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MARINE MAMMAL REPORT

by

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Volume VII
Annual Project Segment Report
Federal Aid in Wildlife Restoration
Projects W-6-R-6, Work Plan G-a and W-14-R-1, Work Plan F

(Printed July, 1966)

RECOMMENDATIONS

The extensive general collections of reproductive tracts from predominently young female walrus can be discontinued at the present time, and initiated periodically at five year intervals, starting again in 1971. More intensive investigation of the true proportion of older females in the population, and knowledge of the reproductive significance of these animals is needed. Selective sampling of older animals (20+ years) should be continued. Studies of walrus in the areas where they winter should be undertaken, if at all possible. A periodic large scale sample of teeth for determination of population size and trend should be initiated at five year intervals; our last extensive collection was made in 1962, and we plan to initiate this phase of the program again in 1967.

A sample will be obtained from Savoonga, during 1966, to provide material in the event that hunting success is poor during 1967. An aerial survey should be undertaken immediately before, or after the sampling program is completed. The present bag limit of five adult cows per hunter, per year, should remain in effect.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE:	Alaska		
PROJECT NO.: and	W-6-R-6 W-14-R-1	TITLE: TITLE:	Alaska Wildlife Investigations Marine Mammal Investigations
WORK PLAN:	G-a and F	TITLE:	Walrus and Seals
JOB NO.:	1	TITLE:	Walrus Biology and Populations

PERIOD COVERED: January 1, 1965 to December 31, 1965

OBJECTIVES

The objectives of this study were to investigate the important facets of walrus biology, the understanding of which will aid in management of this important resource. Special attention was directed to determining age specific birth rates, age composition and social organization of reproductively active females, and the net annual increase (if any) in the herds.

One of the main purposes of the intensive work conducted during the year, was to check previous findings with the intention of 1) revising the approach and methods employed, if findings revealed inconsistencies or inaccuracies; or 2) if present and past findings were found to be valid, discontinuing the time consuming tasks of collecting, examining and analyzing data from large series of reproductive tracts. This would provide the opportunity to work on other aspects of life-history and population dynamics.

Other objectives were to obtain additional information about population size and trend, growth rates, effects of current harvests on existing walrus herds, and herd composition and distribution in wintering areas. It was also hoped that information about natural mortality could be obtained.

PROCEDURES

The field work required for acquisition of current harvest information (Job F-2), provided the opportunity to collect the specimen material and data, and record observations necessary for the biological studies reported here. Department personnel substantially contributing to these studies included Nevin Aspinwall, Richard T. Wallen, and Gary Lust. The location and duration of their work is indicated in the report on walrus harvest and utilization (Job F-2).

Other people substantially contributing to this study included Dr. Francis Fay, Arctic Health Research Center, Anchorage, Alaska, and Dr. Max Brewer, Director, Arctic Research Laboratory, Pt. Barrow, Alaska. Dr. Fay supplied both specimen material and data, and Dr. Brewer was helpful in supplying both logistic support and facilities at Barrow and Wainwright. The many hunters residing in the various villages at which work was conducted were also of great assistance.

Reproductive tracts, lower canine teeth and tusk measurements were collected from 168 female walrus during the spring of 1965. This sample was composed of 160 adults (reproductively mature), and eight sub-adults. We now have some material (primarily lower canine teeth) from 1,121 females, and a complete set of specimens (reproductive tracts, lower canine teeth, and supporting data) from 416 adult females.

During the hunting trips when specimens were collected, every effort was made to accurately determine if the cows were accompanied by calves when taken. It was thought that by careful field observation the cow : calf ratio might be accurately determined. This information is necessary in order to determine the total kill, including orphaned calves, without examination of a large series of ovaries. Knowledge of the cow : calf ratio also provides information about the types of herds being hunted (i.e. "nursery herds," bull herds, etc.) and the general reproductive status of cows taken (whether parturient or non-parturient). The field observations were compared with laboratory examination of ovaries.

Reproductive tracts and other soft body parts were preserved in 10 percent formaldehyde. Lower canine teeth required no special treatment as they were sectioned within a few months of the time they were collected. Two teeth from each animal were examined in order to provide a check on age determinations, and to insure a usable tooth section from each walrus. Teeth were cut longitudinally, using a Felker cut-off saw, into sections between 0.6 and 1.0 mm thick. The age of individual walrus was determined on the basis of the number of annual rings in the cementum layer of tooth sections. (See Fay, 1955; Harbo, 1961: Burns, 1965b).

Ovaries were cut into sections of one to two mm thickness, and microscopically examined for corpora lutea and corpora albicantia. Ovary weights were recorded, and the size, position, and number of corpora albicantia, corpora lutea, and larger follicles were diagrammed and noted on individual cards, along with the animal's age, observed reproductive condition (parturient, pregnant or barren), and other miscellaneous data.

During this report period, teeth from 13 known age walruses were received from Dr. Francis Fay, Arctic Health Research Center, Anchorage, Alaska. The animals had been kept in captivity. Six were Pacific walrus, and seven were the Atlantic subspecies. These teeth provided an invaluable check on the accuracy of the age determination technique employed.

Summer field work at Barrow and Wainwright provided the opportunity to obtain further information concerning growth rates, foetal development and behaviour.

There was no opportunity to obtain information about walrus in the wintering areas, or on natural mortality.

FINDINGS

AGE DETERMINATIONS

The use of lower canine teeth for determining the age of individual walrus has been a very important tool in our investigations. Tooth sections from the 13 walruses of known age provided by Dr. Fay ranged in age from calves to 15.3 years. I first tentatively determined the ages of the animals from which the teeth were taken, and then compared my results with the known ages of the animals.

The ages as I determined them, and the known ages, are presented in Table 1.

Table 1. The known and estimated (from tooth sections) ages of seven Atlantic and six Pacific walruses*

Number		Kind	Sex	Known Age	Estimated Age
AMHU	5925	O. r. rosmarus	M	15.3	14
ZMC	748	O. r. rosmarus	F	7.6	7
ZMHU	3099	O. r. rosmarus	F	7.1	7
ZMHU	1226	O. r. rosmarus	M	1.2	1
ZMHU	1587	O. r. rosmarus	M	2.4	3
AMNH	203343	O. r. rosmarus	F	1.3	1
ZMC	920	O. r. rosmarus	F	5.2	no estimation possible
LACM	M1785	O. r. divergens	M	1.2	1
LACM	1784	O. r. divergens	F	1.2	2
AMNH	203341	O. r. divergens	F	3.4	4
AMNH	203340	O. r. divergens	M	1.3	1
LACM	M1786	O. r. divergens	F	1.3	1
AMNH	203342	O. r. divergens	M	0.4	0(calf)

*The 13 tooth sections were supplied by Dr. F. H. Fay. Estimated ages are based on the number of annual rings observed in the cementum layer.

The close agreement between the known and estimated ages in this sample indicates that the method we have been using to estimate age is valid. The combined known age of the sample (obtained by adding the ages of animals to the nearest year, and disregarding the animal for which no determination was possible) is 41 years, and the estimated combined age is 42 years. Combined (or total) age of samples obtained in western Alaska have been used as one method to determine such things as age specific birth rates, frequency of calving, average age of animals in the harvest, and total reproductive years represented by females in the harvest.

Minor errors (plus or minus one or two years) in age determinations of individual animals would probably not affect the overall findings as they would tend to cancel each other. It is probably not possible to accurately determine the ages of very old animals, but these comprise a very small part of our samples.

The sample of known age teeth is also useful in demonstrating the growth of lower canine teeth, and progression of root apex closure. A comparison of root closure in the teeth of known age walrus, and in animals collected during this study, is shown in Figure 1. It appears that closure of the root apex most commonly occurs between the fifth and sixth years of life.

Age Composition of Female Harvest

Age composition of the female segment of the harvest cannot be used to determine the true age structure of the population, or to determine the rate of hunting mortality. This is so mainly because the harvest of females is almost always taken from a distinct segment of the population composed primarily of young cows migrating in nursery herds. However, records of the female age composition from year to year do indicate the strength of the year classes which largely comprise these nursery herds. The sex ratio of the walrus harvest in Alaska has changed drastically since 1961. This change is the result of increased protection of adult female walrus, brought about by the imposition of a bag limit restricting resident hunters to five females per year. Records of recent harvests show that fewer adult females are being taken; and of equal significance, fewer females are wounded and lost, and fewer calves are being orphaned.

Several authors, most notably Sergeant (1959), have used the frequency of various age groups in the harvest to derive information on the relative strength of each year class, following known catches of young in the particular year. Since female walrus usually do not comprise a significant portion of the harvest until they are about seven years old, the increased survival of younger cohorts will probably not be apparent until 1967 and later.

A discussion of the differences in age composition of the 1964 and 1965 harvests points out the problems involved in using the age composition of females taken from nursery herds (primarily younger animals) to determine overall population size, trend, and mortality rates.

