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NAVAL ARCTIC RESEARCH LAB BARROW ALASKA
BIOPHYSICS OF COLD ADAPTATION AND ACCLIMATIZATION.(U)
1979 G A LAURSEN, G M SELBY

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Animal Research Facility Annual Report for Fiscal Year 1979

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NAVAL ARCTIC RESEARCH LABORATORY

Barrow, Alaska

Annual technical rept. no. 3 (Final)
for period ending FY77

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BIOPHYSICS OF COLD ADAPTATION AND ACCLIMATIZATION

FY-79 Annual Report
for
Animal Research Facility
Naval Arctic Research Laboratory
Barrow, Alaska

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ACKNOWLEDGEMENTS

For the past three fiscal years, 1977, 1978, and 1979, the Office of Naval Research, Biophysics Program Office Director, Dr. Arthur B. Callahan, Code 444, has financially supported "Biophysics of Cold Adaptation and Acclimatization", Grant Number N00014-C-0162, a three-year continuing proposal made to Dr. Gary A. Laursen, Assistant Director for Science, Naval Arctic Research Laboratory (NARL), for research support at the Animal Research Facility (ARF) in the amount of \$366,376. It is with dedicated thanks that the ARF and NARL staffs pay tribute to Dr. Callahan for his direction, his guidance, his love for the Arctic research programs, and dedication to his friends--all native species--at the Facility, and for his enduring patience to see such a project through to its completion and its untimely demise by forces beyond his control. This report is dedicated to and presented to Dr. Callahan as the Final Report. It is submitted in compliance with agreements made in the NARL contract (Appendix I), Attachment No. 12, as amended. The NARL and ARF staffs have enjoyed a long and dedicated association with Dr. Callahan since those days when, as an investigator at the ARF, he saw room for growth and the attainment of excellence in research directed toward the study of native species in their natural Arctic environments and conceived the ARF as it is finally today. The pictorial review of the NARL/ARF 1976 to 1980 in this report is of the last three years. Being costly, the photoreproductions are limited and not provided for distribution.

INTRODUCTION

Within the United States, the only truly Arctic lands are located in the State of Alaska. The area of the State north of the Brooks Mountain Range constitutes a large expanse of Arctic tundra known as the "North Slope".

The vast, gentle, and northerly dipping coastal plateau features an oligotrophic aquatic habitat covering up to 85% of the land surface of the Arctic low and middle tundra north of the 10C July isotherm. Vegetation patterns and species composition repeatedly suggest aquatic influences. The "peat wick" supplies a constant source of surface water during the growing season from a defrosting and receding melt within the "active layer". Vegetational patterns also reflect influences imposed upon it by geomorphological and physiographical land features that so uniquely characterize Alaskan tundra.

Environmentally, the North Slope of Alaska is a cold desert and lies in the rain shadow of the east-to-west arching Brooks Mountain Range. Precipitation rarely exceeds 150 mm at the northernmost reaches of Pt. Barrow. Large differences in physical and biological character are manifestations of northern latitude geological history, climate, low relief landforms, soils, and numerous abiotic and dynamic cycles. Geomorphic processes are dynamic and promote substantial instability.

Research support for a wide variety of programs is provided by the only and largest laboratory of its kind in the world--the Naval Arctic Research Laboratory (NARL) (Figure 1.).

The NARL is the only coastal logistics support base of its kind in the Arctic that the U.S. Federal Government actively maintains throughout the year. It is, in fact, the only research support laboratory of its kind throughout the arctic regions (above 70°N Latitude) worldwide. Several other northern countries with high latitude arctic tundra within their national boundaries maintain research stations similar in concept to the NARL, but they are smaller and are operated seasonally, for the most part.

The Laboratory, first established in 1947, is owned by the Department of the Navy and operated under a prime contract awarded by the Office of Naval Research (ONR) to the University of Alaska. The NARL's mission is to provide logistic support, facilities, services, and equipment to the scientific community for the accomplishment of many varieties of basic and applied research related to the Arctic problems that ultimately contribute to the successful completion of the Navy's mission.

