 12	25	4	0	.16	0
Sept 15	24	5	0	.20	0
Sept 19	26	29	2	1.11	.068
Sept 21	27	43	3	1.57	.069
Sept 23	28	74	13	3.00	.170
Sept 29	30	242	52	8.06	.210
Oct 2	47	525	106	11.17	.201
Oct 5	53	800	193	15.00	.241
Oct 7	62	1179	337	19.01	.285
Oct 9	57	1208	475	21.19	.393
Oct 13	61	1529	867	25.06	.560
Oct 16	63	1720	1191	27.3	.629
Oct 18	60	1754	1229	29.1	.700
Oct 20	59	1782	1391	30.2	.780
Oct 25	48	1777	1624	37.0	.910
Oct 28	56	1681	1727	30.01	1.020
Nov 2	51	1281	1747	25.11	1.36

Table II..... Census figures for Dartmouth Point 1965.

<u>DATE</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>	<u>COW/BULL</u>	<u>PUPS/COW</u>
Sept 9	20	2	0	.10	0
Sept 16	31	14	0	.451	0
Oct 11	145	1720	794	11.80	0.404
Oct 23	142	2209	1858	13.08	0.840

Table III....Census figures for Stromness Bay, 1965.

The population showed more fluctuation throughout the season than in previous years.

<u>DATE</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>	<u>COWS/BULL</u>	<u>PUPS/COW</u>
Oct 12	24	60	16	2.500	0.26
Oct 23	9	138	127	15.33	0.90
Oct 30	18	119	134	6.61	1.12

The majority of the season, a count was made of all bulls ashore on the beach.

Table IV.....First sightings, Hestesletten, Dartmouth Point 1951, 62, 64, 65.

was obtained.

<u>LOCATION</u>	<u>YEAR</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>
Hestesletten	1951	Sept 16	Sept 20	Oct 2
	1962	c Sept 5	Sept 12	c Sept 26
	1964	-	-	Sept 29
	1965	c Sept 1	Sept 5	Sept 19
Dartmouth Pt.	1951	c Sept 5	c Sept 10	Sept 20
	1962	-	-	-
	1965	c Sept 9	Sept 9	-

Table V...Highest values for Hestesletten & Dartmouth Point 1951, 62, 65.

will be due to the rather low water totals of the past two seasons.

<u>LOCATION</u>	<u>YEAR</u>	<u>BULLS</u>	<u>COWS</u>	<u>PUPS</u>	<u>COWS/BULL</u>	<u>PUPS/COW</u>
Hestesletten	1951	41	938	1113	24.0	5.32
	1962	41	1646	1860	56.75	2.67
	1965	63	1782	1747	37.00	1.36
Dartmouth Pt.	1951	84	1066	621	14.7	0.58
	1962	137	2912	1892	21.2	0.65
	1965	142	2209	1858	13.08	0.84

INTERPRETATION OF RESULTS.

In itself this rather limited census is not of much value, but when compared with the census figures obtained by Laws (1951) and Vaughan (1962), several interesting points occur.

It is proposed to deal with the three classes of animal separately.

1. BULLS

The bulls were beginning to haul out on Hestesletten at the beginning of September, but not however, as rapidly as in 1962. The numbers of harem bulls ashore reached a maximum of 63, compared with 41 in 1951 and 1962. This represents an increase of 53%, but

the population showed more fluctuation throughout the season than in the previous years.

Although only harem bulls were counted for the majority of the season, a count was made of all bulls ashore on Oct. 25 (the approximate date of peak cow haul out), and a total of 106 was obtained.

At Dartmouth Point, hauling out commenced at the beginning of September, and a maximum of 142 bulls ashore was recorded on Oct. 23. Compared with the highest value obtained in 1951 (84) and for 1962 (137), this represents an increase of 66% and 3.6% respectively.

The increase in bulls is encouraging, and may well be due to the rather low catch totals of the past two seasons, 3939 in 1963 and 5147 in 1964.

2. COWS.

The cows commenced to haul out much earlier this season, probably on account of a very mild spell of weather in the first two weeks in September.

The first cows were sighted at Hestesletten on Sept. 5, seven days earlier than in 1962, and fifteen days earlier than in 1951. Although hauling out commenced earlier, the rate of increase was very much the same as in 1962, as shown by the graph of No. cows ashore / date. The numbers of cows ashore at any one time rose to a maximum of 1782 on Oct. 20, compared with 1646 on 23.10.62 and 938 on 22.10.51. This represents an increase in the total numbers of cows ashore of 8.2% and 88% respectively.

The very interesting factor obtained from the above figures is that the date of maximum haul out of the cows does not seem to have altered significantly over the past fourteen years.

3. PUPS.

The first pups began to appear much earlier this season than in previous years, no doubt due to the same period of fine weather which may have influenced the early haul out of the cows.

The first pup was recorded on Sept 19 at Hestesletten, and I would think at approximately the same time at Dartmouth Point, although no data is available to support the assumption. Sept 19 represents a seven day advance over 1962, and thirteen days in advance over 1951. In addition, it is ten days in advance of the first pup recorded at Hestesletten in 1964 by Wheeler.

Thus it appears that a seven day increase in the appearance of both pups and cows has occurred since 1962, although I feel that this may be due more to climatic conditions than the effects of commercial sealing, a factor born out by the fact that the pups appeared three days later in 1964 than in 1962.

In spite of the earlier appearance of the first pup this season, a graph of No. pups/date shows that the birth rates of the two seasons have been very similar, but have shown a fairly large increase since 1951.

The total number of pups recorded from Hestesletten this season was 1747 on Nov 2, compared to 1860 on 10.11.62, and 1113 on 13.11.51. However, extrapolation of the graph No. pups/date gives a theoretical value of 1880 pups for the 1965 season, an increase of 20 over 1962. Further calculation from the graph shows that on 2.11.62 1680 pups were counted, 57 less than this season. Since the rate of pupping is decreasing rapidly at this late date in the season, a theoretical total of 1880 pups for 1965 at Hestesletten appears a reasonable assumption.

The theoretical total represents an increase of 11% and 68% over 1962 and 1951.

At Dartmouth Point, the highest value recorded was

1858 pups on 23.10.65 compared with 1892 on 26.10.62 indicating that pupping has progressed at a similar rate in the two seasons.

4. COW/BULL RATIO

The highest cow/bull ratio recorded this season at Hestesletten was 37.00 on 25.10.65, compared to 56.75 on 23.10.62.

This is very encouraging, a decrease of 19.75 cows/bull. Undoubtedly this lower figure is due to the fact that the 1962 season was the first during which no commercial sealing had occurred since 1910, and, combined with the low catch totals for the past two seasons has resulted in a slight recovery of the stocks. Thus, with there being no sealing this season, I think we can expect a further slight recovery and reduction of the cow/bull ratio.