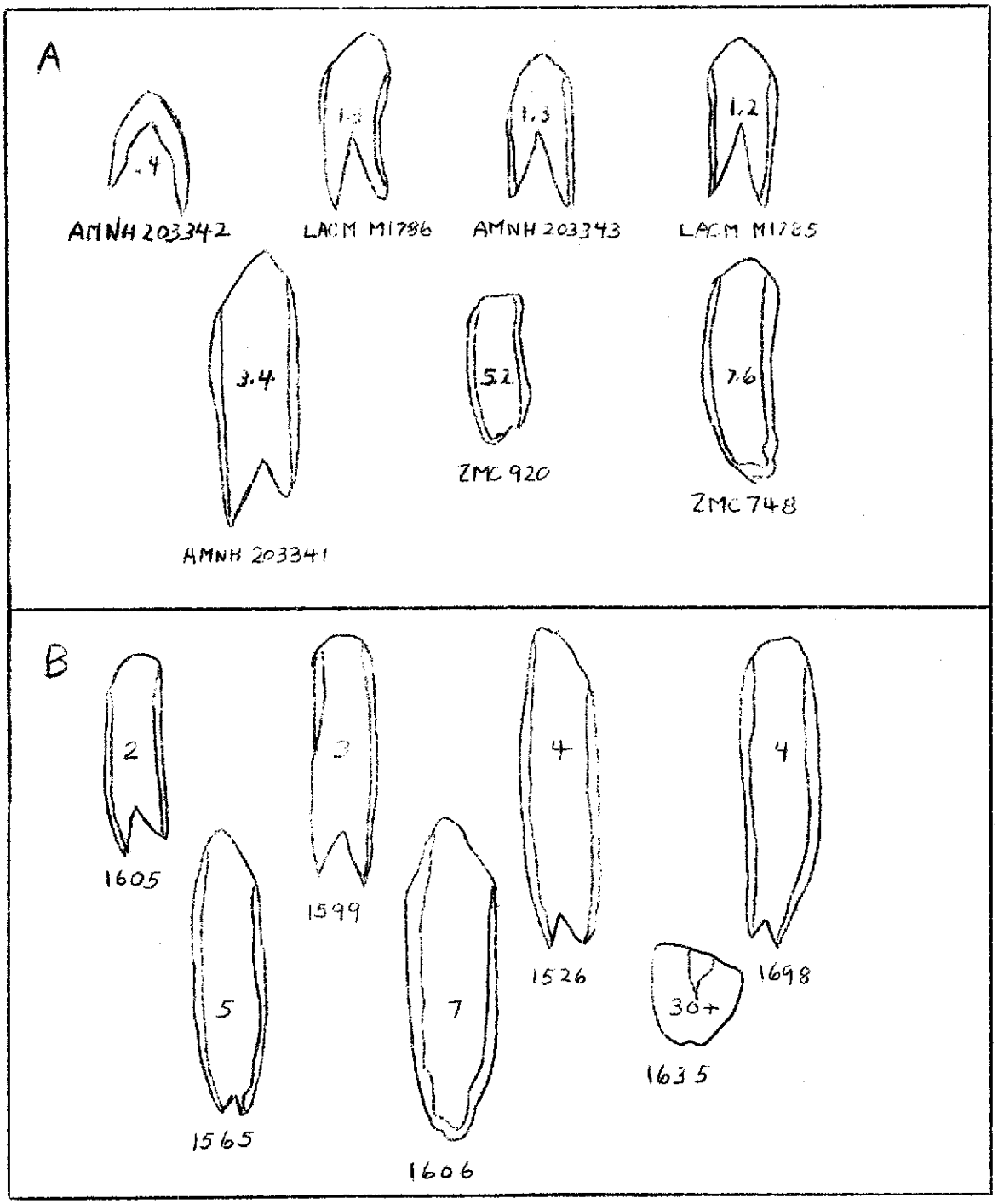

Fig. 1. General growth and progression of root apex closure in the lower canine teeth of known age walruses (A), and Pacific walrus collected during this investigation (B). Sample A was furnished by Dr. F. H. Fay (see Table 1 for data). Age determinations of teeth in sample B (indicated by number in outline) are based on the number of annual rings present in the cementum layer. Acquisition numbers are indicated immediately below each tooth section.

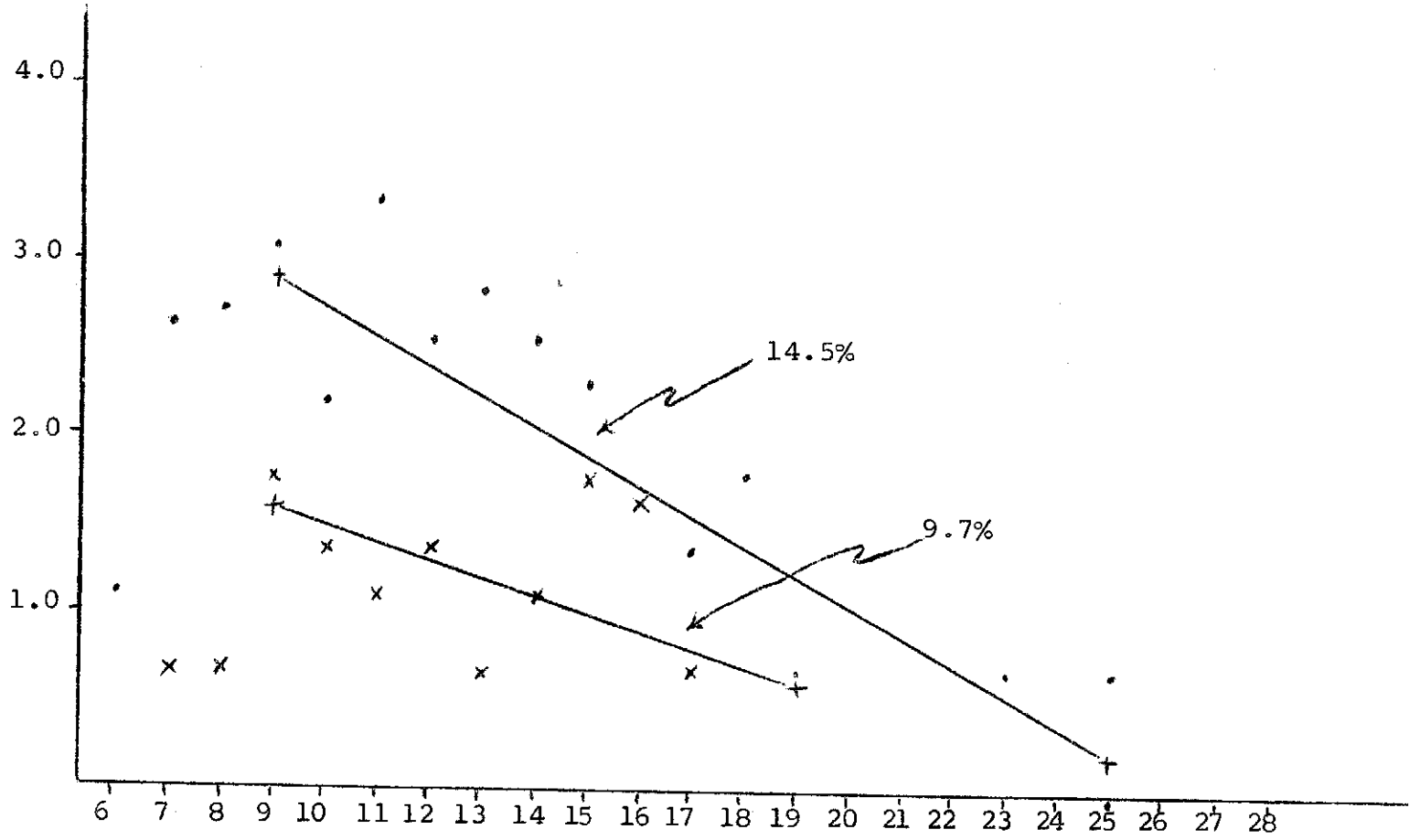

Fig. 2 Catch curves and derived mortality rates for female walrus taken in Alaska during 1964 (X) and 1962 (.). Catch curve analysis follows the methods outlined by Ricker (1948, 1958).

During the 1964 spring hunting season, the main herds of walrus were not available to hunters in the northern Bering Sea area. Hunting success was very poor, and relatively few females were taken. Those females that were killed were usually single animals, or were found in small groups, rather than in the usual nursery herds. Under those circumstances, sampling of the various age groups was more random, and a higher proportion of older animals was obtained.

The spring of 1965 was a "normal" hunting season, and most of the cows harvested were from the larger nursery herds available to hunters at Gambell and King Island. As in previous "normal" years, most of these animals were relatively young.

The difference in age composition and calculated mortality rates for these two years is illustrated in Figure 2. The harvests during these years were 975 to 1,040 walrus in 1964, and 1,712 to 1,767 in 1965. The mortality rates for these two years definitely indicate that projections based on samples taken from the nursery herds would be far too high. The calculated mortality rates for females (taken largely from nursery herds) during years prior to 1964 are 21.1 percent in 1960 (Harbo, 1961), and 24.6 percent for females collected during 1961 and 1962.

I think that the actual mortality rate in the entire female segment of the population is between 8 and 14 percent. Unfortunately this assumption will be hard to prove in view of the biased samples being obtained.

As with mortality rates, overall rates of reproduction, based on the samples obtained, would also be too high.

Approximately 70 percent of all adult cows collected during the last four years have been newly parturient. In actuality, about 46 percent of the adult cows produce calves during a given year. A more detailed discussion of this phase of the study follows.

Results of Ovarian Analysis and Correlation with Age

This phase of research was intensively continued in 1965, to provide a basis for critical analysis of results obtained during the last five years. Some of the earlier conclusions which I felt required further evaluation were 1) the general reproductive condition of the adult females in the harvest, and in the population as a whole; 2) age specific birth rates; 3) frequency of calf production; 4) the average reproductive performance of cows being harvested; and 5) the usefulness of field observation to determine the general reproductive status of cows being harvested.

Laboratory examination of ovaries from 160 adult females harvested in the northern Bering Sea area, during the spring of 1965, showed that 76 percent (122 animals) were parturient (had

recently given birth to calves), 19 percent (30 animals) were pregnant, and 5 percent (eight animals) were barren. Barren animals are those that had not recently given birth, were not pregnant, and did not show evidence of having mature ova. These cows had not produced a calf in the year preceeding death, and would not have produced in the following year.

Table 2 shows the reproductive status of adult females taken during the last four years. The close agreement of the findings indicates that they are, and have been, correct. From the samples acquired, it can be concluded that adult females in the nursery herds migrating through the central Bering Sea area are composed of about 71 percent parturient animals, 21 percent pregnant, and 8 percent barren animals.

During 1965 a special effort was made to accurately determine, by field observation, if cows were accompanied by new calves (calves of the year) when taken. This was done in order to 1) find out how the cow : calf ratio obtained by field observation compared with that obtained by laboratory examination of ovaries; 2) determine if careful field observation would yield valid results which could be used in the interim between periodic large scale biological collections; 3) try and obtain data on early calf mortality; and 4) obtain more information about the production of calves in successive years.

The adult cow : calf ratio based on field identification was 160:121. The ratio of cows to calves as indicated by laboratory examination of ovaries was 160:122. Although there was close agreement between the findings as determined by both methods, there were some inconsistencies which will be discussed below.

Of the 122 adult females taken in 1965 (refer to Table 2), that were identified as parturient by the laboratory method, 116 (95 percent) were observed to have been accompanied by new-born calves when killed. Four (3 percent) were not accompanied by calves; and the presence or absence of calves in two cases was not ascertained.

In the 30 cows classed as pregnant, 25 (83.4 percent) were not with new calves. However, four (13.3 percent) were. The other cow was not identified as being with or without a calf.

Among the eight barren cows, only one was with a new-born calf.

