Quarterly Report

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The natural history and ecology of the bearded seal (*Erignathus barbatus*) and the ringed seal (*Phoca (Pusa) hispida*)

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I. Task Objectives

1. Summarization and evaluation of existing literature and available unpublished data on reproduction, distribution, abundance, food habits and human dependence on bearded and ringed seals in the Bering, Chukchi and Beaufort Seas.

2. Acquisition of large amounts of specimen material required for an understanding of food habits in these two species.

3. Acquisition of additional data on productivity and growth rates.

4. Acquisition of baseline data on mortality and morbidity (including parasitology, diseases, predation and human harvest) of ringed and bearded seals.

5. Determination of population structure of bearded and ringed seals as indicated by composition of harvest taken by Eskimo subsistence hunters.

6. Initial assessment of regional differences in density and distribution of ringed and bearded seals in relation to geographic areas and, to a lesser extent, in relation to major habitat condition.

7. Acquisition of additional information on seasonal migrations.

II. Field and Laboratory Activities

A. Schedule

Date	Location	Activity
October-December	Fairbanks	Analyses of seal specimens and data
September	R/V NATCHIK	Collection of seal specimens
October	R/V MILLER-FREEMAN	Collection of seal specimens
November	Nome	Collection of seal specimens
November	Stebbins	Collection of seal specimens

B. Scientific Party

Name	Affiliation	Role
John J. Burns	ADF&G	Principal Investigator
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Kathryn Frost	ADF&G	Marine Mammals Biologist
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C. Analytical Methods

From all specimens we endeavor to obtain weights, standard measurements, lower jaws, foreflipper claws, stomachs, reproductive tracts and intestines. We also obtained blubber, tissue, organ and blood samples as the situation permitted.

The ages of seals are determined by examination of claw annuli (for animals six years and younger) and dentine or cementum annuli (for animals over six years of age). Growth rates are based on weight and standard measurements correlated with specimen age, sex and date and locality of collection. Species productivity and parasite burden are determined, respectively, through laboratory examinations of reproductive tracts and various organs and correlation of these data with age, sex, and date and locality of collection of each specimen.

Regional differences in seal density and distribution were assessed through aerial surveys following the methods of Burns and Harbo (1972).

Analytical methods are discussed in detail in our Annual Report for FY-1976.

III-IV. Results and Preliminary Interpretation

A. Specimen Collections

During the October-December 1976 quarter our major efforts were devoted to laboratory analyses of specimens collected during field activities in previous quarters. However, seal specimens were obtained from Nome, Stebbins and Barrow (Table 1).

Table 1. Seal specimens obtained between October and December 1976.

Location	Male	Female	Total
Stebbins			
Ringed seal	1	1	2
Nome			
Ringed seal	2	3	5
Barrow			
Bearded seal	1	-	1
R/V MILLER FREEMAN			
Bearded seal	1	-	1

B. Ringed Seal

1. Distribution and Taxonomy

The ringed seal has a widespread northern, circumpolar distribution. Ringed seals have been recorded from the North Pole southward, in ice covered seas, to Finland, northern Iceland, southern Greenland, Labrador, Hudson Bay, southern Bering Sea, Sea of Okhotsk and northern Hokkaido. There are isolated ringed seal populations in the Gulfs of Bothnia and Finland, Lake Ladoga (USSR), Lake Saimaa (Finland) and in at least one lake on Baffin Island (Canada). Stragglers have been recorded in France, Scotland, southern Japan and at San Diego California. In Alaska, ringed seals inhabit the Bering, Chukchi and Beaufort Seas, and have been found in the Pribilof and Aleutian Islands.

Seven subspecies have been proposed for the ringed seal (Table 2) (Scheffer 1958 and Miller-Wille 1969). However. the ringed seal is a highly variable species and the subspecies are difficult to separate without examining a large number of specimens. Muller-Wille (1969) investigated the relationships of _P. h. botnica_, _P. h. ladogensis_, _P. h. saimensis_ and _P. h. pomororum_. These four subspecies were found to overlap in many traits but Muller-Wille concluded that they were significantly different enough to be classified as subspecies. The differences are attributed to the isolation of these populations for 8,000 to 12,000 years. The relationhsip between _P. h. pomororum_ and _P. h. hispida_ is unclear.

The population and taxonomic relationships between _P. h. hispida_, _P. h. kraschenínikovi_ and _P. h ochotensis_ are presently under investigation by Soviet and American biologists. _P. h. ochotensis_ appears to be a valid subspecies. The status of _P. h. krascheninikovi_ is unclear. Based on our observations, ringed seals move widely and Bering Strait is not a barrier. There is a net movement of ringed seals southward through the Strait in the fall with the formation of sea ice and conversely a net northward movement in the spring with breakup.

The Soviets have examined large numbers of ringed seal specimens from the Bering and Chukchi Seas and are finding that there are two morphos (which may be subspecies) of ringed seals. A larger morph found in the shorefast ice and a smaller morph in the drifting ice. However, not enough is known about the ecology and behavior of ringed seals to ascertain the relationships between the drifting and shorefast ice seals. Based on specimen material and collecting program, there appears to be age-specific, seasonal movements of seals between shorefast and drifting ice. In our future work we hope to delineate these movement patterns more clearly.

The Caspian seal (Phoca caspica) and the Baikal seal (Phoca sibirica), both found in land-locked water bodies (Caspian Sea and Lake Baikal), evolved from the ringed seal but are presently considered separate species.

2. Pelage

The color of ringed seals is quite variable, but the basic pattern is a gray back with black spots and a light belly. These black spots are ringed with light marks from which comes the seal's name. Several specimens have been examined which have the ringed pattern on back and belly and one adult specimen was observed to have the light coloration on both back and belly.

Pups are born with a white lanugo. The lanugo is shed when the pup is 2 to 6 weeks old. The first year pelage is quiet variable but it is generally light in coloration with faint spots and rings.

Ringed seals molt annually. During the period of molt they haul out on the sea ice on "warm," sunny days. Hauling out during the molt appears to be an important adaptation to the Arctic environment. Skin temperatures of ringed seals during immersion are generally within 3°C of water temperatures (which may be 2°C); upon hauling out the skin temperature may increase to 20°C or more. Epidermal cells of phocid seals in in vitro cultures were found to survive for 6 months at 4°C but required temperatures of at least 17° to 19°C for growth. The most rapid growth was at 37°C (Feltz and Fay 1966). Sleep or inactivity also may be a requirement for mitosis (Bullough 1962, Bullough and Rytomaa 1965). Therefore, growth and reparative functions of ringed seal skin may only be possible when the animal is hauled out and/or at rest.