With regard to the cow/bull ratio, figures obtained from the seal reserves are of great value. The highest ratio obtained this season from Dartmouth Point reserve is 13.08 cows/bull on 23.10.65. This is only two days less than the date on which the maximum ratio was observed at Hestesletten, and assuming that the seals have hauled out at a similar rate on both beaches (in fact slightly faster at Dartmouth Point) it is unlikely that the maximum ratios for Dartmouth Point would be more than 20 : 1 on 25.10.65. Comparing this years value with the value of 21.2 cows/bull obtained on 26.10.62 there has been a slight decrease in the ratio which is encouraging.

At Stromness Bay reserve, a maximum cow/bull ratio of 15.33 was obtained on 23.10.65 and compares well with the figure of 13.08 obtained on the same day at Dartmouth Point.

The comparison of cow/bull ratios from sealing and non-sealing beaches well illustrates the effect that commercial sealing has had on the natural balance of the sexes; the numbers on a sealing beach this season is more is double the ratio occurring on a reserve beach.

TAGGING

Although limited by lack of transport, the tagging programme was quite successful. Tagging was concentrated in the East Cumberland Bay area, but it was also possible to apply a number of tags in the Husvik area.

A total of 2323 tags was applied to Elephant Seal pups, and a high standard of tagging was attained, only four tags being recorded as 'lost'. One tag was placed on the wrong flipper.

Table VI....Tags applied by Divisions, 1965.

Division	I	II	III	IV	RESERVE	TOTAL
Tags Used	-	-	1623	-	700	2323
Losses	-	-	3	-	1	4
Tags applied	-	-	1620	-	699	2319

Table VII....Tags applied by beaches, 1965.

Hestesletten....	1226 - 3 =	1223
Dartmouth Pt....	100 - 1 =	99
Husvik.....	500 - =	500
Stromness.....	100 =	100
King Edward Bay.	397 =	397

There will be an adequate supply of tags in the laboratory for next season, 4,450 are available in stock, and a further 5,000 are on order from the United States. Thus there should be no difficulty in continuing the tagging programme for the next couple of years.

TAG RECOVERIES

This season, eight tagged Elephant Seals have been recovered, all in South Georgia. The details are:

<u>No.</u>	<u>Tagged</u>	<u>Date</u>	<u>Recovered</u>	<u>Date</u>	<u>Remarks</u>
26749	Fortuna Bay	5.11.64	Gun Beach Hestesletten	19.4.65	moulting male
16141	Hestesletten	13.10.62	ditto	ditto	moulting female
-	-	-	King Edward Point	21.9.65	pregnant female reversed tag on left flipper probably 4 yrs.
11455	Bay of Isles (Brunonia)	30.10.60	Husvik	13.11.65	cow with pup.
-	-	-	Jason Harbour	14.11.65	cow with pup reversed tag on flipper right 5 - 7 yrs.
22071	Hestesletten	28.11.63	King Edward Point.	22.11.65	moulting female
26751	Fortuna Bay	5.11.64	ditto	ditto	ditto
26275	Bay of Isles (Brunonia)	ditto	Maiviken	8.12.65	ditto

Table VIII....Tag recoveries, 1965 season.

It will be readily observed from the preceding table that all the recoveries except for one are females, and in fact out of the total of seventeen recovered since the programme began, fourteen are female. The reason for this preponderance of female is not clear, but I am of the opinion that since the flipper of the male Elephant Seal grows much faster and to a much greater size than the female there is a distinct possibility that the tag may become covered over by the epidermis during the growth of the flipper. If this is the case, then it is also going to be difficult to observe whether any of the shot bulls bear tags, since during flensing the flipper is removed intact from the pectoral girdle, and an embedded tag may go unnoticed. However, this factor remains to be seen in future seasons.

Numbers 16141 & 22071 are interesting in the fact that both were tagged in the Hestesletten area, and both returned there to moult three years later. There may be some significance in the fact but it is too early to formulate any opinion until more tags have been discovered.

Although the future of the sealing industry is

uncertain, it is well worth continuing the tagging programme. In the event of there being no further sealing the present stock of tags could be applied in the East Cumberland Bay area by interested personnel, and records kept up to date.

QUOTA RECOMMENDATIONS

I feel that due to lack of data it is not possible to recommend any change in the quota solely on the basis of results obtained from the relatively small area of East Cumberland Bay.

The results do show that the seals in the census area are in a better position than in 1962, but I am not prepared to apply this data to the island as a whole, since quite obviously the position may differ entirely in other areas, especially on such beaches that have been the centre of heavy sealing over the past years.

Data obtained from tooth analysis over the past ten years gives the impression that since the average age of the catch is fluctuating within small limits only, the population may well have stabilized itself to some extent to accept a 6,000 quota.

In the 1964 sealing report it was stated that some overfishing was occurring in Div. II, particularly in Fortuna Bay where a cow/bull ratio of 64:1 was obtained on the post-season census trip. Hence it was thought that if the situation did not improve during the 1965 season, then it was to be recommended that the Div. II quota be sub-divided to prevent overfishing in that division, as has already been done with Div. III.

Since there has been no sealing this year, it is reasonable to assume that the position in that area will have improved somewhat, although obviously this cannot be determined until such a time as commercial sealing commences again.

Thus, with the position of the stocks in Div. II in

mind, and the fact that no relevant population data is available this season, I feel that I cannot recommend any change in the quota from the 6,000 level at the present time.

Whilst on the subject of quota recommendations, I am unable to form reports and papers available here as to how the quota of 6,000 came to be determined in the first place. Obviously it was on the basis of population census data, and it appears that the figure arrived at was very reasonable, but as to how this was deduced is not recorded.

If possible, this data should be made available to future sealing inspectors in order to clear up any confusion that may exist.

EXPERIMENTAL WORK

Due to the lack of really worthwhile experimental work that remains to be done on the Elephant Seal (other than population studies) very little has been performed this season.

However, due to large concentrations of pups on King Edward Point in the vicinity of the Laboratory, I was able to carry out a small experiment on pup weights. Originally it was intended to carry out a daily project to determine the weight girth and length increases of the pup, and to obtain values for rectal temperatures in order to determine to what degree the body temperature varied with variation in the atmospheric temperature. However, after having broken three thermometers due to the pup objecting on aesthetic grounds, the temperature experiment was abandoned.

Similarly the girth and length measurements are incomplete due to the extreme difficulty in measuring a well developed pup single handed.

However, a series of interesting weights were obtained showing the following:

Males...No. 1....108 lbs at birth increasing to 210 lbs on weaning at 19 days.

No. 2....107 lbs at birth increasing to 319 lbs on weaning at 20 days.

Females.No. 1....109 lbs at birth increasing to 270 lbs on weaning at 19 days

No. 2....80 lbs at birth increasing to 251 lbs on weaning at 21 days.

The weights agree well with those obtained by Laws at Signy Island in 1950, but the maximum weights at weaning are less than for Signy.

Comparison with birth weights obtained from Macquarie Island show the South Georgia pups to be slightly heavier. Birth weights at Macquarie are approximately 75 lbs.