In most cases the occurrence of calves with barren and pregnant animals can usually be attributed to the "mixing" of orphaned animals, during the confusion resulting from disturbance by hunters. Orphaned calves have been observed to temporarily associate with other cows and even bulls. The association of calves with the barren cow, and three of the pregnant cows mentioned above, was of this nature; as none of the animals were lactating, or showed a corpus luteum of lactation in their ovaries, that would indicate that the calves were theirs. However, in one case, a pregnant

Table 2. General reproductive condition of adult female walrus taken during the spring hunting seasons from 1962 through 1965 in the northern Bering Sea - Bering Strait area

Year	N	Parturient		Pregnant		Barren	
1962	104	72	(69%)	21	(20%)	11	(11%)
1963	109	74	(68%)	25	(23%)	10	(9%)
1964	41	26	(64%)	10	(24%)	5	(12%)
1965	160	122	(76%)	30	(19%)	8	(5%)
TOTALS	414	294	(71.0%)	86	(20.8%)	34	(8.2%)

cow was accompanied by a calf, was lactating and her ovaries contained a large corpus luteum of lactation (21x17 mm), and a proliferating corpus luteum of pregnancy (32x26 mm). This particular cow had conceived two years in succession.

Since 1962, the observed incidence of breeding two years in succession has been very low. Only one cow in a sample of 61, collected in 1963, was supporting a calf, and also pregnant.

The bond between recently parturient cows and their calves is very close. They will usually not part company, even if one or the other is killed. The absence of calves in the case of the four recently parturient cows can probably be attributed to death of the calves by previous encounters with hunters, or to natural mortality. If they were all lost through natural mortality, then our limited sample indicates a maximum natural mortality rate in new calves of 3 percent. A low rate is in agreement with our knowledge of maternal care for the young, and relatively slow rate of reproduction observed in the walrus.

In spite of the minor inconsistencies discussed above, field counts of cows with calves do furnish a valid indication of the number of parturient cows in a herd.

When the cow : calf ratio and the total harvest of females are known, it is possible to determine the number of calves orphaned during the hunts. In this manner it can be done without examining extensive collections of reproductive tracts. Orphaned calves of the year are included in the total kill, as it is assumed that they do not survive.

Age Specific Birth Rates

Throughout this discussion, the initial age at which breeding begins in females, should be kept in mind.

In the 1965 sample the two oldest, sexually immature females obtained, were five and six years of age. The youngest sexually mature cow (she was pregnant) was five. Most cows begin breeding at five or six years of age, although some begin as early as age four (Brooks, 1954; Fay, 1955; Burns 1965b), and others as late as age ten (Burns, loc. cit.).

Correlations of age and reproductive performance have been made in all samples collected since 1961. A comparison of the data obtained prior to 1965 can be made by referring to Table 2 of the 1964 marine mammal segment report (Burns, 1965a, p. 6), and Table 3 of the walrus comprehensive report (Burns, 1965b, p. 16). Findings obtained from the 1965 material, and from the combined sample obtained to date, are here presented in Table 3.

Results of these correlations are in close agreement. It appears that most cows produce one calf by age seven, two by age nine, three by age twelve, four by age 14, five by age 16, and six by age 20. Data from animals older than 20 years are meager. In some instances where only one animal is represented in an older age group, the findings are inconsistent. However, the data show that older cows produce calves less frequently. The trend indicates that most cows have produced seven calves by age 25, and eight by age 30.

The frequency of calf production was also determined in a different way, by working with the samples as a whole. Basically this procedure involved dividing the total estimated "reproductive years" represented in annual and combined samples, by the number of "successful" pregnancies. This procedure involves the assumptions that:

1) Six years is the usual age of initial breeding
2) 85 percent of the conceptions result in live calves (Fay, 1964).

The equation for determining the frequency of calving can be written as

$$\frac{a - (N)\ (6)}{(c)\ (.85)} = X$$

in which

a = total age of the sample
N = sample size
6 = average number of years before initial breeding
c = total number of conceptions (determined by ovarian analysis)
.85 = proportion of conceptions resulting in live calves
X = average frequency of calf production in the female segment of the herd.

The findings obtained from various samples acquired since 1961 are shown in Table 4. The average frequency of calving is once each 2.2 years.

Table 3. Age composition and number of pregnancies observed in 160 female walrus taken in Alaska during 1965, and comparative findings in 416 females taken from 1961 through 1965.

	1965			Combined 1961 through 1965		
Age	N	Total Pregnancies	Pregnancies Per Age Class	N	Total Pregnancies	Pregnancies Per Age Class
5	0	0	0	2	2	1.00
6	3	3	1.00	10	9	.90
7	15	20	1.34	33	47	1.42
8	15	25	1.67	36	65	1.80
9	18	41	2.28	54	118	2.19
10	8	19	2.37	27	69	2.55
11	28	76	2.72	44	125	2.84
12	12	41	3.41	38	115	3.03
13	15	49	3.27	42	140	3.34
14	10	44	4.40	25	102	4.07
15	9	43	4.78	36	159	4.42
16	5	23	4.60	15	77	5.13
17	4	22	5.50	14	77	5.50
18	5	31	6.20	12	70	5.83
19	2	10	5.00	7	41	5.87
20	1	6	6.00	4	25	6.24
20+	2	13	6.50	3	16	5.33
21+	1	6	6.00	4	30	7.50
22+	0	0	-	1	4	4.00
23+	3	19	6.33	3	19	6.34
24+	0	0	-	1	7	7.00
25+	2	17	8.50	2	17	8.50
26+	0	0	0	0	0	0
27+	0	0	0	1	3	3.00
28+	0	0	0	0	0	0
29+	1	6	6.00	1	6	6.00
30+	1	8	8.00	1	8	8.00
TOTALS						
	160	522	$\bar{x}$=3.26	416	1,351	$\bar{x}$=3.27

In the female segment of the herd as a whole, individual production at a rate of one calf each 2.2 years is considered highly probable. However, this average rate does not reflect the high rate of production in young animals, or the decreasing reproductive performance of the older age groups.

Referring to Table 4, it can be seen that by age 20, females have usually borne six calves. From my findings of the frequency of calving based on the number of "successful pregnancies" in a given number of "reproductive years", it can also be seen that the number of calves produced by a 20 year old cow is also about six (i.e. a-(N) (6) /X or 14/2.2).

At this time more data are needed to accurately assess the reproductive performance of animals older than 20 years, and to determine the importance of these older animals as far as overall reproduction is concerned. The assumption that older cows (20 + years) calve once every three to five years is probably correct.

Considering the data obtained through field observation and laboratory examination of ovaries, my earlier conclusions (Burns, 1965b) that about 80 per cent of the mature cows calve every other year, 15 per cent every third year, and the remainder less frequently, are valid. This does not take into consideration the occurrence of twinning, or the production of calves in successive years, as these are presently considered insignificant with regard to the overall rate of reproduction.

Approximately 36 per cent of the walrus population is younger than six years of age (Fedoseev, 1962; Burns, 1965b). Assuming a 1:1 sex ratio, which is indicated by the ratio observed in calves (142 males: 136 females, or 51 per cent males), about 32 per cent of the walrus population is composed of reproductively mature females. The rate of reproduction in the Pacific walrus is estimated at between 14 and 15 per cent. This was determined on the basis of the following data:

a) 32 per cent of the walrus population is composed of mature females.

b) 80 per cent of the mature cows calve once in two years, or 40 per cent during a given year; 15 per cent calve once in three years, or five per cent during a given

Table 4. Comparative findings used in determining the frequency of calf production in samples of adult female walrus obtained since 1961, in Alaska

Parameters	1961 - 63*	1964**	1965	1961 - 65
Sample Size =N	227	29	160	416
Total Age of Sample =a	2746	342	1942	5030
Total Reproductive years =a-(N) (L)	1384	168	982	2534
Total Conceptions =c	731	98	522	1351
Total Successful Conceptions =(c) (.85)	621	83	444	1148
Average Frequency of Calf Production =X	2.2	2.02	2.2	2.2

* From Burns (1965b)
** From Burns (1965a)

year; five per cent calve less frequently; I assume one per cent during a given year. Therefore, 46 per cent of the mature cows will bear calves during any one year.

c) It then follows that the annual rate of reproduction is between 14 and 15 per cent (.32 x .46 x 100).

Population Trend

On the basis of my past and present findings, it appears that the walrus herds are slowly increasing. The difference between the rate of reproduction (14 to 15 per cent) and the mortality rate (about 13 per cent; Burns, 1965b) dictates that all possible steps should be taken to prevent removal of the small annual increment. This can be done by continued protection of cows and calves, and by reducing the total kill (not necessarily the retrieved harvest) by more efficient hunting procedures.

Hunters throughout northwestern Alaska are also of the opinion that the walrus population is slowly increasing.

Growth Rates

Foetal Development

The normal breeding season in the Pacific walrus extends from December to May. The peak of breeding activity is between February and March (Fay, 1960). The earliest recorded date of embryo implantation is 10 June (Kenyon, 1958); and the main period of implantation occurs sometime between 15 June and 15 July (Brooks, 1954; Fay, 1955, 1960; Burns, 1964b). The relatively uniform size of foetuses collected at Wainwright, Alaska, during July and August, indicates that the period during which implantation occurs is probably more restricted than first believed. It seems to occur mainly between 15 and 30 June.

Birth usually occurs during late April and early May.

There are few opportunities to obtain walrus foetuses during the duration of the gestation period. At this time it does not appear that any major collection of this material will be

obtained in the near future. For this reason it is probably expedient to document the findings concerning foetal growth, at this time.

Table 5 indicates the progressive increase in length of Pacific walrus foetuses. Figure 3 graphically illustrates foetal growth.

Post Natal Growth

The maximum size of walrus, and the amount of utilizable meat obtainable from an adult are of interest from the standpoints of both walrus biology and management.

Adult walrus have been weighed by Brooks (1954), and Kenyon (1958). Through necessity, both of these workers butchered the animals, and weighed them piece by piece. Weights of some of the larger animals (all males) handled by Brooks (loc. cit.) were 1,600, 1,179, and 2,795 pounds. Three adult males taken on the Walrus Islands (in Bristol Bay) by Kenyon, Brooks and Fay (Kenyon, loc. cit.) ranged in weight from 2,895 to 3,432 pounds ($x = 3,177$).

During 1964 and 1965 I weighed two term foetuses, and 27 animals ranging in age from calves to adults over 14 years of age. The adults, all taken at Wainwright during July and August, were weighed whole by suspending a scale from a derrick mounted on a "Caterpillar" diesel tractor. The data appear in Figure 4.