The molt appears to begin in mid-May in the Bering Sea-Norton Sound and progressively later as one goes farther north; in Alaska the peak is in mid-June. Two adult ringed seals (BP-11-76, BP-12-76) collected at Barrow, Alaska in early August were just completing their molt.

3. Dentition

The dental formula of phocid seals varies according to the subfamily:

	Incisors	Canines	Postcanines	
Phocinae	1-2-3 / 0-2-3	1 / 1	1-2-3-4-5-(6)-0 / 1-2-3-4-5-0-0	= 34-36
Monachinae	0-2-3 / 0-2-3	1 / 1	1-2-3-4-5-(6)-0 / 1-2-3-4-5-0-0	= 32-34
Cystophorinae	0-2-3 / 0-0-3	1 / 1	1-2-3-4-(5)-(6)-0 / 1-2-3-4-(5)-(6)-0	= 26-34

The ringed seal follows the Phocinae pattern and typically has 34 teeth (lacks upper postcanine 6). Dental anomalies are not uncommon and those that we have found include:

a. Upper postcanine number 6 present
b. Upper postcanine numbers 4, 5 and/or 6 absent (never found)
c. Lower incisor number 1 present
d. Lower incisor number 3 absent
e. Supernumary lower incisor number 3
f. Supernumary lower canine

The incisors, canines and first postcanines are single rooted while postcanines (upper and lower) 25 are double rooted. One postcanine number 5 had 3 roots. The relative size of postcanines, in descending order, is 3-4-2-5-1. The postcanines are reticulated and are offset such that when the jaws are closed a net-like structure is formed, which is presumably used to assist in the retention of smaller invertebrates from the seawater.

Five early and mid-term fetuses (NP-14-76, STP-1-76, BS-11-70, BS-14-70, BS-15-70) had the deciduous dental formula:

$$i\ \frac{3}{2} \qquad c\ \frac{1}{1} \qquad pc\ \frac{3}{3} \qquad = \qquad 26$$

A mid-February fetus (N-2a-71) had a complete set of permanent teeth but they were not erupted. At birth, ringed seals have a complete set of fully erupted, permanent teeth.

Several cases of dental disease have been noted during examination of specimens. Two ringed seals were found to have caries in their second postcanines. The caries were situated in the pit of a tooth reticulation. One seal from Nome had grooves in the enamel of all teeth and the grooves resembled those of hypoplasia. Hypoplasia is a deficient formation of enamel due to injury or dysfunction of the ameloblasts (enamel-forming cells) during enamel formation.

Erosion of the teeth at the gingivolabial and buccal level has been noted in 30 ringed seals. The lesion is characterized by a smooth, highly polished notch in the tooth surface with no evidence of caries. Erosion appears to originate in the canine-postcanine 1 region and spreads anteriorly and posteriorly. The lesion appears to become progressively worse and ultimately the tooth erodes to a thin level and breaks. The etiologic factors responsible for this condition are unknown. In humans, erosion is caused by acid secretions from the labial or buccal glands and it is found in nervous individuals who are chronic worriers (Massler et al. 1958).

Another form of tooth wear, noted in several seals, appears to be a mechanical wearing away of the cusps. The cusps become flattened and the tooth takes on a peg shape. The abrasive action of invertebrate exoskeletons has been postulated as the etiologic factor.

4. Food Habits

See quarterly report of Research Unit 232.

5. Growth Rates and Productivity

Ringed seals are the smallest of all pinnipeds, with the largest adult female recorded for Alaska being 155 cm in length and the longest male 146 cm. The heaviest ringed seals examined thus far in this research were a 90.9 kg pregnant female, taken in November, and a 90.9 kg male, taken in January. However, the weight of an individual varies with age and season. Heaviest weights are achieved, by adults, in winter and early spring when the seal has a heavy layer of fat or blubber under the skin. This blubber is used for insulation and as an energy source during the breeding and pupping seasons. The weights of ringed seals decline with the decrease in feeding during the reproductive and molting season.

Fetal and Pup Development - The embryonic and fetal development of the ringed seals is one of the parameters that influences fertility. Embryological development is usually considered as a continuous process of growth and differentiation from the formation of the zvgote to parturition. Growth and differentiation appear continuous, albeit slow during the 3-1/2 month delay before implantation, but the factors that affect the rate of growth and differentiation are unknown.

Female ringed seals appear to be impregnated in mid to late April, soon after the birth of the pup. Impregnation is followed by a delay of up to 3-1/2 months before implantation, approximately in August. Additional seal specimens are required from August and September to demonstrate the precise period of implantation and to determine early fetal growth rates.

Thus far, 50 ringed seal fetuses (27 males and 23 females) have been examined and measured, yielding a fetal sex ratio of 1:1 (P 0.01). The fetal growth curve for length (Fig. 1) closely resembles that of ringed seals in Canada (McLaren 1958). The growth curve for weight (Fig. 2) is similar to those for most mammals. The relative growth of length and weight (L/W) (Fig. 3) is most rapid just after implantation, in August and September, with relative growth rates leveling off in late pregnancy. No differences between the growth rates of males and females were detected (P 0.05).

Pup Growth Rates - Weights of 55 ringed seal pups (21 males, 33 females and 1 sex unknown) have been obtained thus far, yielding a pup sex ratio of 1:1 (P 0.05). Ringed seal pups weigh about 4.0 kg at birth. A live pup two or three days old weighed 5.0 kg while the mean weight of 8 full-term fetuses was 3.4 kg.

Pup weights increase steadily from birth until weaning in late May or early June (Fig. 4). In late June and early July the weights of pups decrease somewhat as the pups adjust to life on their own. In mid and late July pups' weights increase steadily leveling off in August and September. The mean weights of male and female pups generally do not differ (P 0.05), however, there is more variation in the weights of males than in the weights of females.

Blubber thickness over the sternum increases from 0.5 cm or less at birth to an average of 2.6 cm in May and early June. During mid and late June and July, the blubber thickness decreases to a mean of 1.1 cm and this decrease in thickness is probably associated with the loss of weight immediately after weaning. By August mean blubber thickness has increased to 1.9 cm and then levels out at a mean of 3.0 cm from September to February. There appears to be no difference in blubber thickness between male and female pups (P 0.05 cm).