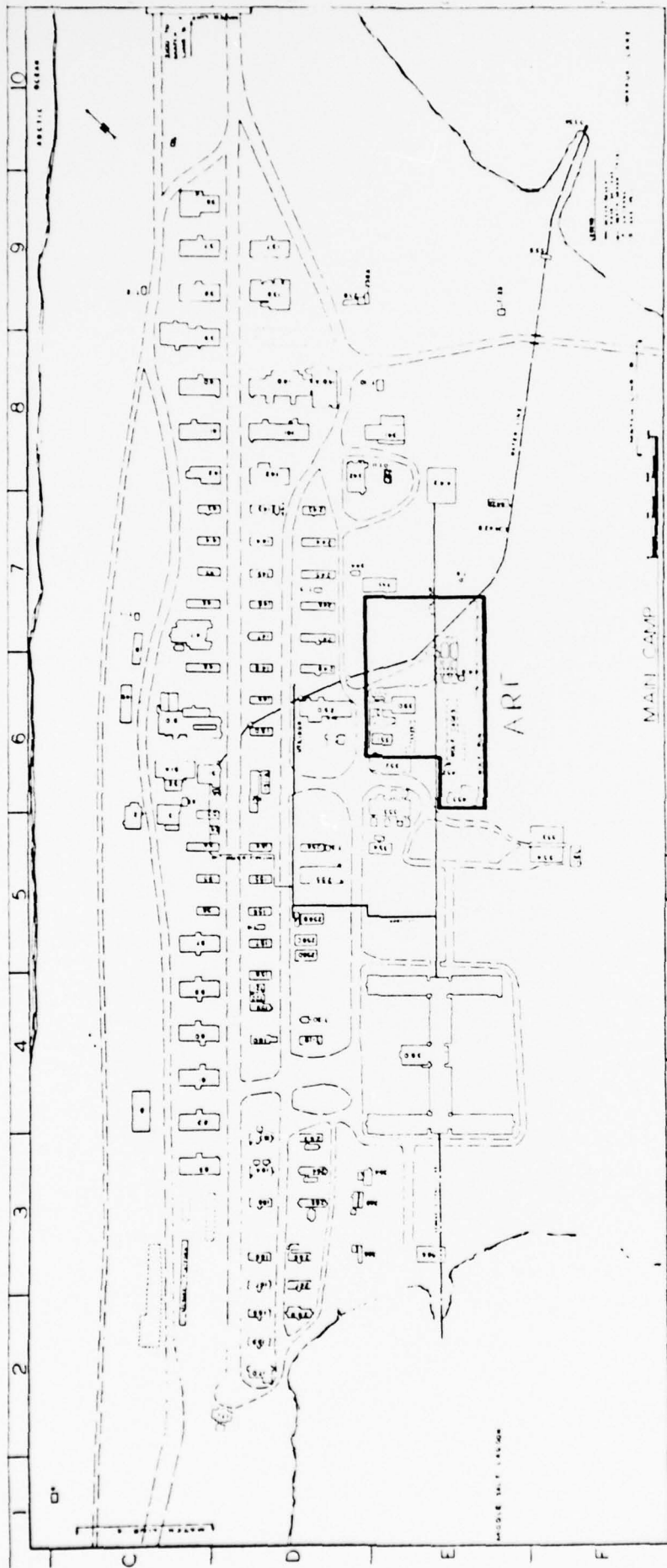


FIGURE 1.
 Naval Arctic Research Laboratory
 Main Camp Map

The ONR has traditionally operated the NARL as a national facility rather than one serving Navy interests alone. Activities have included the support of a wide variety of scientific investigations, and one of those has been the Animal Research Facility (ARF).

The Animal Research Facility at the NARL provides an opportunity to study native species of northern Alaskan animals in a modern and well-equipped laboratory. It has helped to establish and maintain a life science in-house research capability. An important part of the research is concerned with behavioral and physiological mechanisms of adaptation and acclimatization demonstrated by mammals in the Arctic environment. Specific areas of interest have included metabolic and cardiovascular responses to cold, hematology, body water, and electrolyte regulations, radio telemetry, and thermoregulatory mechanisms. An understanding of mammalian physiological mechanisms of cold acclimatization is important in helping mankind cope with living in cold environments.

Most animal species represented at the ARF were originally captured on the Alaskan North Slope. Although the animals are maintained as laboratory specimens, significant effort has been made to provide them with adequate exterior living enclosures. They have adjusted well to the laboratory environment with reproductive success noted for several species. As many as 60 wolves have been born and raised successfully at the facility; however, only 18 are presently maintained for research purposes. Complete clinical records provide the researcher with baseline information on vital statistics, monthly weights, quarterly blood chemistries, hemotological data, and a detailed history of the animal's previous role in research and surgery. Complete medical health statistics are also recorded in these records.