In general appearance the adult cows, especially those that were pregnant, were in very good condition. The condition of the bulls was highly variable (as is reflected by the weights); some being extremely lean and others appearing much as they do in the fall. During the fall and winter months the males regain their thick blubber layer. These general comments are in agreement with the statements of Clark (1884) that:

> The quantity of oil to a single walrus varies very much in different animals and from year to year, for in some years they are much fatter than in others. The female yields more oil than the male.

Table 5. Growth of Pacific walrus fœtuses as indicated by length and date of capture

Date	N	Length (cm)	Location	Source
15 June	2	2.0 $=\bar{x}$	Wales, Alaska	Brooks, 1954
20 July	1	6.3	Wainwright, Alaska	Burns
27 July	2	8.2 $=\bar{x}$	Wainwright, Alaska	Burns
30 July	1	21.5	E. Long Strait, Siberia	Krylov, 1962
5 August	4	18.5 $=\bar{x}$	W. Long Strait, Siberia	Krylov, 1962
17 August	1	31.0	Wainwright, Alaska	Burns
18 August	1	29.2	Wainwright, Alaska	Burns
20 August	1	28.1	Wainwright, Alaska	Burns
20-21 August	3	27.8 $=\bar{x}$	SW and W. of Wrangell Is., Siberia	Krylov, 1962
22 August	2	31.6 $=\bar{x}$	Wainwright, Alaska	Burns
29-31 August	10	32.0 $=\bar{x}$	SW and W. of Wrangell Is., Siberia	Krylov, 1962
9-12 Sept.	12	37.2 $=\bar{x}$	SW and W. of Wrangell Is., Siberia	Krylov, 1962
18-20 Sept.	10	47.0 $=\bar{x}$	SW and W. of Wrangell Is., Siberia	Krylov, 1962
30 November	1	65.0	St. Lawrence Is., Alaska	Fay, Pers. Comm.
6 December	1	71.0	St. Lawrence Is., Alaska	Fay, Pers. Comm.
9-11 December	3	69.7 $=\bar{x}$	St. Lawrence Is., Alaska	Fay, Pers. Comm.
15-16 December	2	62.5 $=\bar{x}$	St. Lawrence Is., Alaska	Fay, Pers. Comm.
24 April	1	109.2	St. Lawrence Is., Alaska	Burns
Term Foetus (Probably early May)	1	129.6	Bering Strait, Alaska	Brooks, 1954
Term Foetus (Probably late April and early May)	10	102.0 $=\bar{x}$	St. Lawrence Is., Alaska	Fay, 1964

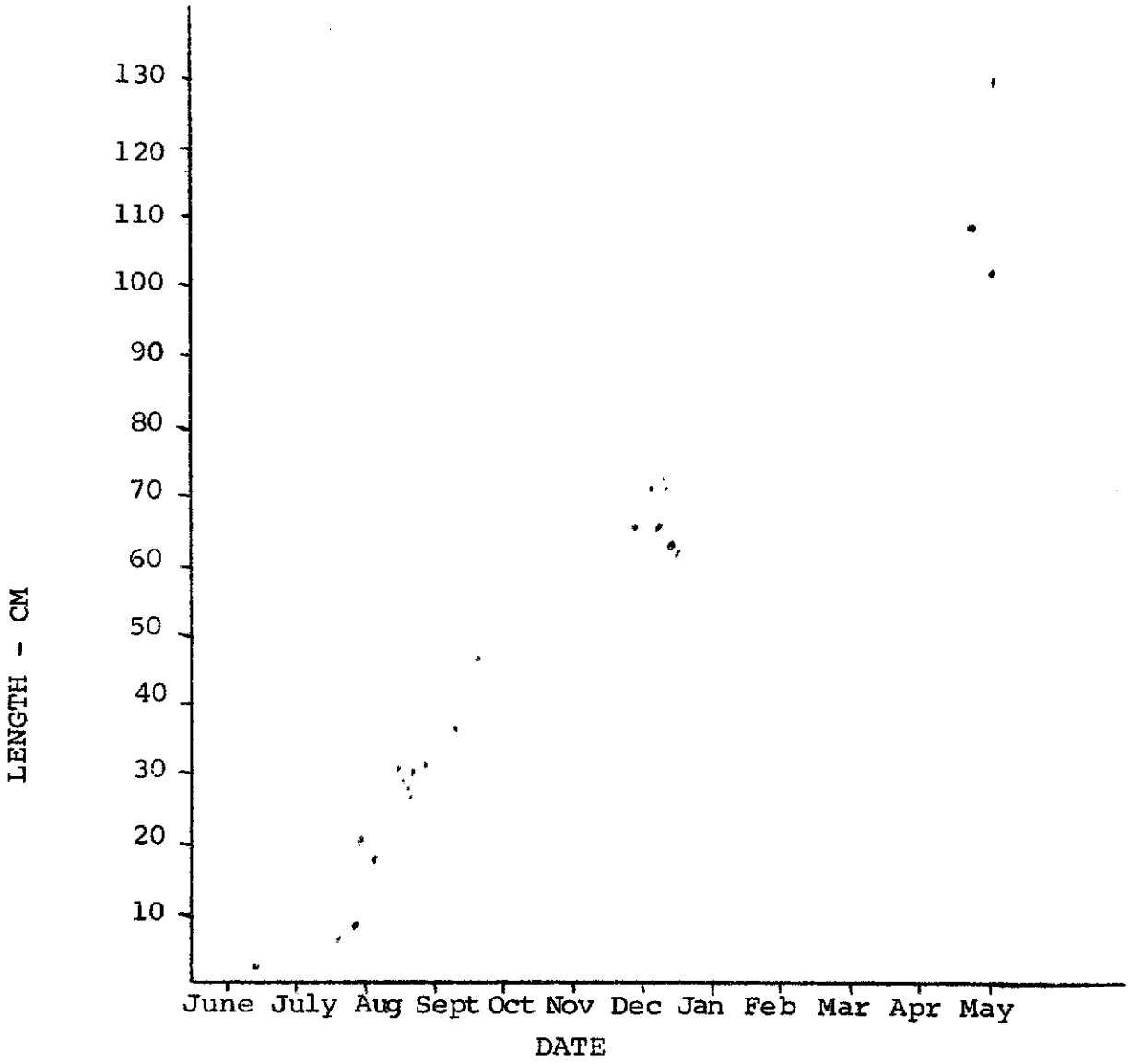

Figure 3. Increase in length of Pacific walrus foetuses from implantation to birth. The sources of data are indicated in Table 5.

It should be kept in mind that the early commercial exploitation was restricted to the summer months, when many of the males are in poor condition.

Two of the largest reproductively mature females (ages eight and 19+) that I handled, weighed 2,020 and 2,140 pounds respectively ($\bar{x}$ = 2,080). These weights are probably a good indication of the size attained by adult cows.

Yield

Approximately two-thirds of a walrus can be utilized by hunters, or sold as food for humans. The usable portions are composed of about one-third skin and blubber (the skin of walrus, called cóke of cówke, is edible, unlike the skin of seals), and one-third meat and certain parts of the viscera. The remaining one-third (bone, entrails, blood and undesirable parts) is either discarded or fed to dogs.

With a knowledge of the age composition of the harvest, and a limited amount of information about weights attained by walrus of different ages, it is possible to estimate the amount of meat obtained from the harvest. It is felt that commercial sale of walrus meat will increase as a result of replacement of the traditional dog teams by "snow machines." At present, the demand for walrus meat is greater than the supply. In the event of increased commercial sale, we will have the means to determine the approximate quantity of meat, and commercial value of the harvest.

It has been determined that an average of 1,100 pounds of skin, meat and blubber can be obtained from male walrus between five and nine years of age, 1,400 pounds from animals between ten and fourteen years of age, and 1,700 pounds from walrus fifteen years and older.

Spring Migration Timing

The period of spring migration through the northern Bering Sea-Bering Strait area is reflected by hunting success at the various villages where walrus are taken.