FUTURE OF THE INDUSTRY.

The Sealing Industry appears to be in a state of uncertainty, although there are some signs that something may develop in the near future.

Unofficial discussions with the Secretary of Chr. Salvesen & Co. at Leith Harbour indicates that Salvesen's are interested in the possibilities of equipping an at present uneconomical stern trawler to operate in South Georgia waters as a pelagic sealer.

Similar discussions with the Manager of Albion Star Grytviken indicate the possibility of Compania Argentina de Pesca sending down two whale-catchers to take both whales and seals in the 1966 season.

Obviously as these are not official statements no reliance can be placed on them, but such a venture as that which Salvensen's appear to be interested in should be given every encouragement.

ACKNOWLEDGEMENTS.

I would like to take the opportunity here of acknowledging my gratitude to the following persons for the valuable assistance they have afforded me.

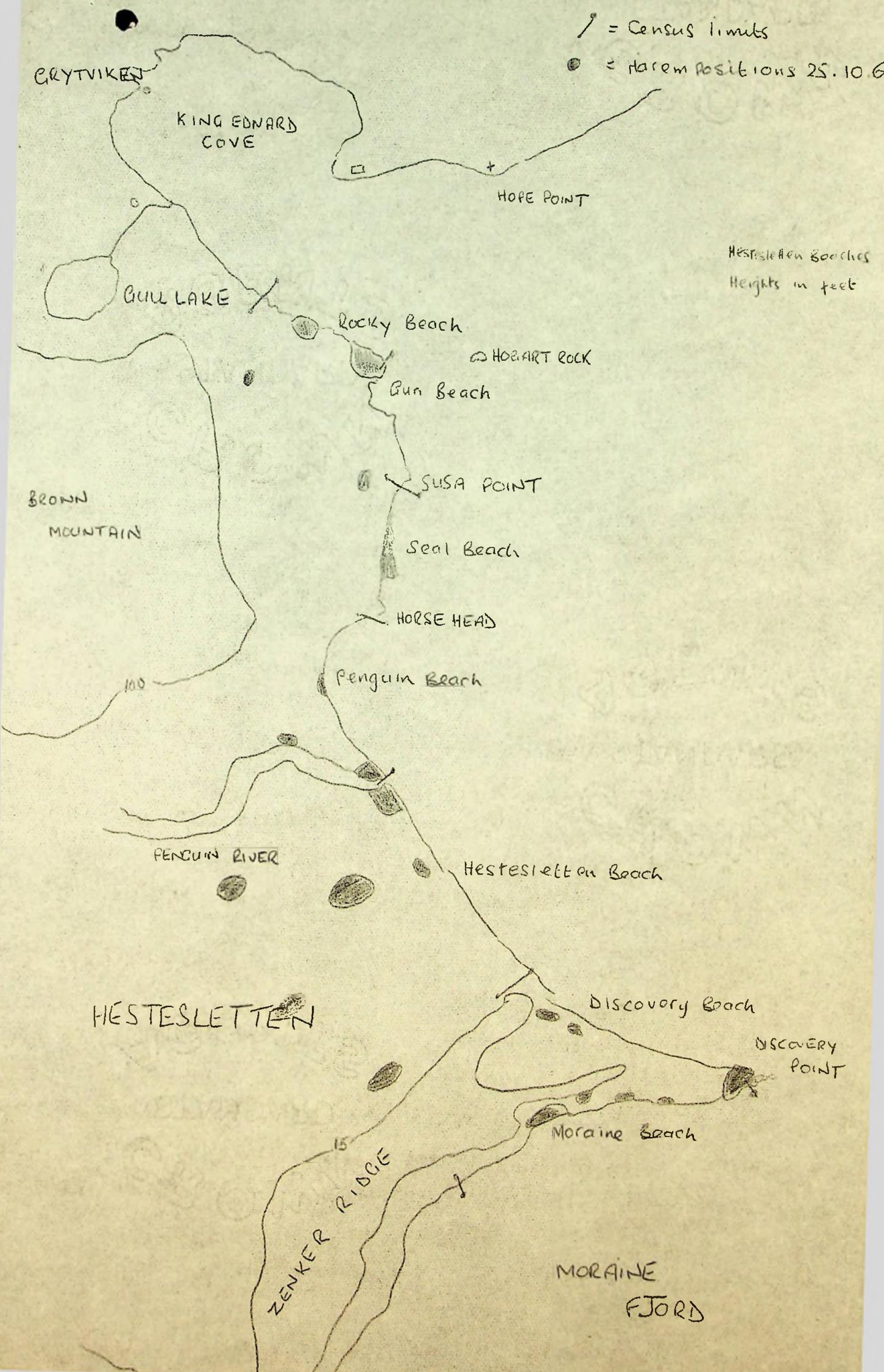
To...The Manager of Nippon Suisen Kaisha for his generosity in allowing me to stay at Leith Harbour whilst carrying out tagging operations at Husvik.

To...M.R.Kneen (Senior W/T Officer) and R.Biggs (Assistant Customs Officer) for valuable assistance with the tagging and census programme.

To...Messrs. Smith and Blenkinsop, the Leith Harbour Whaling Inspectors for their assistance with tagging at Husvik, and also for their periodic seal counts in Stromness Bay.

SAMPLE CENSUS AREA HESTESLETTEN

/ = Census limits
● = Harem positions 25.10.65



Hestesletten Beaches
Heights in feet

Administrative Officer,
King Edward Point,
South Georgia

23rd December 1965.

Ref: CL/9

I have referred to 'Layman' inspectors in your memo, but would be interested to know if you intend to undertake the job, as I now find that your activities only provide for sea sealing inspectors. In my letter of 23.11.65, I suggested that one of the four sealing inspectors could do the job. This could have been done by appointing one of the Cryviken sealing inspectors to be also sealing inspector. After the sealing season he could then take up his duties as sealing inspector. When this was suggested I was aware that there would be four inspectors, that there would be two regional Sir, they are not that the duration of the sealing season would be for all seals.

Attached please find 'Instructions for Sealing Inspectors South Georgia' By A.B. Dickinson.

Reference your memo D/2/64 dated 20.11.65 the following should cover the duties of a layman sealing inspector.

1. Supervise sealing operations in so far as seeing that sections 6, 10, 11, 12, 13 of the sealing licence are carried out (copy of licence attached)
2. Able to check reports required under section 5, of the licence i.e., seal catcher trip report giving the number of seals killed per beach and division, also number of teeth required in relation to the divisional kill.
3. Check end of season company report and give total kill per beach, division and total teeth per division.
4. Able to carry out census of selected beaches.

Foregoing information together with teeth to be sent to the appropriate UK authority who should then report on the age of the total and divisional kill. Make any recommendations they may consider necessary with regards to the next seasons quota.

Tagging.

This programme started in 1957 and to date 15085 tags have been applied. From the 15085 tags recoveries amount to 17 (14 of these from cows).