The lengths of pups increased steadily from birth and appeared to begin leveling out in August and September (Fig. 5). A significant decrease in length immediately after weaning was not noted. The mean lengths of males and females did not differ (P 0.05) and the variation in lengths was approximately equal in the two sexes.

Reproduction - The epididymides of 245 male ringed seals (representing all age classes and collected during all months) have been examined for the presence of sperm. Active spermatogenesis has been detected in essentially all males seven years old and older which were collected during the months of March, April, May and June (Table 3). Eight of 15 (53%) six year old males collected between March and May had abundant sperm in their epididymides. One five year old male taken in May had a trace of sperm in its epididymides. No geographic variation in spermatogenic activity has been detected thus far, however, our sample size from the Beaufort Sea is small.

The earliest date that sperm was found in male epididymides was mid-March and active spermatogenesis appears to continue until mid-June. Sperm remains on the epididymides of some males until mid-August. Most adult female ringed seals appear to ovulate in April and May therefore the males are physiologically capable of breeding well before and long after most females.

The reproductive tracts of 40 female ringed seals collected during 1975 and 1976 have been examined and a tabulation of their reproductive status is presented in Table 4. Two three-year-old females, one four-year-old and one five-year-old female had ovulated for the first time but they apparently did not conceive. Six of eight females (75%) six years old or older had ovulated but it could not be determined whether these females had conceived. A female 14 years old had cysts on both uterine horns. The cysts caused complete obstruction of the uterine horns and both ovaries had begun to atrophy. A 21-year-old female showed no follicular activity, whereas a 22-year-old female had ovulated but it could not be determined whether she had conceived.

6. Polar Bear Predation on Seals

During 1976, 25 seals killed by polar bears have been examined (Table 5). Ringed seals comprised 96 percent (24) of the seals killed and one bearded seal made up the remaining 4 percent. Two cases of bears feeding in garbage dumps near human habitation were noted and numerous observations were made of bears feeding on carrion, particularly on whale carcasses north of Barrow and on the beaches of St. Lawrence Island.

Of the 24 ringed seals examined, 14 (58%) were males and 10 (42%) were of undetermined sex. Thirteen (54%) of the ringed seals were adults (greater than 6 years old; had achieved sexual maturity); 2 (8%) of the seals were immature (older than pups yet less than 6 years old); and 9 (39%) seals were of undetermined age. The single bearded seal comprised the only pup and the only female in the sample.

Twenty (80%) seals were killed on moving pack ice and 5 (20%) seals were taken on shorefast ice. Most seals (88%) were killed by bears waiting at seal breathing holes. Bears were relatively unsuccessful in obtaining ringed seals from lairs in the drifting ice, as only 3 seals were killed out of 32 lairs excavated by bears.

At Cape Lisburne, polar bears were tracked for 3105 bear-kilometers, along which 20 seal carcasses were found. Bears killed on the average, at Cape Lisburne in the spring, 1 seal every 155.2 kilometers.

7. Density of Ringed Seals

Successful feeding and reproduction are tantamount to the survival of all species. Therefore the goal of seal management should be to protect these critical feeding and reproduction areas from unnecessary disturbance or disruption. These critical areas change temporally and spatially and, considering the dynamic state of the sea-ice ecosystem, there can be large spatial changes in the location of critical areas in a short period of time. Habitat selection by ice-inhabiting pinnipeds has been aptly discussed by Fay (1974) and Burns (1972), and the reader is referred to those papers for a fuller discussion. Breeding adult-ringed seals are found primarily (but not entirely) associated with shorefast ice, while the bearded seal is associated with many ice types and overlaps with all ice-associated pinnipeds in the study area.

Critical areas are ascertained first by determining seal densities in various locations and then by correlations of densities with observed or measured ice, behavioral, ecological or oceanographic conditions. In June, 1970, 1975 and 1976, ringed seal surveys were conducted by airplane over the shore-fast ice from Barter Island to Point Lay. In addition, the 1976 survey was expanded to cover the shorefast ice from Pt. Hope to Cape Krusenstern and Kotzebue Sound. The results of these surveys are presented in Table 6. The areas of highest mean densities (Cape Krusenstern - Point Hope; Cape Lisburne - Pt. Lay; Wainwright - Barrow; Barrow - Lonely) are normally areas of very stable shorefast ice during late winter and spring. Within these larger areas there are variations in the density of ringed seals which appear to be dependent on the quality of shorefast ice. For example, between Cape Krusenstern and Point Hope the mean density was 2.3 ringed seals per square mile yet within this larger area the densities varied from 0.2 seals per square mile near Kivalina (early breakup of shorefast ice) to 3.8 seals per square mile near Cape Thompson (stable shorefast ice).

The most stable shorefast ice is found either along complex coasts or along coasts where the 10 fathom line lies far offshore. The edge of the shorefast ice tends to coincide with the 10 fathom curve. The higher densities in the Chukchi Sea are probably reflective of the better ice conditions together with higher overall biological productivity of the Chukchi as compared to the Beaufort Seas.

The total area of fast ice present during the 1975 and 1976 surveys is being calculated at this time from ERTS imagery. The total area of fast ice in each sector and the mean seal density for that sector will give a minimum estimate of the ringed seal population in each sector. However, this estimate will only reflect the seals on the ice. Not enough is known of ringed seal behavior to correct for animals in the water or otherwise not seen. This "population" analysis will be presented in our next report.

C. Bearded Seal

The major emphasis of work on bearded seals during this quarter involved laboratory preparation of teeth for age determination of the older seals, and the various aspects of data management including keypunching. Computer analysis of data was not possible due to problems of scheduling at the computer center.

Reproductive status of 77 female bearded seals obtained at hunting sites in the Bering, Chukchi and Beaufort seas was determined. Females in which one or both of the uterine horns had a thick and rugose appearance (indicating they had supported at least one fetus) and/or in which the ovaries contained a recent corpus albicaus or corpus luteum, were considered mature. As yet, the sample of ovaries has not been sectioned to determine the reproductive history of each female, or age-specific birth rates.

Based on this gross examination, 31 (40%) of the females were sexually immature (pup or adolescent) and 46 (60%) were mature. Previous studies (Burns, 1967 and unpublished) have suggested that there is a significant difference in the general age structure of samples obtained from the Bering Sea, as compared to those from the Chukchi and Beaufort Seas. In a sample of 391 bearded seals obtained from northern Bering Sea during the period 1964-1966, 209 (53%) were pup or adolescent seals (Burns, loc. cit.). Stirling, et al. (1975) found that in the eastern Beaufort Sea their samples included mainly adults. Pup and adolescent bearded seals comprised 29 percent of their 1974 sample (N = 31) and 18 percent of their 1975 sample (N = 51). These samples included both male and female seals.