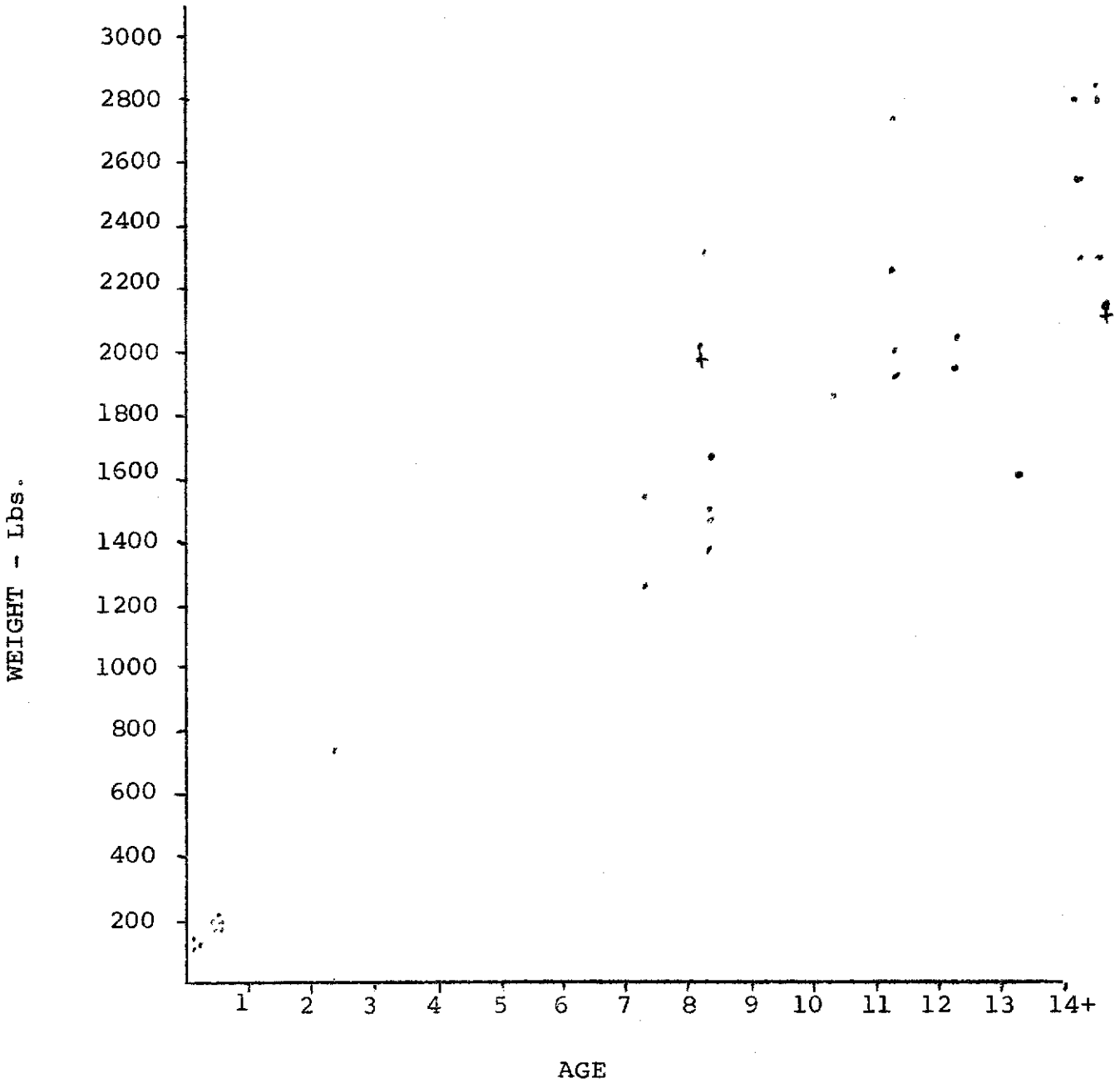

Figure 4. Weights and estimated ages of Pacific walrus taken in Alaska during 1964 and 1965. The only two adult females from which weights were obtained are indicated by the female symbol.

Fig. 5. The 1965 spring harvest of adult walrus, in relation to date, at Gambell, King Island, and Little Diomede Island, Alaska.

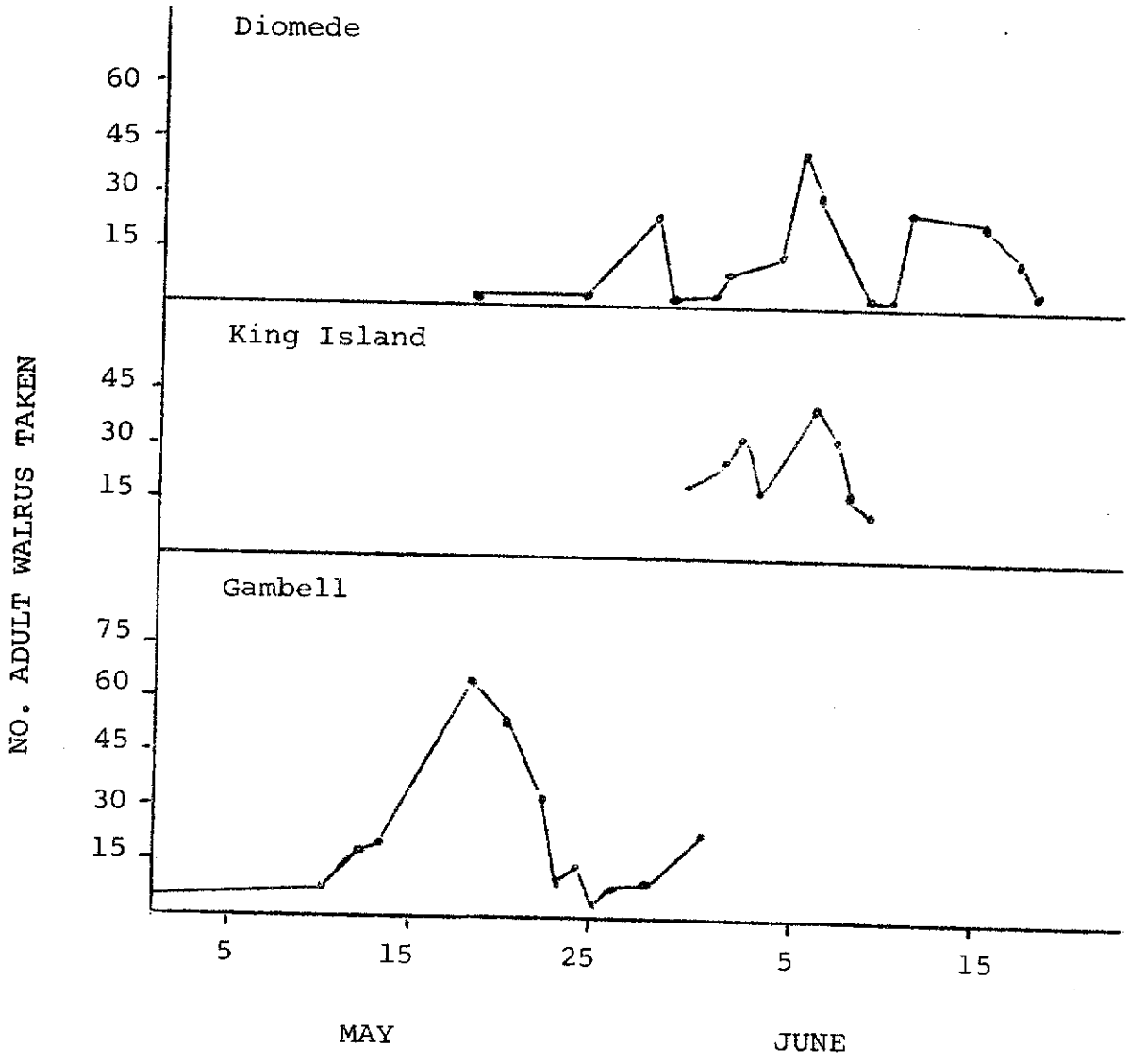

Figure 5 shows the hunting success, in relation to time, at Gambell, King Island, and Little Diomede Island. During 1965 the main spring migration of walrus past Gambell (on St. Lawrence Island) occurred between 10 and 25 May. At King Island it took place between 30 May and 9 June. At Diomede (central Bering Strait) the migration was more prolonged, and large groups of animals were moving north from 25 May to 18 June.

Movement past these points has occurred at the same time during the past four years, regardless of ice conditions.

Of significance is the fact that on 31 May, there were concentrations of walrus at all three sites. At that time the walrus were occupying the whole of the northern Bering Sea. The most successful hunting periods at King and Little Diomede Islands occurred simultaneously: between 30 May and 9 June. The distance between these islands is approximately 60 miles.

Comments of personnel working at these two sites provide a general indication of walrus abundance in the area. My field notes, and the comments of King Island hunters indicate that from 3 to 9 June walrus were around the island (except east - toward the mainland) as far as we could see. Field notes of Richard Wallen, Department observer stationed at Little Diomede Island, contain the following entry for 5 June:

> Many [walrus] passed on previous days but the numbers observed reached a peak between 2 A.M. and 5 P.M., on June 5. During this time walrus were in such abundance that the crews were frightened to go out in their boats.

As stated previously, hunters throughout the area feel that the number of walrus has increased during recent years.

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No.: W-6-R-6 Title: Alaska Wildlife Investigations
and W-17-R-1 Title: Marine Mammal Investigations

Work Plan: G-a and F Title: Walrus and Seals

Job No.: 2 Title: Walrus Harvest and Utilization

PERIOD COVERED: January 1, 1965 to December 31, 1965.

ABSTRACT

The retrieved kill of walrus during the report period was between 1,712 and 1,767 animals. This harvest was composed of 936 to 968 adult and sub-adult males (54.7%), 507 to 520 adult and sub-adult females (29.6%), and 269 to 281 calves (15.7%). Considering the harvest of adults only, 65 percent were bulls and 35 percent cows. Hunting loss at the various villages ranged from 20 to 60 percent, averaging 46.7 percent for all villages combined; thus the total kill was between 3,243 and 3,322 animals. Residents of the northern Bering Sea-Bering Strait area enjoyed good hunting in the spring of 1965, taking between 1,297 and 1,452 walrus. Summer hunting at Wainwright was also good, 194 animals being taken. Utilization was about the same as during previous years of good harvests, ranging from poor at King and Little Diomede Islands to excellent at Wainwright and other villages with large human and dog populations. Greatest potential value of the walrus harvest was calculated at $322,658.

RECOMMENDATIONS

The present regulation imposing a limit of five cows per resident hunter, with no limit on bulls, should be continued. At the present time, information about the magnitude and composition of the Soviet walrus harvest does not appear to be available. The status and trend in the Pacific walrus population, at least in the immediate future, will have to be determined on the basis of what we find in Alaska. The last thorough analysis of the age composition of the Alaskan harvest was in 1962. This should be undertaken again at five year intervals, starting in 1967. If at all possible, it should be preceded or followed by an aerial census. The current public information program (village meetings and personal contact with the walrus hunters) should be continued.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No.: W-6-R-6 Title: Alaska Wildlife Investigations
and W-14-R-1 Title: Marine Mammal Investigations

Work Plan: G-a and F Title: Walrus Harvest and Utilization

PERIOD COVERED: January 1, 1965 to December 31, 1965

OBJECTIVES

To obtain current information about the magnitude, composition, utilization and value of the annual walrus harvest in Alaska.

PROCEDURES

As a result of the annually recurring necessity to obtain accurate information about the magnitude and composition of the walrus harvest, certain procedures have become more or less established. Department observers are temporarily stationed at the more productive hunting sites, especially where most of the adult female walrus are killed. At less productive hunting sites, interested individuals supply the harvest information. This information is compared with comments from village residents that come to the Nome office during their frequent travels. Correspondence with resident clergymen, teachers and village leaders also provides harvest information. This correspondence also provides valuable information about the impact of varying harvests on the villages.

The field work associated with this job was conducted concurrently with Jobs 1 (Walrus Biology and Population) and 3 (Seal Biology and Harvest) and provided the opportunity to collect biologica specimens and data. Department personnel that substantially contributed to the marine mammal projects during the past year were Nevin Aspinwall, who worked at Gambell (St. Lawrence Island) from 14 April to 3 June; and Richard T. Wallen who worked at Little Diomede Island from 24 April to 11 June.

I worked at King Island from 31 May to 18 June, and Gary Lust and I conducted field work at Barrow and Wainwright between 15 July and 4 August. Various tasks during the year permitted brief visits to Unalakleet, Golovin, Teller, Brevig Mission, Wales, Shishmaref, Buckland, Kotzebue and Kivalina.