PROJECTS AND PRODUCTIVITY

During FY-79, the Animal Research Facility research program supported 15 research projects (Table 1.). A total of 13,609 man-hours (1701 man-days) were spent in support of these projects by the ARF research support staff. Eight different scientists were associated with or performed studies at the ARF under funding provided by ONR, Code 444, on Grant No. N00014-77-C-0162. Projects included in-house research, visiting scientist investigations and field study support with followup investigation activities.

From results of project investigations, 24 publications in the form of journal articles (J), presentations (P), technical reports (T), symposium volume contributions (S), book chapters (B), and abstracts (A), 16 titles were produced during FY-79 (Table 2). Of these titles nine were journal articles, seven were national presentations even though international presentations were given in Denmark, Sweden, and Finland on ARF activities not listed in Table 2, six were symposium contributions, abstracts and technical reports, and one was a book chapter. The ARF enjoyed a productive year.

ANIMAL RESEARCH FACILITY FY-79

CONTINUING PROJECTS BY TITLE

TABLE 1.

POSTDOCTORAL PROGRAM

Follmann

1. Cold adaptation in arctic foxes.
2. Comparative metabolism of arctic red foxes.
3. The effects of activity and ambient air temperature on the internal body temperature in wolverines.
4. The effects of activity and ambient air temperature on the internal body temperature in wolves.
5. Arctic fox carcass analysis for disease, reproduction, diet, and age structure.

Follmann, Philo, Reynolds

1. Cold adaptation of arctic grizzly bears.

Chappell

1. Energy Budgets of small arctic homeotherms.

VISITING SCIENTIST PROGRAM

Albert

1. Studies on the influence of: 1) normal hibernation and 2) plasma from hibernating animals on the extent of regional heterothermy and metabolic rate in the arctic marmot, Marmota broweri, during acute cold exposure.
2. Establishment of a breeding colony of arctic marmots, Marmota broweri, at the Naval Arctic Research Laboratory, (NARL).
3. Influence of season and chronic cold exposure (hibernation) on the blood chemistry of the arctic ground squirrel, Spermophilus parryi.
4. Health maintenance of arctic marmots, groundhogs, and arctic ground squirrels kept as laboratory animals.

Laursen

1. Decomposition in Arctic environments.
2. CETA Arctic Mammalogy: Biology, Mechanisms of Adaptation, Care and Maintenance Training.

RESEARCH VETERINARIAN PROGRAM

Philo

1. The effects of fasting length and exercise on water dynamics and compartmentalization in arctic wolves.

Philo and Bovee

1. Amino acid losses in wolves through urination.

Table 2. NARL/ARF FY-79 Publications

- J Albert, T.F., G. Migaki, H.W. Casey and L.M. Philo. Healed penetrating injury of the bowhead whale, Balaena mysticetus. Marine Fisheries Review, In Press.
- J Migaki, G., T.F. Albert and L.M. Philo. Histopathological findings associated with barnacles on the skin of the gray whale, Eschrichtius robustus. Submitted to Journal of Wildlife Diseases.
- J Migaki, G., T.F. Albert. Sarcocystis sp. in the ringed seal, Phoca hispida. Submitted to Journal of the American Veterinary Medical Association.
- JP Chappell, M.A. In Press. Thermal energetics of chicks of arctic-breeding shorebirds. Submitted to Comp. Biochem. and Phys.
- J Chappell, M.A. In Press. Energy costs to endotherms eating cold food. Submitted to the American Naturalist.
- JP Chappell, M.A. In Press. Insulation, convection, and radiation in small arctic mammals. Submitted to the Journal of Mammalogy.
- J Chappell, M.A. In Press. Thermal energetics and thermoregulatory costs of small arctic mammals. Submitted to the Journal of Mammalogy.
- JP Chappell, M.A. In Press. Thermal energetics and energy exchange in small arctic breeding birds. Submitted to the AUK. Presented at AAAS, Fairbanks, Aug. 1978.
- T Coffey, D.L. and Selby, G.E. 1978. Manual for animal caretakers, NARL Animal Facility. Technical report submitted to Assistant Director for Science, NARL.
- SP Laursen, G.A. and J.J. Kelley. In Press. Arctic and sub-arctic research support facilities above the Arctic Circle. IN Comparative Mechanisms of Cold Adaptation, Academic Press.
- T Laursen, G.A. and G.E. Selby. 1979. NARL Animal Research Facility Annual Report for 1978. Technical Report #2 submitted to Office of Naval research, Code 444, Biophysics Program Office.
- B Miller, O.K. and G.A. Laursen. 1978. Ecto and endomycorrhizae of arctic plants at Barrow, Alaska. IN Ecological Studies 29 Vegetation and Production Ecology of an Alaskan Tundra, CH. 9 pp. 229-236, Springer-Verlag, N.Y.