Based only on the composition of females available from this study, there appears to be little difference between the samples we obtained in the Bering Sea and those acquired in areas further north. Our Bering Sea sample of 21 females included 9 (43%) sexually immature individuals. Of the Chukchi and Beaufort Sea specimens (N = 56), 22 (39%) were sexually immature.

The incidence of pregnancy in our sample of 46 sexually mature females was 87 percent. This is based on (1) indications of recent parturition in animals collected during April through mid-July, (2) the presence of an apparently active corpus luteum observed during this same period, or (3) presence of an implanted fetus in females collected after mid-July.

This incidence of pregnancy can be roughly compared to previously reported rates of ovulation. Stirling, et al. reported that all of nine adult females from the eastern Beaufort Sea, collected in 1974, had recently ovulated or were about to do so. The reported ovulation rate in their 1975 sample (N = 23) was .52. Burns (1967) reported an ovulation rate of .83 (N = 133) which is quite similar to the .87 found in this study.

Our objective during the current quarter of this study is to more clearly describe the actual age structure of our entire sample and to determine age specific birth rates, if possible.

V. Problems Encountered

Two problems have been encountered. First was the difficulty of obtaining specimens from the Beaufort Sea and the second is the continuing delay involved with computer services resulting from the needs of a large number of active programs. Neither can be immediately rectified.

VI. Estimated Funds Expended (since 1 July 1976)

100.	Salaries and wages	$46,829.27
200.	Travel	3,136.58
300.	Contractual	892.48
400.	Commodities	2,017.51
500.	Equipment	-0-

VII. Literature Cited

Bullough, W. S. 1962. Growth control in mammalian skin. Nature 193 (4815):520-523pp.

________ and T. Rytomaa. 1965. Mitotic homeostasis. Nature 205 (4971): 573-578pp.

Burns, J. J. 1967. The Pacific bearded seal. Alaska Dept. Fish and Game, Juneau, 66pp.

________ 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi seas. J. Mammal. 51(3):445-454pp.

________ and S. J. Harbo. 1972. An aerial census of ringed seals, northern coast of Alaska. Arctic 25(4):279-290pp.

Fay, F. H. 1974. The role of ice in the ecology of marine mammals of the Bering Sea. In D. W. Hood and E. J. Kelley (ed.) Oceanography of the Bering Sea. Inst. of Mar. Sci., Univ. of Alaska, Fairbanks. 383-399pp.

Feltz, E. T. and F. H. Fay. 1967. Thermal requirements in vitro of epidermal cells from seals. Cryobiology 3(3):261-264pp.

Massler, M., I. Schour, and C. T. Linden. 1958. Atlas of the mouth in health and disease. American Dental Association, Chicago, Ill. 140pp.

McLaren, I. A. 1958. The biology of the ringed seal (Phoca hispida Schreber) in the eastern Canadian Arctic. Fisheries Res. Bd. Canada, Bull. No. 118:97pp.

Muller-Wille, L. L. 1969. Biometrical comparisons of four populations of Phoca hispida Schreber in the Baltic and White seas and lakes, Ladoga and Saimaa. Commentationes Biologicae, Societas Scientiarum Fennica 31(3):1-12pp.

Scheffer, V. B. 1958. Seals, sea lions and walruses. Stanford Univ. Press, Stanford, California. 179pp.

Stirling, I., R. Archibald, and D. DeMaster. 1975. The distribution and abundance of seals in the eastern Beaufort Sea. Victoria, Canada, Beaufort Sea Technical Report #1: 58pp.

Table 2. Distribution of currently accepted subspecies of the ringed seal.

Subspecies	Distribution
Phoca hispida hispida	Arctic Ocean, northern Eurasia, Greenland, northern North America and southward to Hudson and James Bays and Labrador
Phoca hispida krascheninikovi	Bering Straits southward throughout the Bering Sea and Bristol Bay to the southern Kuril Islands
Phoca hispida ochotensis	Sea of Okhotsk, northern Kuril Islands and south to Hokkaido
Phoca hispida botnica	Baltic Sea, Gulf of Bothnia and Gulf of Finland
Phoca hispida ladogensis	Lake Ladoga
Phoca hispida saimensis	Lake Saimaa and its series of interconnected lakes
Phoca hispida pomororum	White Sea and the coasts of the Kola Peninsula and Novaya Zemlya

Table 3. Seasonal variation in sperm presence in the epididymides of male ringed seals seven years old and older.

Month	Number Examined	Sperm Presence: Abundant (Number)	Sperm Presence: Trace (Number)	Sperm Presence: None (Number)
January	3	-	-	3
February	1	-	-	1
March	9	9	-	-
April	15	15	-	-
May	24	23	-	1
June	36	21	5	10
July	21	1	1	19
August	5	-	2	3
September	1	-	-	1
October	2	-	-	2
November	11	-	-	11
December	12	-	-	12

Table 4. Reproductive status of 40 female ringed seals collected during 1976.