The field work by all persons involved with the marine mammal investigations provided the opportunity for the most important and challenging aspect of walrus management - public education and information. The close and relatively prolonged contact with hunters encourages the public exchange of ideas and questions, and of greater importance, contact with individual village leaders.

Hunters realize the Department's dependency on their assistance, a situation which makes them active participants in a research program of interest to them.

FINDINGS

The retrieved and total kill of walrus, by village or area, is shown in Table 1. Since walrus are migratory, and available to hunters from various villages at different times of the year, the seasonal harvests are discussed below. During the 1965 calendar year the hunting success at all the traditionally productive sites was good.

Winter Harvest

Between the first part of January and early March walrus were generally not available to Alaskan hunters. As far as can be ascertained, the winter harvest numbered nine walrus. The animals killed were all adult bulls, taken at various sites along the coast from Point Hope to Mekoryuk.

Spring Harvest

Throughout the northern Bering Sea, the spring migration of walrus brings them near the traditional hunting sites, and enables the hunters to get to them. Walrus winter primarily in two areas of the American sector of the Bering Sea: south and southeast of Nunivak Island, and in the central Bering Sea between St. Lawrence and St. Matthew Islands. During the northward migration

of animals that winter south of Nunivak Island, they pass the hunting sites of Kwigillingok, Kipnuk, Mekoryuk, Tununak, and Hooper Bay (hereafter referred to as the Kuskokwim Area). The harvest of walrus in the Kuskokwim area amounted to between 40 and 45 animals, almost all of which were adult males.

A small number of animals moved through the Norton Sound Area, and 13 adult males were killed. These were taken by hunters from Shaktoolik, Nome and Brevig Mission.

The greatest number of walrus were taken by hunters from the island villages in the northern Bering Sea and Bering Strait.

Productive walrus hunting at Gambell (western St. Lawrence Island) started during the latter part of March and continued until mid June. Records of hunting success show that the main migration of cows and calves (the main component of the spring harvest) passed Gambell between May 18 and 20. During those three days 213 walrus, or 49 per cent of the total spring harvest, were taken.

The spring hunting season at Gambell (from early March to mid June) produced 434 walrus including 105 adult males (24.2%), 155 adult females (35.7%), 19 sub-adults of either sex (4.4%), and 155 calves (35.7%).

A total of 16 boat crews (approximately 75 men) participated in the hunt at one time or another during the hunting season. The 434 walrus harvested at Gambell will be used to provide food, materials and income for the 390 residents (Alaska Dept. of Econ. Devel.& Plan., 1965), and is the main food item of the 650+ dogs in the village.

Walrus hunting success at Savoonga (north-central St. Lawrence Island) was also good. The reported harvest was between 300 and 350 animals (Rev. Alwin Gall, pers. comm.). Although the exact composition of the harvest at Savoonga is unknown, various informants indicated that it was similiar to previous years. Composition of the harvest during successful seasons has been approximately 50 per cent adult bulls, 25 per cent adult females and 25 per cent calves. The lack of sub-adults in the harvest is due to strong selection by hunters for larger tusked animals of either sex, and cows accompanied by calves.

Assuming a harvest composition comparable to recent years, the animals taken at Savoonga consisted of 75 to 87 calves, 75 to 88 adult females, and 150 to 175 adult bulls. The harvest was taken by approximately 78 men, using 16 umiaks, and will be

Table 1. Retrieved and total kill of walrus in Alaska during 1965*

Location	Walrus Retrieved	Known Composition of Harvest** Males No.	%	Females No.	%	Calves No.	%	Per Cent Hunting Loss %	Total Kill
Kuskokwim Area	50-55	50-55	(100)	0		0		40	83 - 92
Norton Sound	13	13	(100)	0		0		30	19
Savoonga	339-389	184-209	(54)	80-93	(24)	75-87	(22)	50	678 - 779
Gambell	447	125	(28)	167	(37)	155	(35)	40	745
Northeast Cape	71	34	(48)	22	(31)	15	(21)	50	142
King Island	208	93	(45)	110	(53)	5	(2)	60***	520
Diomede Island	284	189	(67)	81	(29)	14	(4)	40****	473
Wales	9	5	(56)	4	(44)	0		40	15
Shishmaref to Pt. Hope	11	11	(100)	0		0		20	14
Pt. Lay	20	20	(100)	0		0		50	40
Wainwright	194	149	(77)	40	(21)	5	(2)	40	323
Barrow	57	54	(95)	3	(5)	0		60	143
Misc.	9	9	(100)	0		0		50	18
TOTALS	1712-1767	936-966	(54.7)	507-520	(29.6)	269-281	(15.7)	46.7%	3213-3322

* Does not include the kill of walrus on the Walrus Islands (in Bristol Bay); estimated at 40 to 60 adult males.

** The columns "Males" and "Females" include all age groups with the exception of calves of the year.

*** Includes orphaned calves which apparently do not survive.

**** The comparatively low hunting loss (usually 60% at Little Diomede) is due to the fact that the walrus herds hunted did not contain many calves, and few were orphaned.

used by the 385 residents (Alaska Dept. of Econ. Devel. and Plan., 1965) and 700+ dogs. At times the salvage of walrus meat by Savoonga hunters is not maximal, and occasionally head hunting is practiced (i.e. if a returning umiak, already filled with meat, comes across an exceptionally well-tusked animal, the walrus will be killed, and only the ivory removed). By custom, at both Gambell and Savoonga, there is no traditional obligation to salvage meat from walrus that are dead when found. In such cases only the tusks are removed even though the animal would provide a large amount of dog food.

More complete utilization of meat by Savoonga hunters would certainly benefit the village as a whole. Notwithstanding the good spring walrus harvest this year, the village leaders are (as of 20 December) concerned about a shortage of food.

The settlement at Northeast Cape (on eastern St. Lawrence Island) also had good hunting in the spring of 1965, and the small number of men (approximately 15) took 37 adult walrus and an estimated 15 calves. Of the adults, 19 were males and 18 were females.

The salvage of walrus by hunters at Northeast Cape was good, as the men market walrus meat (primarily in Nome), in addition to supplying their own needs.

Spring walrus hunting at King Island was very successful, and the walrus were all taken in a short period of time. The total harvest amounted to 202 animals of which 108 (53.5%) were adult females, 89 (44.0%) were adult males, and five (2.5%) were calves. My observations, and results of laboratory examination of ovaries, showed that about 71 per cent of the females migrating in what can be termed "nursery herds" (the type of herds usually available to hunters at Gambell, King Island and Little Diomede Island) are accompanied by calves. Therefore, in addition to the 108 females and five calves that were retrieved, at least 72 calves were probably orphaned. This loss is additional to the number of animals wounded or killed and lost.

The harvest at King Island was made by 23 hunters, using one large and two small umiaks. The number of cows taken per hunter was 4.7, closely approaching the legal limit of five per man. Undoubtedly, the legal limit of females would have been greatly exceeded if a Department observer had not been at King Island. Hunters turned to the adult bulls when the limit of females was approached. King Islanders (especially those residing in Nome)

depend primarily on ivory carving as a livelihood, and require an adequate supply of raw ivory. They are understandably extremely selective toward adult female walrus as they possess the best ivory for carving.

Large concentrations of females and calves passed close to King Island during the period from 30 May to 9 June, and about 180 animals (89% of the total spring harvest) were taken during that time. Hunters never ventured further than two miles from the island on their hunting forays, and often hunted within 500 yards of the village. For several days, from 3 to 9 June there were walrus around the island as far as I could see. On 6 June, several hundred animals were lying on the shore ice 250 to 300 yards in front of the village. They went unmolested as the men do not hunt on Sunday, unless food is in short supply.

The large nursery herds had passed to the northwest of King Island by 8 June, but small, widely scattered herds of bulls continued to move by until most of the ice had passed; by 14 June. Swimming walrus probably continued to pass for a few days, but they were not pursued.

By contrast, winter hunting success at King Island was unusually poor. The total harvest of game (as recorded by the late John Angushak of King Island) between 10 November, 1964 and 23 May, 1965 was 44 seals, 14 bearded seals, 3 walrus, and 3 polar bears. Continuous north winds, strong currents and heavy ice were the cause of such poor success.

Hunters from Little Diomede Island harvested 247 walrus of which 160 (64.8%) were adult bulls, 73 (29.6%) were adult cows, and 14 (5.6%) were calves. By comparison, previous spring harvests at Little Diomede were as follows: 255 animals in 1962; 294 in 1963; and 29 in 1964.

Richard T. Wallen, Department observer at Diomede, relates a report by a pilot flying from Wales to Little Diomede on 9 May. The pilot reported "quite a few" walrus drifting north on the ice through Bering Strait. The first walrus of the spring, a male, was taken on 18 May. It appears that hunters had access to the main movement of females passing Diomede (between 28 May and 5 June), and also to the main movement of bulls (between June 11 and 18). During the first period 101 walrus (including most of the females and calves) were taken, and during the second, 98 animals were harvested.

According to Wallen's notes, the peak movement of the mixed herds (cows, sub-adults, calves, and small numbers of bulls) passed Diomede during the first few days of June. He wrote:

> "Many [walrus] passed on previous days but the numbers observed reached a peak between 2 A.M. and 5 P.M., June 5. During this time [swimming] walrus were in such abundance that the crews were frightened to go out in their boats."

The typical "nursery herds", composed mainly of cows and calves, either did not pass close to Little Diomede Island or the hunters were unable to get to them. This is borne out by Wallen's observation that, "not many of the females observed were accompanied by calves." Laboratory examination of reproductive tracts collected at Diomede also bore this out. Of the adult female specimens collected, 43 per cent were pregnant, 14 per cent barren, and 43 per cent post parturient. The "nursery herds" are composed of mainly post-parturient cows (70 to 80%). Thus, during this hunting season the loss of orphaned calves at Diomede was less than usual, probably around 15 to 20 being deserted in addition to the 14 harvested.

The Diomede harvest was taken by 18 hunters (16 steady crew members) using two umiaks. The harvest of females amounted to 4.1 animals per hunter.

Hunters at the village of Wales do not venture far in search of walrus, and kill very few. The spring harvest amounted to about 9 animals (5 males and 4 females).

Table 2 shows the magnitude and composition of the 1965 spring harvest, and provides a comparison with previous spring harvests.

Northward migrating walrus have usually passed through Bering Strait by the latter part of June, and are not available to Alaskan hunters in large numbers until the pack ice has receeded north to between Icy Cape and Point Barrow (usually in August).