Tags are fastened to the axilla of the flipper and I would like to comment as follows on this practice:-

- (a) Should imagine very tender spot.
- (b) Point where most movement occurs, whether the seal is at sea or on land.
- (c) Tags removed by scratching or shed from unhealed wound.
- (d) Covered by scar tissue forming over tag.

It is possible that the very few recoveries to date are due to (c) and (d) plus the fact that when seals are flensed on the beach, sealers cut around the flipper when removing the blubber. The flippers are then left on the beach with the carcass. Unless it can be proved that this programme is of vital importance, I see no reason for the layman to continue tagging. I should have thought that after eight years the results would have been more encouraging than a paltry 17 recoveries.

...../I have

FALKLAND ISLANDS

I have referred to 'Layman' Sealing Inspector as per your memo, but would be interested to know who is going to undertake the job, as I now find that 1966/7 estimates only provide for two whaling inspectors. In my letter ref: C4 dated 2.3.65, I suggested that one of the four whaling inspectors could do the job. This could have been done by appointing one of the Grytviiken whaling inspectors to be also sealing inspector. After the sealing season he could then take up his duties as whaling inspector. When this was suggested it was assumed that there would be four inspectors, that there would be two companies operating and that the duration of the whaling season would be for six months.

Administrative Officer of South Georgia, one of the Dependencies of the Falkland Islands, in accordance with the powers conferred on me by the Governor under the Seal Fishery Ordinance (Cap. 62) license, I am, Sir, Your obedient servant, approved by the Governor:-

(1) The licensee shall pay (Sgd.) D. J. Coleman Administrative Officer South Georgia. The fee of fifty pounds for this license shall have no effect until such sum of (£50) has been paid as aforesaid.

(2) The license shall be valid from the 1st July to the 30th June, inclusive of the closed season as stipulated in Clause (8).

The Honourable,
The Colonial Secretary,
Stanley,
Falkland Islands.

(4) The number of seals to be taken will be restricted to Elephant Seals.

TB

(5) The licensee shall render an accurate account of all seals taken and report and locate on the chart where such seals were found in large numbers or colonies or where others were observed.

(6) The killing or capturing of the female seal, as well as the killing or capturing of the pup or young seal is prohibited.

(7) The licensee will be restricted to the sealing season and is subject to cancellation at any time.

(8) The sealing season will be for the period 1st July 19... to the 30th June 19..., except for the period 1st November 19... to the 28th February 19...

(9) This license is granted subject to the Seal Fishery Ordinance (Cap. 62) and to any regulations made from time to time hereunder.

(10) The kill is to be confined to males over 5.5 metres in length, measured in a straight line from the nose to the tip of the tail.

F A L K L A N D I S L A N D S

DEPENDENCY OF SOUTH GEORGIA

SEALING LICENCE issued under the Seal Fishery Ordinance (Cap. 62)

I,....., Administrative Officer of South Georgia, one of the Dependencies of the Falkland Islands, do hereby, in exercise of the powers granted me by the Governor under the Seal Fishery Ordinance (Cap. 62) licence.....
.....to take Seals in Sealing Division No.....
of this Dependency, on the following terms and conditions approved by the Governor:-

- (1) The licensee shall pay into the Colonial Treasury, Stanley, or to the Administrative Officer at South Georgia, the sum of fifty pounds (£50) in consideration of this licence and such licence shall have no effect until such sum of (£50) has been paid as aforesaid.
- (2) The licence shall be valid from the 1st July..... to the 30th June..... exclusive of the closed season as stipulated in Clause (8).
- (3) The limits within which seals may be taken under this licence are from..... the whole being known as Sealing Division.....
- (4) The number of seals to be taken will be restricted to.....Elephant Seals.
- (5) The licensee shall render an accurate account of all seals taken and report and locate on the chart where such seals were found in large numbers or rookeries or where others were observed.
- (6) The killing or capturing of the female seal, as well as the killing or capturing of the pup or young seal is prohibited.
- (7) The licence will be restricted to the sealing season and is subject to cancellation at any time.
- (8) The sealing season will be for the period 1st July 19... to the 30th June 19..., except for the period 1st November 19... to the 28th February 19...
- (9) This licence is granted subject to the Seal Fishery Ordinance (Cap. 62) and to any regulations made from time to time thereunder.
- (10) The kill is to be confined to males over 3.5 metres in length, measured in a straight line from the nose to the tip of the tail.

- (11) The licensee must ensure that a sufficient number of bulls over 3.5 metres in length are left on each beach to serve the cows there. As a general rule there should be left no less than one bull to every fifty cows.
- (12) One canine tooth from every twentieth seal killed by each vessel employed must be collected and returned to the Administrative Officer, South Georgia. The projecting part of the tooth is to be cut off at gum level.
- (13) Seals are to be driven and killed by shooting in the most humane way practicable and the licensee must ensure that no injuries are caused to the cows and pups by sealing operations.

Administrative Officer,
South Georgia.

TB

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INSTRUCTIONS FOR SEALING INSPECTORS IN SOUTH GEORGIA...... 2

by..... 2

A.B. DICKINSON B.Sc...... 4

(SEALING INSPECTOR 1964-65)

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THE ZOOLOGICAL LABORATORY
 KING EDWARD POINT
 SOUTH GEORGIA.

DECEMBER 1965.

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The main laboratory/office consists of a 10' x 10' wooden hut, part of which has been modified to form a dark-room. However, the dark-room is now no longer used as such, adequate facilities for photographic work being available at Shackleton House. Although the primary function of the hut is that of an office, a comprehensive selection of chemicals and histological apparatus is available there.

A laboratory/store room has been constructed in Discovery House, and is used mainly as a dissecting and analytical room. Equipment for volumetric analysis is stored there, together with seal tags and tagging equipment.

An inventory of the laboratory apparatus will be found in the main laboratory.

THE ELEPHANT SEAL INDUSTRY.

The industry, as stated above, has been carried out on a basis of controlled commercial exploitation since 1910, the first Sealing Inspector being appointed in 1956.

The duties of the Sealing Inspector, with regard to the Elephant Seal Industry, are to enforce the Seal Fishery Ordinance (Cap. 32) and the related conditions of the Sealing Licenses. Copies of both Ordinances and Licenses are available in the laboratory or the Administrative Office, and should be consulted by the Sealing Inspector before the beginning of the season.

In addition to the enforcement of the aforementioned Ordinances and Licenses, the Inspector is required to continue the tag-tagging program at present under way, and to undertake population census studies concerned with conservation and quota recommendations.

Details of these latter duties will be given at a later stage in this report.

INTRODUCTION

The Falkland Islands Dependency of South Georgia supports a large population of the Southern Elephant Seal (*Mirounga leonina* Linn.), which has been the subject of controlled commercial sealing operations since 1910, on account of the oil yielded by the thick blubber of the adult male seal.

For sealing purposes, the island has been divided into four divisions, each with a fixed catch quota, and subject to revision at the end of each season if the occasion demands.