Number	Age (yrs)	Month of Collection	Pregnant Yes or No	Status	Comments
SHP-63-76	Pup	June	No	Nulliparous	No follicular activity
SHP-118-76	Pup	July	No	Nulliparous	No follicular activity
SHP-126-76	Pup	July	No	Nulliparous	No follicular activity
SHP-179-76	Pup	July	No	Nulliparous	No follicular activity
SHP-180-76	Pup	July	No	Nulliparous	No follicular activity
SHP-187-76	Pup	July	No	Nulliparous	No follicular activity
SHP-192-76	Pup	July	No	Nulliparous	No follicular activity
SHP-194-76	Pup	July	No	Nulliparous	No follicular activity
SHP-201-76	Pup	July	No	Nulliparous	No follicular activity
SHP-218-76	Pup	July	No	Nulliparous	No follicular activity
SHP-224-76	Pup	July	No	Nulliparous	No follicular activity
SHP-236-76	Pup	July	No	Nulliparous	No follicular activity
SHP-265-76	Pup	July	No	Nulliparous	No follicular activity
BP-15-76	Pup	July	No	Nulliparous	No follicular activity
WE-28-75	Pup	July	No	Nulliparous	No follicular activity
WS-39-75	Pup	July	No	Nulliparous	No follicular activity
WS-30-75	Pup	August	No	Nulliparous	No follicular activity
SHP-46-76	1	June	No	Nulliparous	No follicular activity
SHP-134-76	1	July	No	Nulliparous	No follicular activity
SHP-157-76	1	July	No	Nulliparous	No follicular activity
PHS-44-76	2	May	No	Nulliparous	No follicular activity
SHP-2-76	2	June	No	Nulliparous	No follicular activity
WS-43-75	2	August	No	Nulliparous	No follicular activity
PHP-41-76	3	May	No	Nulliparous	Ovulated apparently for first time
SHP-54-76	3	June	No	Nulliparous	Ovulated apparently for first time
SHP-58-76	3	June	No	Nulliparous	No follicular activity
PHP-40-76	4	May	No	Nulliparous	No follicular activity
SHP-77-76	4	July	No	Nulliparous	No follicular activity
SHP-83-76	4	July	No	Nulliparous	Ovulated apparently for first time
SHP-103-76	5	July	No	Nulliparous	Ovulated apparently for first time, degenerate corpus luteum
SHP-167-76	5	July	No	Nulliparous	No follicular activity
WS-24-76	5	July	No	Nulliparous	No follicular activity
SHP-190-76	6	July	Unk.	Nulliparous	No corpus albicantia, one corpus luteum
WS-27-76	6	July	Unk.	Primiparous	One corpus albicantia, one corpus luteum
SHP-202-76	8	July	Unk.	Primiparous	One corpus albicantia, one corpus luteum
SHP-144-76	8	July	Unk.	Multiparous	Two corpora albicantia, one corpus luteum

BP-12-76	11	August	Unk.	Multiparous	Two corpora albicantia, one corpus luteum
NP-1-76	14	January	No	Multiparous	Uterine cysts sealed both horns of uterus, ovaries atrophying
WS-61-76	21	August	No	Multiparous	Four corpora albicantia, no other follicular activity, had not ovulated this year.
BP-7-76	22	July	Unk.	Multiparous	Two corpus/albicantia, one corpus luteum

Table 5. Seals examined during 1976 which were killed by polar bears.

Location	Specimen Number	Species	Sex	Age (Years)	Ice Type	Habitat	Date
Cape Lisburne	CLP-1-76	Ringed Seal	Male	10+	Moving Pack	Breathing Hole	3/24/76
Cape Lisburne	CLP-2-76	Ringed Seal	Male	9+	Moving Pack	Breathing Hole	3/24/76
Cape Lisburne	CLP-3-76	Ringed Seal	Male	3	Moving Pack	Breathing Hole	3/25/76
Cape Lisburne	CLP-4-76	Ringed Seal	Male	11+	Moving Pack	Breathing Hole	3/25/76
Cape Lisburne	CLP-5-76	Ringed Seal	Male	11	Moving Pack	Breathing Hole	3/27/76
Cape Lisburne	CLP-6-76	Ringed Seal	Male	8	Shorefast Ice	Breathing Hole	3/31/76
Cape Lisburne	CLP-7-76	Ringed Seal	Male	10+	Moving Pack	Breathing Hole	4/1/76
Cape Lisburne	CLP-8-76	Ringed Seal	Male	8+	Moving Pack	Breathing Hole	4/1/76
Cape Lisburne	CLP-9-76	Ringed Seal	Unknown	Unknown	Moving Pack	Breathing Hole	4/7/76
Cape Lisburne	CLP-10-76	Ringed Seal	Unknown	Unknown	Moving Pack	Breathing Hole	4/10/76
Cape Lisburne	CLP-11-76	Ringed Seal	Male	9	Moving Pack	Breathing Hole	4/10/76
Cape Lisburne	CLP-12-76	Ringed Seal	Unknown	Unknown	Moving Pack	Lair	4/15/76
Cape Lisburne	CLP-13-76	Ringed Seal	Male	10	Shorefast Ice	Lair	4/16/76
Cape Lisburne	CLE-14-76	Bearded Seal	Female	Pup	Moving Pack	Breathing Hole	4/16/76
Cape Lisburne	CLP-15-76	Ringed Seal	Unknown	Unknown	Shorefast Ice	Breathing Hole	4/16/76
Cape Lisburne	CLP-16-76	Ringed Seal	Unknown	Unknown	Moving Pack	Breathing Hole	4/16/76
Cape Lisburne	CLP-17-76	Ringed Seal	Unknown	Unknown	Moving Pack	Breathing Hole	4/17/76
Cape Lisburne	CLP-18-76	Ringed Seal	Unknown	Unknown	Shorefast Ice	Lair	4/17/76
Cape Lisburne	CLP-19-76	Ringed Seal	Male	6	Moving Pack	Breathing Hole	4/17/76
Cape Lisburne	CLP-20-76	Ringed Seal	Male	7	Moving Pack	Breathing Hole	4/17/76
Barrow	BP-8-76	Ringed Seal	Male	8+	Moving Pack	Breathing Hole	3/23/76
Barrow	BP-9-76	Ringed Seal	Male	Unknown	Moving Pack	Breathing Hole	3/25/76
Barrow	BP-10-76	Ringed Seal	Unknown	4	Moving Pack	Breathing Hole	4/22/76
Barrow	BP-14-76	Ringed Seal	Unknown	Unknown	Moving Pack	Breathing Hole	4/22/76
Barter Island	BIP-6-76	Ringed Seal	Unknown	12	Shorefast Ice	Breathing Hole	7/27/76

Table 6. Ringed seal densities (observed seals/mi^2) calculated from 1970, 1975 and 1976 surveys.