- SP Philo, L.M., D.F. Patterson, and J.W. Buchanan. In Press.
Mitral valve insufficiency in an arctic fox, Alopex lagopus.
Submitted IN Proceedings of the Symposium on the Compar-
ative Pathology of Zoo Animals, Washington, D.C.
- JAP Philo, L.M., E.H. Follmann, and H.V. Reynolds. In Press.
Comparison of two field surgical techniques for implan-
tation of temperature-sensitive radio transmitters in
grizzly bears. (Ursus arctos). Submitted to Journal
of Wildlife Management.
- SA Selby, G.E. 1979a. Methods of handling and restraint in arc-
tic research animals. IN Proceedings of 1979 District 8,
AALAS Conference, Salt Lake City.
- P Selby, G.E. 1979b. The NARL Animal Research Facility.
Presented at UC Medical Center, San Francisco and at
San Francisco State University.

J = Journal

P = Presentation

T = Technical Report

S = Symposium Volume Contribution

B = Book Chapter

A = Abstract

RESEARCH ACCOMPLISHMENTS

The ARF research program has developed to the point of maintaining not only the research veterinarian but a visiting scientist program, a research technician, and a postdoctoral program with two participant positions. The facility is open year-round. Support and funding are provided by Dr. Arthur B. Callahan, Director of the ONR Biophysics Program Office and the NARL Base contract N00014-77-C-0003 with the University of Alaska as Prime Contractor.

Because of its location, the ARF offers unique opportunities for studies on arctic-acclimatized and -adapted animals. The ARF is the only facility of its kind in North America and the largest in the world where northern species of mammals are maintained in an arctic environment with its unique temperature and life regimes. These conditions cannot be duplicated in artificial light-dark rooms or temperature chambers.

Post Doctoral Program: Two postdoctoral research fellowships were concluded during the year; those of Dr. Erich Follmann who has since taken a Research Associate position at the University of Alaska (Fairbanks) in its Institute of Arctic Biology; and Dr. Mark Chappell who went on to another postdoctoral position with Dr. Bartholemew's laboratory at UCLA. Both projects were completed in January. The research each completed at the ARF during full-time residency and during field studies is as follows.

Dr. Erich Follmann's completed objectives were to first review whether research objectives were actually met during his two-year tenure at the Animal Research Facility (ARF). Each project is considered separately.

The arctic fox project to monitor activity and body temperature for one year was successful for the most part, and all objectives were met except one. The treadmill experiment was not conducted. Difficulties with getting the treadmill operating satisfactorily prevented this aspect of the project from being completed.

The wolverine study to monitor activity and body temperature for one year was partially successful. Delays in obtaining telemetry equipment and his termination at the NARL allowed monitoring for only eight months.

The wolf study to monitor activity and body temperature during the period when the animals were not being used by Mike Philo was successful, and all aspects were completed.

The grizzly bear project was successful. All phases in which Dr. Follmann was involved are either nearing completion or will continue well into 1979. The metabolism work comparing energy contents of food and feces is nearly complete with only two more vegetative samples requiring analysis--these were completed in

January 1979. Samples of ground squirrel tissues will require a longer time to process and analyze since a functional freeze-drying machine was not available at the NARL to accomplish this work. The telemetry work to monitor body temperatures is ongoing and probably will continue until the implant transmitters stop operating which is expected to be in early summer 1979.

The study of comparative metabolism of arctic and red foxes was almost completed at his termination. Three samples of feces need to be combusted to determine caloric content; these were completed in January 1979. Samples of the experimental food fed to foxes during four seasons will require a longer period to process and combust. A functional freeze-drying machine was not available at the NARL to accomplish this work. The environmental chamber experiments for this project were not conducted due to equipment problems.