At the time of writing (Dec. 1965) the duties of the Sealing Inspector are concerned with:

1. The Elephant Sealing Industry.
2. Population studies on the Southern Fur Seal (*Arctocephalus tropicalis gazellae*) at Bird Island.

However, since at the present time the future of (2) is uncertain, so the present notes will be concerned only with the duties involved in (1).

LABORATORY FACILITIES.

Excellent laboratory facilities are available at King Edward Point.

The Main laboratory/office consists of a 20' x 10' wooden hut, part of which has been modified to form a dark-room. However, the dark-room is now no longer used as such, adequate facilities for photographic work being available at Shackleton House. Although the primary function of the hut is that of an office, a comprehensive selection of chemicals and histological apparatus is available there.

A laboratory/store room has been constructed in Discovery House, and is used mainly as a dissecting and analytical room. Equipment for volumetric analysis is stored there, together with seal tags and camping equipment.

An inventory of the laboratory apparatus will be found in the main laboratory.

THE ELEPHANT SEAL INDUSTRY.

The industry, as stated above, has been carried out on a basis of controlled commercial exploitation since 1910, the first Sealing Inspector being appointed in 1956.

The duties of the Sealing Inspector, with regard to the Elephant Seal Industry, are to enforce the Seal Fishery Ordinance Cap. 32; and the related conditions of the Sealing Licence. Copies of both Ordinance and Licence are available in the Laboratory or the Administrative Office, and should be consulted by the Sealing Inspector before the beginning of the season.

In addition to the enforcement of the aforementioned Ordinance and Licence, the Inspector is required to continue the pup-tagging programme at present under way, and to undertake population census studies concerned with conservation and quota recommendations.

Details of these latter duties will be given at a later stage in this report.

CONDUCT OF SEALING OPERATIONS.

Sealing is carried out using three ex-whale catchers, and the Inspector is required to accompany the vessels on as many voyages as possible.

A sealing voyage is usually of three to four days duration, dependant on weather conditions, when working on the North side of the Island. However, when sealing is in progress on the South side, one voyage may last up to a week, or in extreme conditions even more, due to the consistently worse weather on that side of the Island.

The seal catchers remain at the Station for the shortest possible period, to unload the catch and collect provisions for the next voyage. Usually the catcher will arrive in the evening, unload, and sail again before dawn the next day, usually at approximately 03.00 hrs. The Inspector will find it more convenient to go on board in the evening and sleep there overnight.

If, when the Inspector arrives back from a sealing voyage to find that there are no other seal catchers available, he should either go out again on the catcher on which he has just arrived, or, if the arrival of an alternative catcher is imminent he should wait for that catcher.

Approximate times of arrival of the catchers can be found by consulting the Company Office, where can also be found a chart showing the total catch and trip catch for each seal catcher.

As conditions on the catchers are somewhat primitive, the Inspector would be well advised to take a sleeping bag (available in the laboratory), since he will in all probability have to sleep on the chart room couch.

It would be advisable for the Inspector to introduce himself to the Manager of the Company as soon as possible, with a view to discussing the forthcoming season.

PERSONAL REQUIREMENTS ON SEALING VOYAGES.

Obviously, personal effects will be varied to suit the individual concerned, but the following may be taken as the essentials:

1. Oilskin Suit: A good suit of oilskins is of the utmost importance. It is recommended that a short pocketless jacket, of the type available in the slopchest at Grytviken, be used (external pockets are liable to catch on projections when entering and leaving boats). Oilskin trousers should preferably be of the bib and brace type, and since there are none available in the slopchest, these should be purchased before leaving U.K.
2. Thigh Boots: At present available in South Georgia.
3. Boiler Suit: Recommended that one such suit should be bought in U.K.
4. Trousers: It is advisable to purchase a couple of pairs of stout denim trousers for wearing under the boiler-suit.
5. Gloves; It is advisable to use woollen gloves, the hide types are not as warm and are liable to become soaking wet much easier.
6. Headgear: A warm hat having ear-pieces is very necessary. Fur lined sealing hats can at present be purchased in Grytviken slopchest.

7. Socks: It is advisable to wear a couple of pairs of long sea-boot socks with thigh boots. Since socks tend to wear out at a surprising rate a good supply should be acquired.
8. Rough Notebook: A supply of small hard backed notebooks (with pencil) are available in the laboratory, to be used for the purpose of making rough notes whilst on the beach. Such notes are then transferable to a meter diary at the end of each days activity.
9. Diary: Suitable books are obtainable from the Administrative Office.
10. Map: A 1:200,00 South Georgia map can be obtained from the Administrative Office.
11. Spare Clothing: It is recommended that a complete set of spare clothing be taken on each voyage.

It should be born in mind that the above items stated as being available in the Grytviken slopchest are available at the time of writing, which does not mean that they will be available in future years, and this fact should be born in mind when kitting out in the U.K.

BEACH DUTIES

On arrival at a sealing beach, the flensing crew and gunner/mate are put ashore to take the available seals. The Inspector should go ashore on every occasion and carry out the duties enumerated below.

1. Enforcement of the Seal Fishery Ordinance Chap 62; particularly

- a. The killing or capturing of the female seal, as well as the killing or capturing of the pup or young seal is prohibited.

The Inspector should enforce this condition of the licence, but in actual practice the only time that a female or pup is killed is when the animal moves into the firing line of the gunner at an inopportune moment. Also, if an animal is seen to be in physical distress of some kind, the Inspector may order it to be shot, if the occasion demands it.

- b. The kill is to be confined to males over 3.5 metres in length measured in a straight line from the nose to the tip of the tail.

The correct observation of this clause requires careful attention on the part of the Inspector. It is impossible to measure each bull before it is shot, and pointless afterwards so the Inspector must develop some rule of thumb method whereby he can determine the approximate size of a bull at a glance. In practice, since it is uneconomical to take a small bull and thus sacrifice hold space which could have been taken up by a larger skin, the above condition is not often broken, except perhaps at the end of a voyage, when the sealers are anxious to complete the load and return to the Station. In this case, a number of bulls of debatable size may be shot, and the Inspector must keep a careful watch for this.

- c. The licensee must ensure that a sufficient number of bulls over 3.5 metres in length are left on each beach to serve the cows there.

This is one of the conditions of the licence which requires careful attention on the Inspector's part, since there are quite often attempts to shoot the great majority of the bulls leaving a ratio of less than 1:50, especially on the smaller beaches.

d. One canine tooth from every twentieth seal killed must be collected and returned to the Administrative Officer, South Georgia. The projecting part of the tooth is to be cut off at gum level.

Strictly speaking the fulfilment of this condition is the responsibility of the gunner and the skipper of the sealing vessel, but the Inspector may find it advisable to check occasionally when the time permits.

Further reference to tooth collection will be made at a later stage in this report.

e. Seals are to be driven in the most humane way possible (and killed), and the licensee must ensure that no injuries are caused to cows and pups by sealing operations.