Location	1970	1975	1976
Kotzebue Sound	-	-	0.7
Cape Krusenstern - Pt. Hope	-	-	2.3
Pt. Hope - Cape Lisburne	-	-	0.9
Cape Lisburne - Pt. Lay	-	-	4.9
Pt. Lay - Wainwright	5.4	2.9	1.9
Wainwright - Barrow	3.7	6.2	3.8
Barrow - Lonely	2.3	2.8	1.4
Lonely - Oliktok	1.0	1.4	1.1
Oliktok - Flaxman Island	1.4	1.0	1.4
Flaxman Island - Barter Island	2.4	1.8	0.4

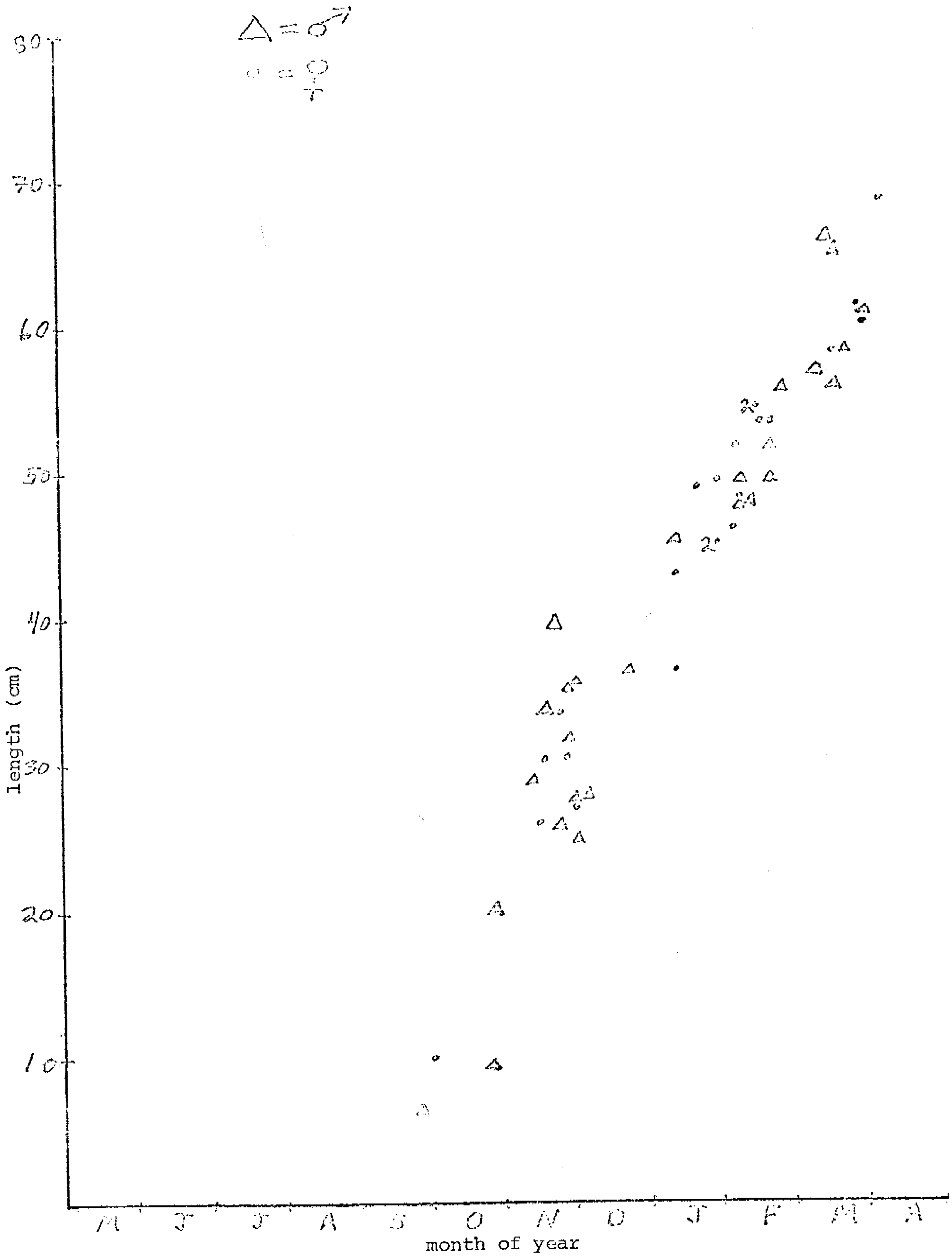

Figure 1. Fetal growth, length in relation to month of collection

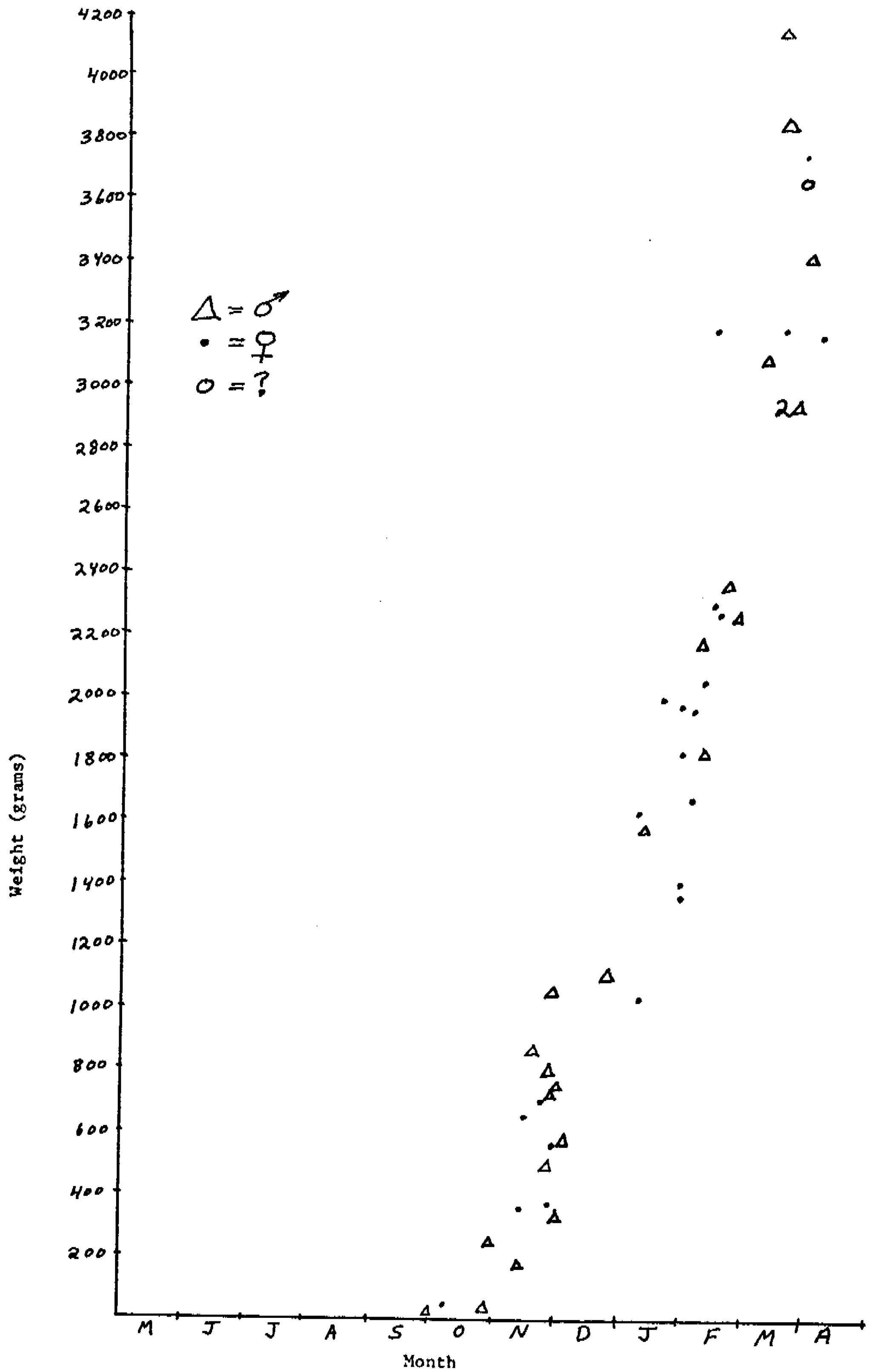

Figure 2. Fetal growth, weight in relation to month of collection.

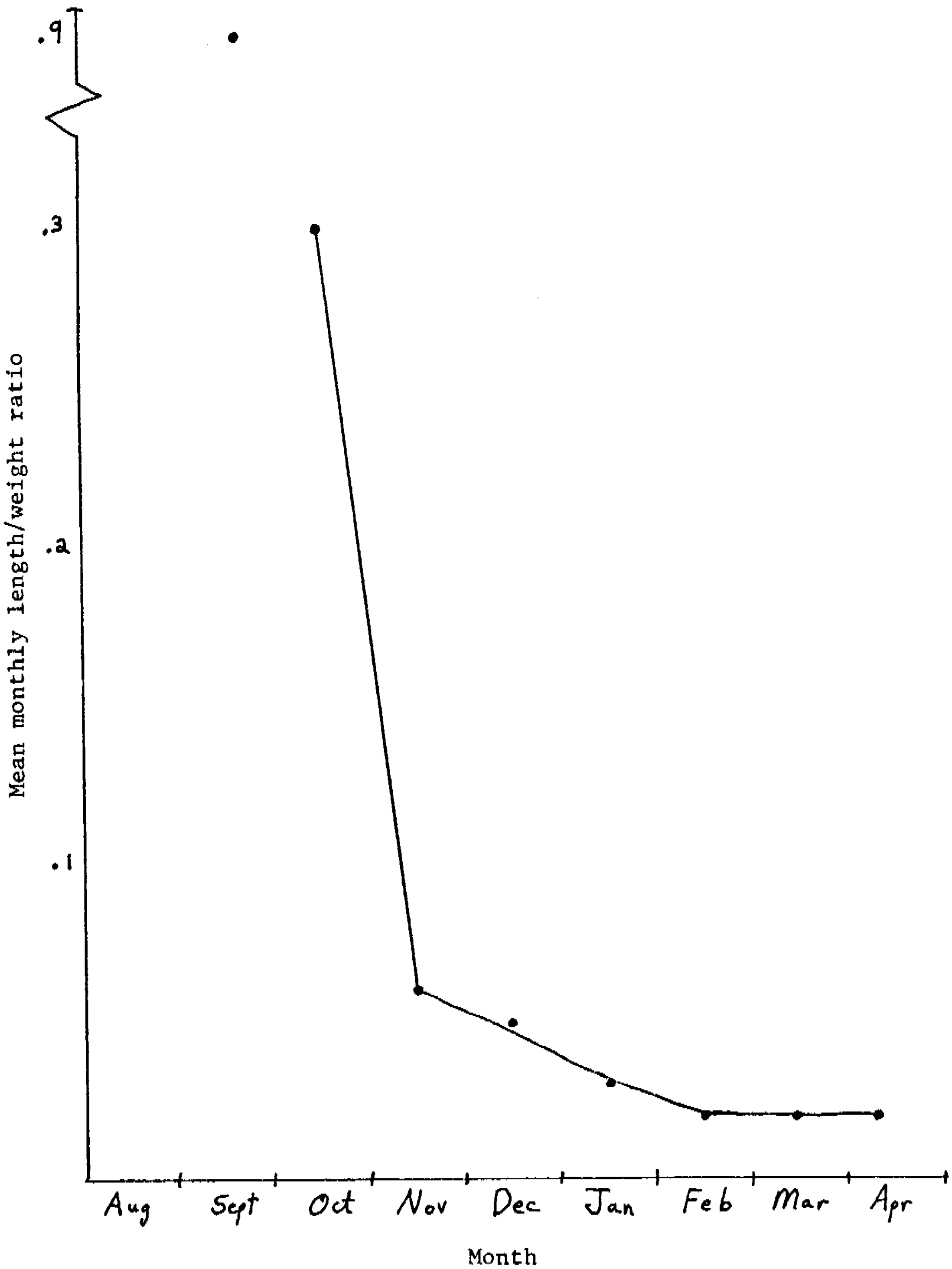

Figure 3. Fetal growth, length in relation to weight.