Arctic fox carcasses were collected during the 1977-78 trapping season and are being collected during the current trapping season. A project to study age structure, reproductive biology, and diseases was proposed but funds have not been obtained to date.

A study to instrument whales with radio tags was proposed and approved for funding. Equipment has been ordered; however, field work in the Barrow area will not begin until summer 1979, or later. A pilot study to radio-tag gray whales in Baja, Mexico, was funded and took place in winter 1979.

Concerning all of his activities during two years at the NARL, it is felt that it was a very productive period.

Certain of the objectives of individual projects were not met, but generally these were related to inoperative or unavailable equipment. In a few cases he was not able to accomplish all of the objectives set for himself due to his being overextended. It should be noted that Dr. Follmann willingly assumed certain administrative responsibilities by agreeing to act as interim ARF Supervisor for two periods during the winter of 1977-78. This detracted from research activity, but he was aware of its probable effect.

Dr. Follmann could have met all objectives except for those experiments where equipment failures or lack of funds prohibited completion. Doing his own work and not seeking assistance insured the quality of the work performed. Requested assistance of the NARL technicians for some of the more routine aspects of his projects might have freed him to conduct other work and perhaps would have allowed all of the objectives to be met.

Nonetheless, there were still a few problems with work-related assistance. In general, the NARL and ARF provided an atmosphere conducive to conducting research on a full-time basis. The staff was helpful and went out of its way to assist when requested to do so.

The availability of most needed equipment was good, and there usually was little reluctance shown by administrative staff to purchase new equipment when required to conduct research projects (assuming funds were available).

The purchasing staff of the University in Fairbanks was responsible for the many time-related problems in obtaining materials and supplies at the NARL. This problem is recognized by cogent administrative staff who are attempting to alleviate the dilemma.

One problem encountered at the NARL was inoperative equipment which prevented Dr. Follmann from completing some of his projects. It is believed that the major problem is lack of planning and budgeting for maintenance of equipment. Fiscal budgets are apparently developed only to purchase new and additional equipment. Funds are not identified for repair or maintenance. When problems are identified (usually by an investigator), great efforts are made by the science staff to correct them. However, the Science Department should not wait until a crisis develops before seeing to it that equipment is working. The equipment should be ready to go when an investigator arrives. A case in point was the readiness state of the freeze dryer. The high costs of conducting research at the NARL and the remoteness of the NARL, relative to repair facilities, are factors having profound influence on research success.

Drs. Mike Philo and Erich Follmann met with Harry Reynolds at the Driftwood Camp to prepare for capture of two grizzly bears. The experiments to be conducted were to monitor the heart rates of bears using radio transmitters. The surgical procedure involved was to place the heart-rate transmitters in a subcutaneous location posterior to the scapula.

On 28 June, an adult male bear (#1082) was captured with a helicopter and brought to the base camp. The surgery took place in a tent so as to minimize the effects of wind and cold ambient temperatures. Following the standard surgical preparation of the skin around the incision area, the first heart-rate transmitter was tested again with the result being a very erratic signal transmission. Checking the connections between the electrodes and the transmitter module and the placement of the electrodes had little bearing on the problem. Therefore, the transmitter was removed and replaced with another that work perfectly.

The bear was flown out of camp and placed on a protected ridge about three km from camp. It was monitored periodically through its recovery from anesthesia. The heart-rate transmitter was transmitting a sporadic signal on 1 July and was not heard at all on 2 July. Subsequent attempts to monitor the transmitter failed except on 12 July when a sporadic signal was received. The reason for the transmitter failure is unknown.

One of the heart-rate transmitters was modified and a second attempt to instrument a bear took place on 16 September. Dr. Jeff Everitt, visiting scientist, performed the surgery on an adult female bear (#1086). The surgery was much simpler and proceeded much quicker because of the modified module design. The transmitter worked perfectly through the time when the bear was released about two km from camp. A good heart-rate signal was obtained from the bear on 23 September. The current plan is to monitor bear #1086 through the winter and perhaps also bear #1082, if the transmitter is working while the bear is in its den.