In many ways this is the most difficult condition of the licence to enforce. It has been the practice to reprimand the individual concerned on the spot, and if severe injuries occur, such as the bursting of seal eyes by the driver's pole, a note should be made of such incidents for the attention of the Administrative Officer and the Manager of the Company involved.

Antagonization of the pups and cows by the sealing crews during non-working periods should be prevented.

Personal discretion must be exercised by the Inspector on what he considers inhumane actions during the driving of the bulls.

2. Population Census and Tagging.

These duties will be referred to in a later section of this report.

COMPANY SEALING REPORTS.

At the completion of each sealing voyage a report is required to be submitted by the skipper of each vessel, stating:

- a. Total number of seals killed
- b. Number of seals killed in each division
- c. Number of seals killed on each beach
- d. Number of teeth taken in each division
- e. Total number of teeth taken.

Before the commencement of each season the Inspector should construct catch progress charts for each division, examples of which can be found in the laboratory. Thus after each trip, the numbers of seals taken can be subtracted from the quota for that division, and thus the state of the quota residue in each division is readily available to the Inspector.

A similar chart should be made for each vessel, showing catch and tooth returns by divisions for each trip. Hence can be shown whether the numbers of teeth returned for each division after each trip tallies with the theoretical numbers of teeth required, assuming a tooth is collected from every twentieth seal.

A word of warning. Teeth are collected on a divisional basis. Hence if a vessel takes 45 seals in Div. II, 2 teeth are required. Assuming the vessel then moves on to Div. III to take seals, and then back to Div. II where it takes a further 15 seals, then one more tooth is required from Div. II to give 3 teeth for 60 seals in division II.

If discrepancies occur in the sealing reports submitted by the Company, such as a greater or lesser number of teeth returned than in theory, a letter should be sent to the company informing them of the discrepancy and hoping that it will not re-occur. A duplicate should also be sent to the Administrative Officer.

In addition, incidences of the shooting of short bulls, burst eyes through careless driving, and any other acts contrary to the Seal Fishery Ordinance Chap. 62 and Licence should be brought to the attention of the Administrative Officer and the Company Manager, whereupon any action that may be deemed necessary will be taken.

TOOTH COLLECTION AND AGE DETERMINATION.

As stated under clause 12 of the Sealing Licence issued under the Seal Fishery Ordinance Chap. 62, a canine tooth must be collected from every twentieth seal killed, for the purposes of age determination of the catch, and subsequent quota revisions if any.

The procedure is as follows. The gunner saws off a canine tooth (usually from the lower jaw) at gum level so as to include a substantial portion of the pulp cavity in the specimen. The pulp cavity is then cleaned out and the specimen washed. The teeth collected on each sealing voyage are kept separate for each division, and submitted to the seal research laboratory at the end of each voyage, together with the catch report stating the facts enumerated in the previous section of this report.

The numbers of teeth returned after each voyage should be compared to those required in theory, and discrepancies should be reported to the Administrative Officer and the Manager of the Company. The teeth should be examined to determine if any are without a pulp cavity, and instances of such short teeth should be reported to the authorities, asking in future that the teeth shall be cut so as to include the pulp cavity necessary for age determination. Teeth obtained throughout the season should be stored in separate containers for each division. i.e. all Div. I teeth in one container, all Div. II in another.

At the end of the season the teeth are prepared for analysis by grinding off any projecting surfaces and then polishing the cut surface on a fine grade oilstone.

The prepared teeth are then aged using the method developed by R.M. Laws (A New Method Of Age Determination In Mammals With Special Reference To The Elephant Seal---F.I.D.S. Scientific Report No. 2 1955). A copy of the Report is available in the Laboratory, but briefly the method is as follows.

Examination of the cut surface of the tooth under a binocular microscope shows the tooth to be composed of alternating rings of columnar and marbled dentine. The columnar dentine is more dense than the marbled dentine, and is visible as light coloured rings on microscopic examination. Similarly the marbled dentine appears as a series of dark rings. The formation of the alternating rings is probably due to a change in the calcium metabolism of the animal. The simplest method of analysing the zones is as follows. For the first two years of growth, eight zones of marbled (dark) dentine are formed. Thereafter, for every year of growth, two dark rings occur, a thicker dark ring corresponding to the breeding season, and a thin dark ring corresponding to the moulting season.

Thus by counting the numbers of dark zones the age of the animal can be determined.

After every tooth is analysed, a note is made of the numbers of teeth of the various age groups occurring in each division. The results are then analysed statistically to, give an overall picture of the age of the commercial kill in each division.

However, in practice the inexperienced worker will find difficulty in interpreting the growth rings with a sufficient degree of accuracy, especially if he has to teach himself to carry out the process. Since it appears that in future years the Sealing Inspector may be a person with no biological training, then it is suggested that the following process be carried out.

At the end of the season, all the teeth should be carefully washed and cleaned (do not grind or polish) and placed in polythene bags, which should be clearly labelled to state the numbers of teeth and the divisions from which they were obtained. Do not discard any short or nearly short teeth. The labelled bags should then be handed in to the Administrative Office, from where they will be sent to the appropriate authorities for examination. At this stage it is not quite certain as to who will examine the teeth, but it seems probable that it will be the British Museum (Natural History).

STATISTICAL ANALYSIS OF AGES

The next step after determination of the teeth ages by Law's method is the statistical analysis of the results. Full details of the formulae involved can be seen by reference to sealing report 1958 Pages 16-29, but I will endeavour to give a brief explanation below.

The procedure is as follows:

1. For each division count the numbers of teeth of the various age groups
i.e. in Div. I 13 @ 7yrs, 10 @ 8yrs etc.
2. Determine the total numbers of teeth of the various age groups
i.e. total teeth at 7yrs for Div. I - IV = 75 and similarly for all other age groups.
3. Construct the following table for each division and for the total of all divisions.

The following table is based on the results obtained for Div.I during the 1961 season.

Age	f	t	ft ²	f(t+1) ²
5	2	-2	-4	2
6	9	-1	-9	0
7	13	0	0	13
8	10	+1	10	40
9	3	+2	6	27
10	1	+3	9	16
11	0	+4	0	0
12	1	+5	25	36
Total (Σ)	39	-	11	73

f = number of teeth of that particular year.

t = zero at 7yrs always.

Applying Charlier's check, we have

$$\sum f(t+1)^2 = \sum ft^2 + 2 \sum ft + \sum f = 73 + 22 + 39 = 134 \dots \dots (1)$$

Thus, Charlier's check shows the calculations involved in constructing the table to be correct.

To determine the average age for the catch from a particular division, the following formula is used:

$$\bar{x} = x_0 + \frac{\sum ft}{\sum f} \dots \dots \dots (2)$$

Thus, for Div. I. 1961, the formula is,

$$\bar{x} = 7 + \frac{11}{39} = 7.2810 \text{ yrs.}$$

Now, the whole idea of tooth collection, age determination and subsequent analysis is to determine how the ages of the catch varies over the years, and consequently what revisions, if any, are needed in the quota. Thus, one has to compare the average age of the catch from each division, and also the total, with the average ages of the previous seasons catch. However, direct comparison of average ages as determined from equation (2) is not sufficient, since although there may be a great difference in the average ages for successive seasons when determined by (2), statistical analysis may show that there is no significant differences in the averages, and thus no cause for concern. On the other hand, the converse may be shown.