Summer Hunting

As far as could be determined, only eleven walrus were killed by hunters from Shishmaref, Kivalina and Point Hope. The animals taken were mostly sub-adult males, far removed from the main migration.

The most productive summer hunting occurred at the villages of Pt. Lay, Wainwright and Barrow. As usual, most of the animals taken were adult bulls. The harvest at Point Lay was around 20 animals and reportedly, all were bulls.

Table 2. Comparison of known sex and age composition of walrus taken in the Bering Strait area during the spring hunting seasons from 1962 through 1965

Village	1962			1963			1964			1965		
	Males*	Females*	Calves*	Males	Females	Calves	Males	Females	Calves	Males	Females	Calves
Gambell	72	153	155	54	117	77	42	15	19	125	167	155
Savoonga	241	133	19	94	55	53	127	26	25	184	80	75
L. Diomede Is.	136	104	15	183	85	26	18	9	2	189	81	14
King Island	-	-	-	-	-	-	29	144	10	93	110	5
Wales	-	-	-	-	-	-	2	0	0	5	4	0

* The notations "males" and "females" include adult and sub-adults, and "calves" are of both sexes.

Of the walrus hunting sites bordering the Chukchi Sea and Arctic Ocean, Wainwright is one of the most productive. The harvest, all taken between 14 July and 4 August amounted to 194 animals. Of these, 149 (77%) were adult bulls, 40 (21%) were adult cows, and 5 (2%) were calves. Nine umiaks and one inboard power launch, manned by approximately 36 men, were used for walrus hunting. The walrus will be used primarily for dog food, although the 290 residents do eat some walrus meat. Their preferred diet is caribou, fish and seals.

At Barrow, only a few men participated in the walrus hunt. It was reported that 57 walrus were taken during the last part of July and in early August. Of the animals taken, 54 (95%) were adult bulls, and the remainder cows. No calves were reported taken. Conversations with some of the hunters indicated that hunting loss was extremely high, on some hunts approaching 3 animals lost for each one retrieved. This loss is attributed to poor equipment, lack of harpoons, and use of larger, less maneuverable power launches.

After the middle of August, walrus were no longer available to Alaskan hunters (except for the Walrus Islands animals which are protected by regulations), until they again passed through Bering Strait on their southward fall migration.

Fall Hunting

As usual, the southward fall migration was nothing like the more concentrated spring movements. Walrus began to appear around St. Lawrence Island as early as the end of September. As of 25 September, two sub-adult bulls (sub-adults comprise most of the early arrivals) were killed by Gambell hunters, and two by Savoonga hunters. Although cows with calves are usually found in association with the drifting sea ice, in October a hunter at Northeast Cape killed a cow and calf which were hauled out on Punuk Island.

On 24 October, two boats from Northeast Cape found between 150 and 160 walrus on, and around, Punuk Island. Five men hunted the 50 or 60 animals that were on the beach but, in spite of the concentrated fire power, none of the walrus were taken (an example of high hunting loss, as undoubtedly many of the walrus were hit).

Walrus hunting throughout November was poor as a result of continuously adverse weather. However, the main fall movement of animals was passing through Bering Strait, and as far south as St. Lawrence Island.

Prior to December 20 (when ice conditions became unfavorable for hunting with boats), the men at Little Diomede reported taking 37 walrus of which 29 were males and 8 were females. Mr. Edward Muktoyuk, of King Island, informed me by radio that on December 3, walrus were very numerous in the vicinity of King Island. Most of them were sleeping on top of the young ice, which was drifting south. The four men staying on King Island this winter took six walrus (four males and two females).

The most productive fall hunting at St. Lawrence Island occurred between 10 and 24 December. The total fall harvest at the three villages on the island was 71 walrus. The harvest by villages was as follows: Gambell, 13 walrus (10 males and 3 females); Savoonga, 39 (34 males and 5 females); and Northeast Cape, 19 animals (15 males and 4 females). The number of calves taken is unknown.

As far as I can determine, the fall harvest at other sites not mentioned here amounted to about 10 animals. I assume these were all males. The total fall harvest is indicated in Table 3.

For the year as a whole (January through December) the total harvest of walrus throughout Alaska, excluding those killed near the Walrus Islands, was between 1712 and 1767 animals. Of this total harvest 54.7 per cent (936 to 966 animals) were adult and sub-adult bulls, 29.6 per cent (507 to 520) were adult and sub-adult cows, and 15.7 per cent (269 - 281) were calves. Considering the harvest of adults and sub-adults only, 65 per cent were bulls and 35 per cent cows.

Hunting Effort

In the previous discussions of the village by village harvests, one aspect of hunting effort, the number of men and craft involved in the hunts, was mentioned. Several anthropologists presently working in western Alaska have requested similiar information for periods prior to 1959, but unfortunately very little is available.

Other measures of hunting effort and success at the sites traditionally realizing the greatest harvests, are presented in Table 4. These indices include the number of hunting days, the number of boat-hours, and the number of boat-hours per walrus retrieved.

Table 3. Fall 1965 harvest of walrus in Alaska

Village	Total	Males		Females	
Little Diomede Island	37	29	(78.4%)	8	(21.6%)
King Island	6	4	(66.7%)	2	(33.3%)
Gambell	13	10	(76.9%)	3	(23.1%)
Savoonga	39	34	(87.2%)	5	(12.8%)
Northeast Cape	19	15	(78.9%)	4	(21.1%)
Other Areas	10	10	(100%)	0	(0%)
TOTAL FALL HARVEST	124	102	(82.3%)	22	(17.7%)

Table 4. Comparative hunting effort and success during the spring walrus hunting seasons in Alaska from 1961 to 1965*

Measure of Effort		Gambell	Diomede	King Island
No. Hunting Days	1961	13 of 35 days	18 of 26	--------
	1962	19 of 33 days	8 of 16	--------
	1963	14 of 20 days	11 of 37	--------
	1964	27 of 48 days	21 of 51	13 of 48
	1965	25 of 42 days	16 of 28	6 of 18
Boat Hours	1961	910	399	--------
	1962	947	140	--------
	1963	810	320	--------
	1964	1,714	502	199
	1965	2,157	408	93
Boat Hours per Walrus Retrieved	1961	5.10	.75	--------
	1962	4.62	.58	--------
	1963	4.74	1.20	--------
	1964	29.55	17.31	1.14
	1965	5.74	2.33	.46

* Data include only those hours expended, and walrus taken while an observer was at the respective villages.

Utilization

An extensive discussion of the factors affecting walrus utilization at the various hunting sites was presented in a previous segment report (Burns, 1963). As would be expected, the proportion of walrus meat and skins salvaged is dependent upon the magnitude of the harvest, the number of people and dogs using the harvest, and weather and ice conditions at the time the walrus are killed. The walrus harvest during 1965 was relatively good, and utilization was similiar to that recorded for 1963.

Briefly, utilization of the 1965 harvest was as follows: in the Kuskokwim area, Norton Sound, and Wales, 80 to 90 per cent; at Gambell and Northeast Cape, 70 per cent; King Island, 5 to 7 per cent; Little Diomede Island, 10 to 12 per cent; Savoonga, 50 per cent; Point Lay and Barrow, 85 to 90 per cent; and at Wainwright utilization approached 100 per cent.

The primary interest of hunters at King and Diomede Islands is in ivory, a commodity on which they are very dependent for their necessary income. The excellent utilization at Wainwright is the result of extremely favorable ice conditions, and the presence of heavy equipment to move the walrus carcasses which are brought to the beach intact.

Value of the 1965 Harvest

The potential value of the 1965 walrus harvest was calculated in the same manner as outlined in the 1963 and 1964 Segment Completion Reports (Burns, 1963; 1965). It is based on the following values set forth by Fay (1958), and Harbo (1961):

Tusks of adult females valued at $10.00 per pair.
Tusks of adult males valued at $24.00 per pair.
Tusks, carved, either sex, valued at $125.00 per pair.
Bacula valued at $7.00 each.
Walrus meat valued at $.10 per pound.
Skins of female walrus valued at $20.00 each.

The estimated values of the component parts of the walrus harvest are presented in Table 5. The total potential value of the harvest is calculated to have been $322,658.

Table 5. Potential value of the 1965 walrus harvest in Alaska

Location	Harvest			Value of Ivory					Greatest
	Males	Females	Calves	Raw	Carved	Bacula	Meat*	Skins**	Pot. Value
Kuskokwim Area	50	0	0	$ 1,200	$ 6,250	$ 350	$ 5,000	$ 0	$ 11,600
Norton Sound	13	0	0	312	1,625	91	1,300	0	3,016
Gambell	125	167	155	4,670	36,500	875	23,528	3,340	64,243
Savoonga	184	80	75	5,216	33,000	1,288	23,688	1,600	59,576
Northeast Cape	34	22	15	1,036	7,000	238	4,818	440	12,496
King Island	93	110	5	3,332	25,375	651	15,933	2,200	44,159
Diomede Island	189	81	14	5,346	33,750	1,323	23,851	1,620	60,544
Wales	5	4	0	160	1,125	35	740	80	1,980
Pt. Lay	20	0	0	480	2,500	140	2,000	0	4,640
Wainwright	149	40	5	3,976	23,625	1,043	17,333	800	42,801
Barrow	54	3	0	1,326	7,125	378	5,400	60	12,963
Miscellaneous	20	0	0	480	2,500	140	2,000	0	4,640
TOTALS	936	507	269	$27,534	$180,375	$6,552	$125,591	$10,140	$322,658

* Utilizable weight is calculated on the basis of 1,000 lbs. for adult males, 600 for adult females and 65 for calves.

**Does not include commercial value of male skins which are marketed for $100.00 each, when sold.

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WORK PLANT SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE:	Alaska		
PROJECT NO.:	W-6-R-6	TITLE:	Alaska Wildlife Investigations
AND:	W-14-R-1	TITLE:	Marine Mammal Investigations
WORK PLAN:	G-a and F	TITLE:	Walrus and Seals
JOB NO.:	3	TITLE:	Seal Biology and Harvest

PERIOD COVERED: January 1, 1965 to December 31, 1965

OBJECTIVES

To obtain current information about the magnitude, characteristics and value of hair seal harvests in northwestern Alaska; to identify the factors affecting seasonal movements, abundance and distribution of the bearded seal (Erignathus barbatus), and the age and sex composition of these seals in the harvest; to obtain information about the reproductive physiology of the bearded seal, the ribbon seal (Histriophoca fasciata), and the harbor seal (Phoca vitulina); to attempt to determine the patterns of dispersal in the harbor seal, and to investigate the clinal differences in certain characteristics of reproduction.