Dr. Mark Chappell, working on "Energy Budgets of Small Arctic Mammals", also concluded his research at the ARF in December. The purpose of his project was severalfold. Primarily, he was to look at cold adaptation from the standpoint of total energy budgets rather than by examining only an individual's physiological, morphological, or behavioral characteristics. The energy budget approach, while somewhat tedious and difficult, allows accurate assessment of the importance of each adaptation within the context of all pathways of energy flow between animal and environment. Also, this approach allows predictions of climatic limits and the energy requirements for survival in any combination of ambient temperature, wind speed, and radiation load. These predictions have obvious implications for studies of natural history, competition and predation, and ecosystem energy flow dynamics.

A secondary purpose was to obtain accurate values of surface areas, insulation, and convective heat-loss coefficients from actual animal shapes. These parameters are necessary for use in energy budget equations. Recently there have been several careful studies concluded on the heat transfer from simple geometrical shapes (cylinders, spheres, etc.) covered with artificial fur. These objects behaved in accordance with heat-transfer theory and indicated that, for most purposes, animals could be assumed to exchange energy in a similar fashion. Comparative data from real animal shapes would be useful for confirming this assumption.

Fur-covered metal casts of the animals, equipped with internal heaters, were constructed and used to obtain the necessary data. Measurements of surface area, radiation, surface, area, insulation, and convection coefficients were collected from a total of 21 casts of seven species of North Slope mammals; ermine, least weasel, brown and varying lemmings, masked shrew, tundra vole, and Alaska vole. Several species were examined in various ages and pelages. From these studies and from physiological data obtained from the literature, climate space diagrams were constructed for five most important and interesting species of weasels (2), lemmings (2), and the shrew. These diagrams can be used to determine maximum tolerable temperatures at any metabolic rate, wind speed, and radiation condition. They also provide information on the effects of wind, pelage thickness and color differences, the condition of the sky (clear, cloudy, sunny), and other significant factors.

The climate-space based prediction of energy requirements for homeothermy were tested by placing the casts in various microclimates and comparing predicted with necessary power inputs (the metabolisms). Microclimates used were snow caves, snow surface during night and day, and the summer tundra surface. Ambient temperatures ranged from -25 to $+16^{\circ}\text{C}$ during these tests. Wind velocity ranged from 10 to 300 cm sec^{-1} , and radiation conditions ranged from direct sunshine to blackbody and to clear-night sky exposures. In some 75 test runs, the average difference between predicted and actual power requirements was six percent, and the maximum error was 18 percent. This indicates that the equations and parameters used were quite accurate.

Daily energy costs in various microhabitats and long-term (monthly, yearly) predictions of necessary metabolic intake for North Slope small mammals were made by integrating the energy budget climate-space information with behavioral and climatological data. Accurate predictions are not possible because there is not enough information available on critical behavior and habitat selection tendencies. However, reasonable estimates of upper and lower limits are feasible. These calculations were performed with the aid of a small computer system. Results emphasize the importance of behavioral traits for thermoregulatory efficiency. For example, by emerging from burrow or snow tunnels, an animal can save up to 100 percent in energy costs on such excursions. The value of the nest is also demonstrated. Almost all of these mammals can maintain thermoneutral metabolic rates inside typical nests, even during the coldest months of an average year. Any excursion outside the nest is very expensive energetically. Animals are, therefore, under intense selective pressure to maximize foraging efficiency.

A secondary project along similar lines was undertaken with several species of tundra-nesting birds. Of special interest were neonate sandpipers, which are active and forage almost from the moment of hatching. Since they are small and have relatively poor insulation, they are under constant thermal stress. They exhibit pronounced thermolability and can remain fully functional at body temperatures as low as 30°C . Climate-space calculations revealed the changing relationships between body size, heat loss rates, and activity vs brooding times as the chicks aged. Also, the additional surface area and convection data from the birds was very useful for comparison with other studies and with the differently shaped mammals.

The purpose of Dr. Chappell's Driftwood field camp project during August 1979 was to investigate body temperature regulation in free-living arctic ground squirrels, Citellus undulatus. Specifically, he wished to determine the effects of wind and sun on body temperatures. Effective temperatures (integrations of wind, sun, and air temp) were obtained via thin metal fur-covered models of

squirrels placed in natural habitats. Body temperatures were obtained from implanted radio telemetry packages, which also yielded data on activity patterns. Results in brief were as follows:

- 1) Body temperature (T_b) averages 38C at night and 39C during the day (range 37.4C to 41.2C).
- 2) There was no observed correlation between T_b and activity, other than the daily cycle. Similarly, there was no apparent relationship between light intensity and T_b .
- 3) Effective temperatures were within the thermal neutral zone of the animals, except during sunny periods when effective temperature was as high as 34C with air temperatures of 20C.
- 4) The lack of correlation between T_b and activity on solar heatload can be explained by the abundant available cover and the nonrigorous nature of most squirrel activities. When hot, the animals simply move to shaded areas.