Thus, after having determined the average age of the catch for a particular division, we can proceed as follows:

$$SD \text{ (Standard Deviation)} = \sqrt{\frac{\sum ft^2}{\sum f} - \left(\frac{\sum ft}{\sum f}\right)^2} \dots \dots \dots (3)$$

Thus, for Div. I 1961 we have

$$SD = \sqrt{\frac{73}{39} - \frac{11^2}{39}} = \sqrt{1.872 - 0.5313} = \sqrt{1.341} = 1.158$$

After determining the Standard Deviation, the Standard Error must then be determined viz:

$$SE = \frac{SD}{\sqrt{\sum f}} \dots \dots \dots (4)$$

Thus for Div. I 1961 we have

$$SE = \frac{1.158}{\sqrt{39}} = 0.1854$$

& 2 SE's = 0.3708

Therefore, to compare the mean age (equation 2) with the same value for the previous seasons catch in Div. I:

$n_{60} = 69$	$\bar{x}_{60} = 7.568$	$SD_{60}^2 = 1.785$
$n_{61} = 39$	$\bar{x}_{61} = 7.281$	$SD_{61}^2 = 1.341$

where n = total number of teeth returned for division

\bar{x} = average age from equation (2)

SD_{60}^2 = square of standard deviation from (3)

Thus the difference between the mean ages for 1960 and 1961 is:

$$\bar{x}_{60} - \bar{x}_{61} = 7.568 - 7.282 = 0.287 \text{ yrs} \dots \dots \dots (4)$$

Therefore,

$$\text{Variance } \bar{x}_{60} - \bar{x}_{61} = \frac{SD_{60}^2}{n_{60}} + \frac{SD_{61}^2}{n_{61}} = 0.02581 + 0.03438 = 0.06019 \dots \dots \dots (5)$$

and $SE = \sqrt{\text{Var}} = \sqrt{0.06019} = 0.2454$

and $2SE's = 0.4908 \dots \dots \dots (6)$

This completes the calculation.

Now, since the final value for 2SE's (0.4908) is greater than the value for the difference between the mean ages of 1960 and 1961 (0.287) as determined by equation (4) then statistically the difference between the average ages of the catch for Div. I in the years 1960-61 is of no significance, no matter how great the difference appears upon comparison of the average ages determined from equation (2).

Consequently, since the age difference of the catch in successive years is insignificant then the stocks of seals in that division appear to be relatively unaffected by sealing operations, and thus no revision of the quota for that division is necessary.

However, if the final value obtained for 2 SE's from equation (6) is less than the value obtained for the difference between the mean ages obtained from equation (4) then there is a significant difference between the average ages of the catch obtained from equation (2) for that division in successive years.

Thus, if say, the average age of the catch (as determined by equation 2) in Div. I for 1960 was 7.568 yrs. and similarly for 1961 was 7.281 yrs. although on first sight there appears to be a decrease in the age from 1960-61, statistical analysis shows it to be an insignificant decrease, and hence there is no cause for alarm.

Coversely, the average age of the total catch for 1959 (7.231 yrs) as against the 1958 value (7.455 yrs) shows a decrease in age by what appears to be a mere 0.224 yrs. However statistical analysis showed the difference in ages to be a significant decrease, which, along with other factors should lead to re-examination of the quota.

The following table shows the statistically determined changes that may occur:

age increase (significant).....	very good, seals not greatly affected
age increase (insignificant).....	ditto
age decrease (insignificant).....	no cause for alarm.
age decrease (significant).....	not good. Overkilling occurring, re-examination of the quota needed.

For successive seasons the following should be compared:

1. age of catch from each division
2. age of the total catch.

Quota determination and subsequent re-examination will be considered in a later section of this report.

POPULATION STUDIES

Population studies on the Elephant Seal may roughly be divided into two categories.

1. Those undertaken during the commercial sealing season.
2. Those undertaken during the special post season census and tagging trip.

Since 1958 it has been the practice to undertake a special census trip after the completion of the commercial season. In order to provide some measure of uniformity in the census data obtained from each division during the season, it was decided to count certain set beaches each year. Consequently the Company has placed a vessel at the disposal of the Sealing Inspector for this trip, provided that they are allowed to take a cargo of seals on the trip, the number of seals to be decided on the beach by the Inspector. The arrangement has worked satisfactorily and good results have been obtained each year to indicate the state of the seal stocks in each division on completion of the seasons sealing.

The special census beaches are:

- Div I.....Nilshul
Wilson Harbour
Undine Harbour
- Div II.....Right Whale Bay
Brunonia
Fortuna Bay
- Div III.....Lille Jason
St. Andrews Bay
Gold Harbour
- Div IV.....Ranvik
Dias Cove
Holmestrand

When carrying out a seal census the following data should be obtained:

- | | |
|--------------|-------------------|
| 1. Date | 5. No. Pups |
| 2. Beach | 6. Cow/Bull ratio |
| 3. No. Bulls | 7. Pup/Cow ratio |
| 4. No. Cows | |

From such yearly data available from the special census (and other beaches) observations can be made regarding the state of the seal population. The most important figure obtainable is the cow/bull ratio. It is suggested (Laws) that a cow/bull ratio of 30:1 is the maximum permissible in order to ensure efficient fertilization of the cows. Hence, an approximate ratio of 30:1 is taken as the deadline. Ratios over this indicate a decrease in the numbers of bulls available in the areas under consideration, probably due to the effects of commercial sealing operations. Peak pupping and cow haul out dates can be determined, and comparisons will show whether or not the extent and commencement of the breeding season has been further affected by sealing.

Direct comparison of values for each class of animal will give information as to whether or not the numbers are increasing or decreasing in a particular area. However, as regards commercial sealing it is the cow/bull ratio on the various beaches that should be carefully watched for evidence of oversealing.

Census figures obtained during the course of the commercial season also give a good picture of both the total seal population and its build up.

TAGGING

A pup tagging programme was commenced in 1957 and at the present time some 15,000 tags have been applied to Elephant Seals.

It was hoped that eventually the tags would start appearing in the commercial catch to such an extent that they would replace the present method of age determination, which as stated previously is liable to personal error.

In addition it was hoped that initiation of a tagging programme would yield data on such things as migration, (both around the island and abroad), mortality rates and commencement of pupping on the cows etc.

Recoveries have as yet been relatively few, but some interesting facts, notably connected with migration are emerging. However, contrary to the original belief no tags have/yet appeared in the commercial catch.

The tags in use at present are American made monel metal cattle tags. The tags are applied to the axilla of the flipper by means of a special punch. Alternate flippers are tagged each year, so that if the tag becomes reversed on the flipper (as is often the case) the observer is able to determine approximately the age of the animal by whichever flipper bears the tag, and also the general characteristics of the animal.