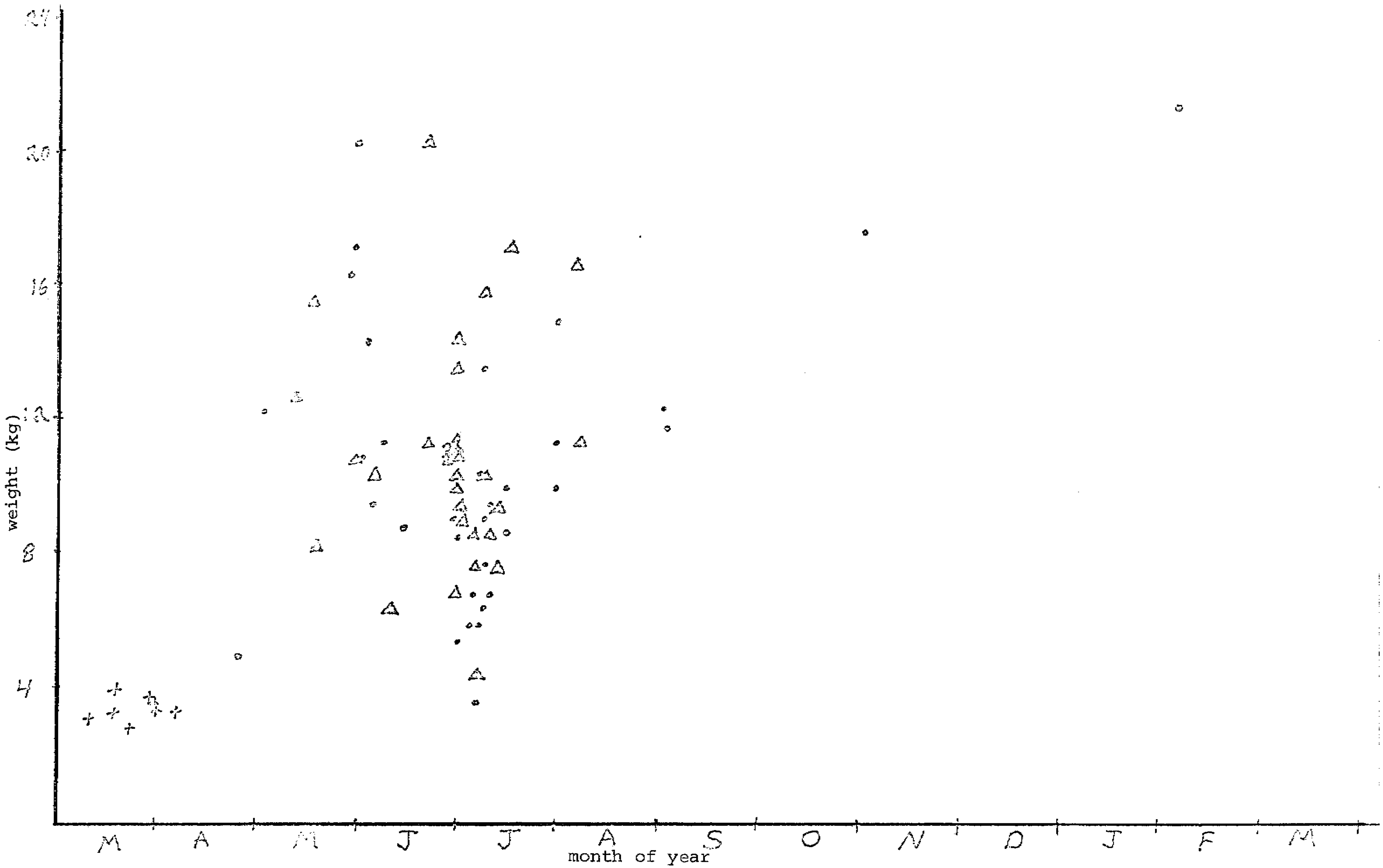

Figure 4. Pup growth, weight in relation to month of year

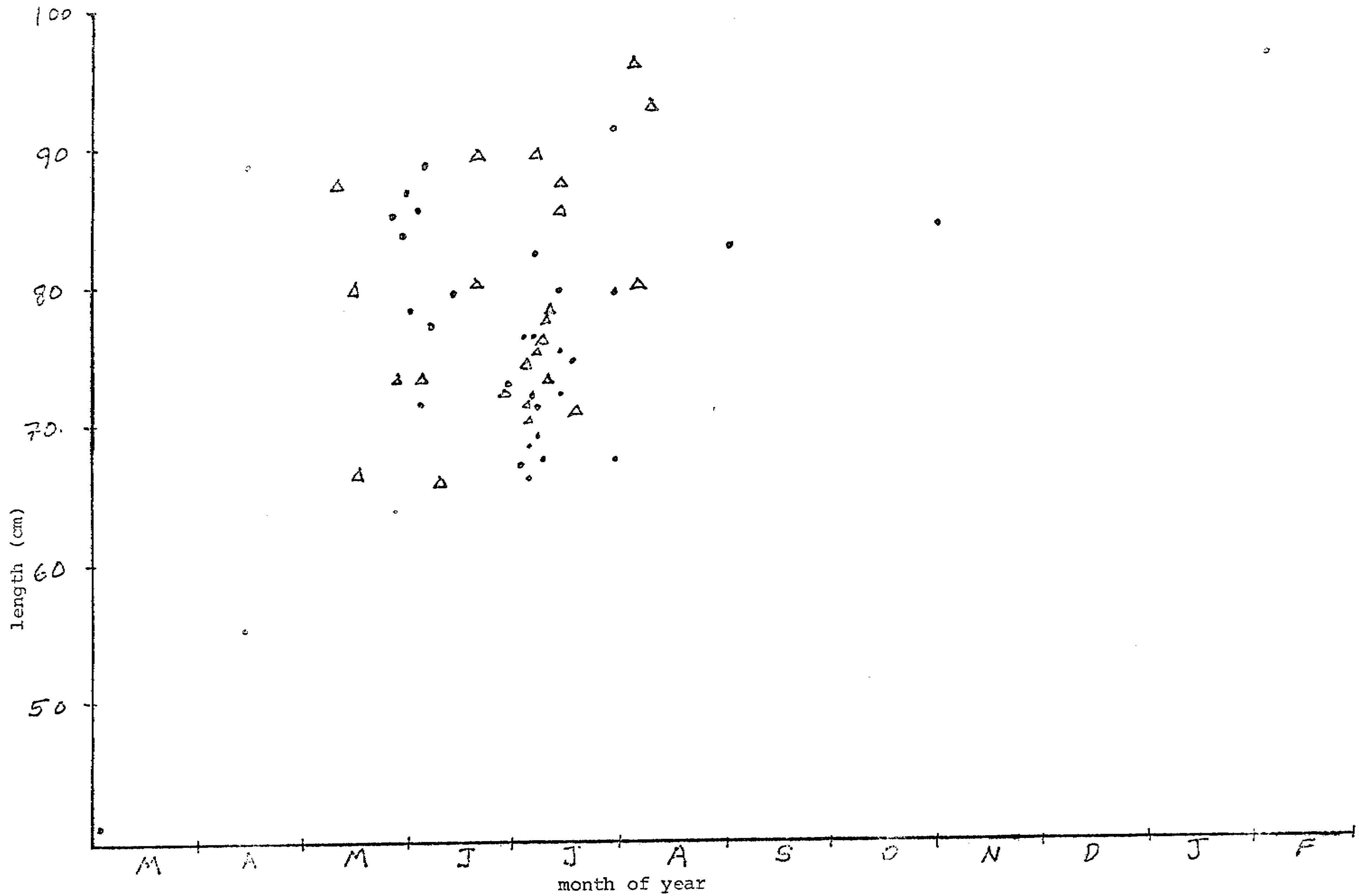

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Figure 5. Pup growth, length in relation to month of collection