PROCEDURES

Information about the magnitude and distribution of the seal harvest in northwestern Alaska was obtained from seal bounty records. Edward Klinkhart, Department biologist in Anchorage, did most of the bounty record analysis. Although the total number, and location where seals are taken, is indicated on the bounty forms, no information regarding the species

of hair seals bountied is indicated. An indication of the species composition of the harvest was obtained by examining random, seasonal samples of seal scalps submitted to the Nome office. Records of the seal harvest were also kept by Department personnel working in the various villages.

The bearded seal received major attention throughout 1965. Extensive collections of specimens and data were made by Nevin Aspinwall, at Gambell. Richard Wallen was able to obtain a limited amount of material from Little Diomede Island. Gary Lust and I worked with these seals at Barrow and Wainwright, and I collected a small number of specimens from bearded seals taken by hunters in the Nome area, throughout the year.

Almost nothing was obtained from ribbon seals. Only two of these seals were taken at villages where a Department representative was present. However, I was able to examine ribbon seal specimens in the biological collections of the University of Hokkaido, Japan.

The study of harbor seals was not intensively pursued, and is still in the collecting phase. Specimens were received from the following persons and areas: John Crawford, Ketchikan; John Vania and Edward Klinkhart, from the Kodiak Island area; Gary Lust, St. Lawrence Island; and from several of the local hunters in Nome, and at Wainwright. All of the harbor seal material has been examined (except for determining ages), but the analysis of data will not be undertaken until a sufficient amount of material is acquired. I examined a sample of harbor seal skulls in the biological collections of the University of Hokkaido.

FINDINGS

A comprehensive report dealing with the life history and ecology of the bearded seal is presently being prepared. Completion is expected in the near future. Data and findings relative to the bearded seal study will be covered in that report.

Little material was obtained from ribbon seals during 1965. However, Dr. Francis H. Fay and I have pooled specimens and information acquired in previous years. In addition to our material, the specimens examined in Japan will be included in the combined sample.

Dr. Fay and I are in the process of writing a paper dealing with the taxonomy, distribution and notes on the life history of this seal.

As was stated in the previous section, the harbor seal study was still in the data and specimen collecting stage. Little of significance can be reported at this time.

The harvest of hair seals in western and northwestern Alaska, during 1965, as indicated by analysis of bounty records, was 21,015 animals. The distribution and magnitude of the seal harvest is shown in Figure 1.

Prior to 1965 no attempt was made to determine the proportion of the various species of hair seals in the harvest. Since a knowledge of the species composition of the harvest is important from the standpoint of management, an attempt was made to obtain this information.

It was found that the proportion of harbor seals in the total harvest generally decreases from south to north.

The total retrieved kill of hair seals, and an estimate of the species composition, is shown in Table 1. The total harvest (21,015 seals) was taken by 512 hunters, an average of 41 seals per hunter.

The 1965 harvest is the largest recorded to date. Previous harvests of hair seals in the areas indicated in Figure 1 were approximately as follows: 16,550 in 1962; 16,500 in 1963; and 11,800 in 1964.

Seasonal distribution of the ringed and bearded seal is such that hunting pressure, at the present level, will not be detrimental to these species. Hunting pressure is widely dispersed, and is restricted primarily to areas along the coastline, and to a few locations on the offshore islands.

The harvest of ringed seals during the fall and early winter is composed of all age groups. As breeding season approaches, the pregnant females search out areas suitable for giving birth and raising their pups. Favorable conditions exist where large areas of stable, or land-fast ice occur. Pups are born in protected dens, and are relatively safe from hunters until they are weaned and start moving around.

In the vicinity of Nome, most of the seals taken during March and April are juveniles (one to seven year olds) of both sexes, or rutting males apparently traveling in search of females.

The most productive hunting period for bearded seals is primarily in the spring when the young appear near the shore to bask, and when migrating seals, moving with the ice, pass the hunting sites. During the spring, at most locations, the smaller ringed seals are not taken when bearded seals are abundant. The major harvest of bearded seals is taken during the relatively brief spring hunting season.

Value of the Harvest

Estimates of the total value of the seal harvest in northwestern Alaska indicate only the amount of money that could have been realized from the sale of skins.

Seals, especially the ringed seal, are the mainstay of the economy of coastal Eskimos in this area. The primary objective of the hunt is to provide food for consumption by humans and dogs. Sale of skins is, at present, of secondary importance even though it is an important source of income. Unlike the situation in southern Alaska, hunting seals solely for the skins and the bounty is done only after the requirements of a good food supply have been satisfied. The food requirements are seldom met as there is always someone in the villages that can use the meat.

No attempt is made to calculate the intangible but high value of meat, or the value of skins used in the villages for the manufacture of clothing, hunting equipment, and other articles for which seals are used.

Figure 1. Distribution and magnitude of the 1965 hair seal harvest in western and northwestern Alaska. The numbers (0 through 23) correspond to the villages listed in Table 1.

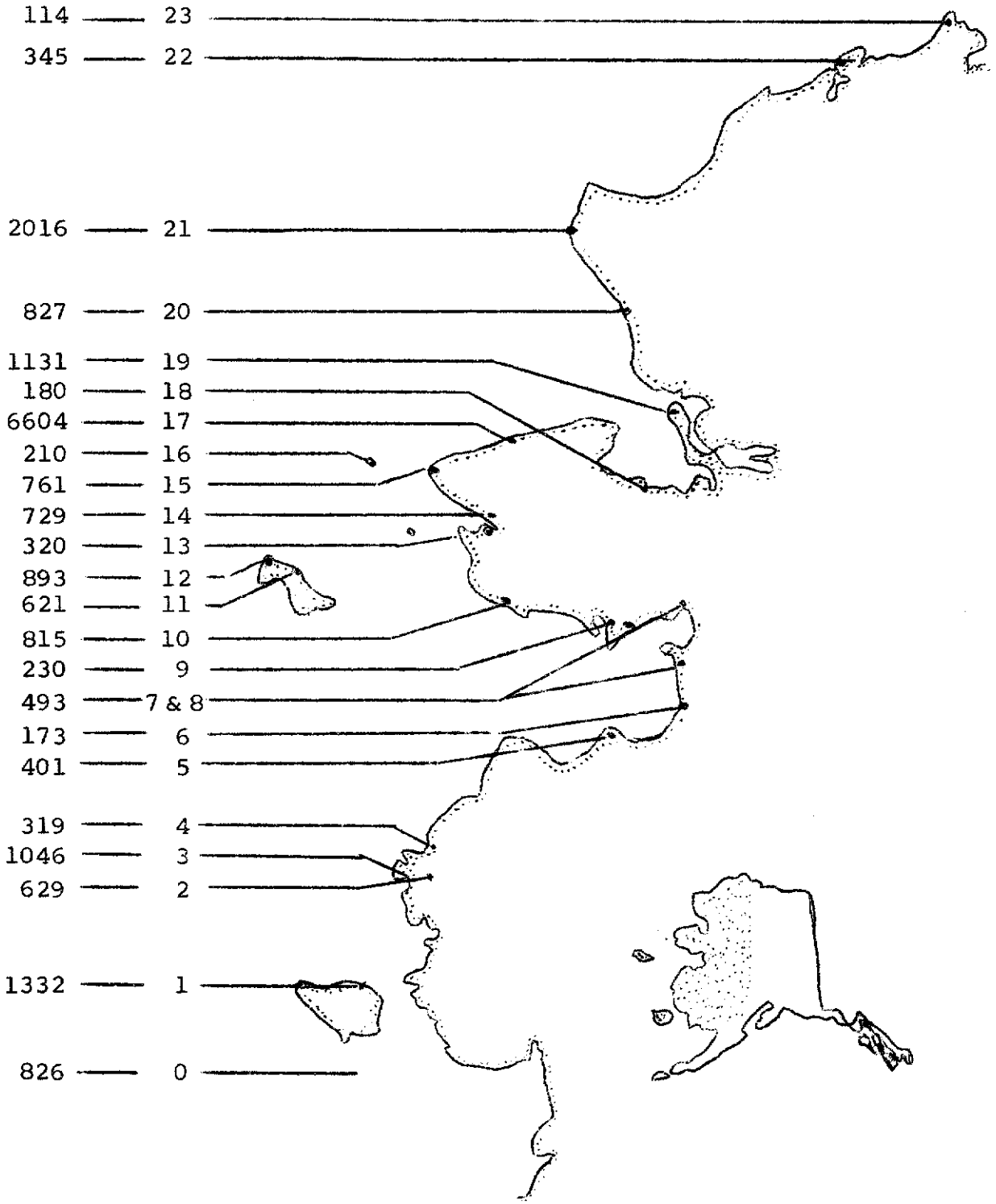

Table 1.--Seals bountied in the Second and Fourth Judicial Districts (western and northwestern Alaska) during 1965, and the species composition as indicated by examination of seal scalps and observation at some of the hunting sites

Village	Village Identification No.	Seal Harvest			
		All Seals	Ringed	Bearded	Harbor
Miscallaneous	0	826	516	150	160
Mekoryuk	1	1,332	532	300	500
Chevak	2	629	329	100	200
Hooper Bay	3	1,046	646	200	200
Scammon Bay	4	319	129	90	100
Stebbins	5	401	181	100	120
Unalakleet	6	173	93	40	40
Shaktoolik	7	321	171	70	80
Koyuk	8	172	82	40	50
Golovin	9	230	120	60	50
Nome	10	815	705	50	60
Savoonga	11	621	321	150	150
Gambell	12	893	543	200	150
Teller	13	320	135	35	150
Brevig Mission	14	729	559	70	100
Wales	15	761	636	75	50
Diomede	16	210	130	70	100
Shishmaref	17	6,604	4,404	1,000	1,200
Deering	18	180	100	40	40
Kotzebue	19	1,131	731	100	300
Kivalina	20	827	652	100	75
Point Hope	21	2,016	1,616	250	150
Wainwright	22	345	205	100	40
Barrow	23	114	54	40	20
TOTALS		21,015	13,590	3,430	3,995

On the basis of a $3.00 bounty for each seal scalp, and an average value of $10.00 per skin, the 1965 seal harvest in western and northwestern Alaska is conservatively valued at $273,195.

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