Tagging, which is best left as late as possible until the pups begin to move out of the harems, is carried out on the latter sealing trips, and in addition a concentrated tagging programme is undergone on the post season census trip.

The tagger should note the following details before commencing tagging on a beach:

1. Date
2. Beach
3. Species
4. The numbers of the tags applied
5. The numbers of any tags applied to the wrong flippers or any tags which are closed before connecting with the flipper.

There is no need to note the sex of the animal. this is time wasting, and in any case the sex of the animal will be noted on recovery in future years.

On returning to the laboratory, all details should be entered in the tag register, which thus provides a continuous record of all tags applied, their locations etc. from the commencement of the programme.

A careful watch should also be kept for any adult seals bearing tags. Record:

1. Tag number
2. Sex
3. Condition (whether moulting, breeding, with pup etc.)
4. Date recovered
5. Beach.

If unable to determine the number of the tag, record which flipper it is on, and the approximate age as determined by visual observation.

It has been observed that in a lot of cases the tags tend to become reversed on the flipper thus obscuring the number. If an attempt is made to turn the tag so as to read the number, it is best to use a stick for the operation, whilst another person distracts the animals attention. Don't turn it by hand, you are liable to get an arm rather messily amputated and Polar Medals aren't given for that.

QUOTA RECOMMENDATIONS.

The present catch quota of 6,000 adult male Elephant Seals was imposed as a result of recommendations made by R.M. Laws in 1951.

However, on searching through the available reports and documents I am unable to find the exact basis upon which the quota was determined. Obviously it must have been on the basis of population counts, but what the mental processes involved amounted to is not recorded.

Notwithstanding this, the figure arrived at seems to be fairly near the maximum that the population can withstand. Further details regarding the quota will be found in my Sealing Report 1965.

Whatever the quota involved, some factors may occur which will necessitate scrutiny of the quota and possible re-adjustment (if only in the quotas allotted to each division). Such factors are:

1. If, upon statistical analysis of the teeth samples returned there appears to be a significant decrease in the age of the seals in a particular division or the island as a whole, then quota revisions may be necessary.
2. Population census figures may show the cow/bull ratio to be above that recommended as the optimum. If the ratio is much greater than in previous years, it is probable that some oversealing is occurring in the area involved, and some revision of the quota may be necessary.

However since the population seems to have stabilized out at the present rate of catching, I see no reason to decrease the quota in the foreseeable future.

SEALING INSPECTORS REPORT

At the end of the season the Inspector is required to submit a report on the seasons activities to the Falkland Islands Government.

I do not intend to go into details as to the form at which this report should take, since Laboratory copies of all Inspectors reports are available since 1956, and perusal of these will give all the details necessary.

In addition to the above it is now necessary to inform the Colonial Secretary, Port Stanley, by telegram every time the Inspector leaves King Edward Point on a sealing voyage.

CONCLUSION

This report is intended as a guide for future Sealing Inspectors in South Georgia.

On commencement of the writing of this report, official sources stated that future Inspectors would be scientists employed on a short term seasonal contract. However, later information suggests that lay-Inspectors will be employed.

With these points in mind, I have tried to arrange the report so as to cover both possibilities, simplifying the details as much as possible and yet trying to provide enough information for the scientist.

TB

Administrative Officer,
King Edward Point,
South Georgia.

23rd December, 1965.

Sir,

South Georgia Sealing.

The South Georgia sealing industry has proved to be a valuable subsidiary when operated in conjunction with whaling, but it is doubtful, if on its own, South Georgia sealing would be a paying proposition. The total oil production from the full quota of 6,000 elephant seals averages about 12,000 barrels valued approximately at £140,000. The 1956 season was the last season during which the full quota was taken, although the licence provides for any residue of quota to be taken in March. The present whaling companies have reduced the period of their operations from 6 months to 2½ months, whaling operations being completed by mid December, this means they will be unable to take any residue of seal quota in March. If sealing continues in conjunction with whaling the following points may be worthy of consideration.

The present licence declares a close season during the months of November, December, January and February. The purpose of this close season 'to provide the seals with a measure of protection during the mating season' my memo ref: 624 dated 6/2/62, 'Extension to Sealing Season', refers. From sealing inspectors reports and personal observation, nearly all pups are born by the latter part of October, mating takes place during the first three weeks of November, all pups are weaned and harems as such, break up by the end of November. If then the close season is to provide seals with a measure of protection during the mating season, stoppage of sealing during the month of November only should give all the protection needed.

If December, January and February are declared open season, this does not mean that it will be possible to seal during the full period. During January and February most of the seals are back at sea feeding, prior to coming ashore to moult at the end of February, nevertheless, it should be possible to seal during the first part of December and take any residue of quota. It is appreciated that oil production from seals taken in December will be less than that produced from the September and October catch, but it should compare favourably with the production from March seals. It may appear that

December/.....

December sealing does not materially help the sealing company, as there still remains the month of November during which the sealing vessels are unemployed. But this need not be so, and the solution may be contained in my letter ref: 632 dated 22/3/61 'Pilot scheme for Fur Seals'.

In 1961 the then sealing inspector, stated he was in favour of operating a pilot scheme whereby 200 Fur Seals could be taken during the period 1st to 14th November. He also stated that the 1961 Fur Seal population (estimated at 29,800 exclusive of pups of the year, estimated at 9,500) should allow for an annual quota of 1,650 seals. A pilot scheme as suggested would keep the sealers employed during November, not alone in obtaining the seals, but in the subsequent treatment and preparation of skins for shipment and marketing. Should the pilot scheme prove successful from all aspects, then an annual quota might be possible.

With the decline in whaling the time may now be opportune to take a new look at sealing generally. Apart from the foregoing which assumes sealing as a subsidiary of whaling there is scope to expand the sealing industry so that it becomes an industry in its own right. In 1957 a scheme was put forward to employ a factory/tanker vessel for the purpose of sealing. The vessel was intended for Falkland Island and South Georgia sealing, production to be on the basis of full carcass utilization. The Government agreed in principle to the scheme and a draft licence was prepared. This licence allowed for a Falkland Island quota of 1000 Elephant Seals and 9000 Sea Lions. The combination of Falkland Island and South Georgia sealing, with the possibility of taking Elephant Seals, Sea Lions, and Fur Seals would be a proposition that might attract new interest in sealing. I understand from the Manager, of the South Georgia Co. Ltd., Leith, that Elliott of Salvesens is still very much interested in sealing, no later than last May he discussed with his South Georgia Manager the possibilities of sealing with a factory ship.

It may be, that if a sealing licence for Falkland Islands and South Georgia were put out for competitive tender, others, besides Salvesens would be interested.

I am, Sir,
Your obedient Servant
(Sgd.) D. J. Coleman
Administrative Officer,

The Honourable,
The Colonial Secretary,
Stanley,
Falkland Islands.

TB