The postdoctoral program at the NARL/ARF was a very worthwhile affair because of the environmental setting and also the structure of the program itself. It is highly unfortunate that budgetary constraints have seemingly terminated it. A NARL postdoc was unique in that there was very little guidance and direction available. In this respect, it more closely fits the definition "Research Associate" or "Visiting Scientist". This isolation required an independent, self-contained individual, able to carry out all aspects of planning and implementing his/her research programs without much outside assistance.

The facilities themselves were quite adequate for Dr. Chappell's purposes, bearing in mind his projects required only minimal amounts of elaborate equipment and essentially no technical help. If such research were to be continued, a complete set of micrometeorological instruments would be highly desirable. If there is, by some chance, a continuation of the postdoctoral program in the future, it is suggested that more equipment funding be made available and that the technical staff be increased.

Research Veterinarian Program: This program was extended into its fourth year by resident veterinarian Dr. L. Michael Philo. The experimentation portion of his study, "Effects of Nutrition and Exercise on Water Metabolism in Arctic Wolves", was completed during the fall, winter, and spring. The FY-79 portion of the project consisted of the effects of alternative gorging and fasting, the effect of water and food withholding, and the effect of exercise on water metabolism of captive wolves.

The gorging and fasting experiment consisted of three parts: A nonfasting period in which five adult male wolves were fed every day for one week; a series of four-day gorging/fasting cycles in

which a four-day ration was fed in two days, and the wolves fasted the next two days; two eight-day gorging/fasting cycles in which an eight-day ration was fed in four days, and the wolves fasted the next four days. The water- and food-withholding experiment consisted of a total lack of food and snow for seven days without an initial gorging period, followed by a three-day recovery period of normal daily access to food and snow. There were two exercise experiments; a seven-day period of cage-restricted exercise and a seven-day period of exercise by running for 1½ hours per day on a treadmill at 13 km/hour at a ten percent gradient.

Measurements performed or that are to be performed on collected samples include: body water turnover; total body water; plasma, blood, extracellular fluid, and intracellular fluid volumes; body weight; body fat; body temperature; water intake in food, snow, and metabolic water production; water output in urine, feces, and respiratory-evaporative loss; relative concentration of blood, plasma, and urine; nitrogen intake in food and output in feces and urine; electrolytes in plasma, urine, food, feces; energy content of food and feces; and the digestible energy (expressed as percent of gross energy intake).

A collaborative study on arctic wolves was conducted by Dr. Michael Philo and Dr. Kenneth C. Bovee of the University of Pennsylvania School of Veterinary Medicine. Last winter, a screening test of urine specimens from all animal facility wolves revealed the presence of excessive amino acid excretion in at least six animals. These wolves may have an inherited disease recognized in humans, dogs, and Brazilian-maned wolves.

The purpose of the study was to characterize the urinary loss of amino acids by performing standard clearance studies on both normal and affected wolves. Four affected wolves and four apparently normal wolves were studied.

Diuretic and clearance solutes were infused intravenously. Blood was collected from an intravenous catheter. The urine and serum samples were frozen and taken to Pennsylvania for analysis. The results will be used to attempt a determination of the significance of the amino acid loss and total renal function.

Visiting-Scientist Program: The research of Dr. Tom Albert during FY-79 at the NARL, up until his departure June 30, consisted of work in several areas.

These research areas are briefly described below as the ARF contract provided only logistical support for his research projects.

Regional Heterothermy During Acute Cold Exposure

Animals were surgically implanted with thermocouples in five separate areas of the body in order to assess regional blood flow changes during acute cold exposure. Twenty-two arctic marmots were utilized. The basic method of study was to infuse plasma from either hibernating groundhogs into the marmots or to infuse plasma from summer-active ground hogs. The recipient marmots were then exposed to acute cold (-10C for eight hours) and regional heterothermy examined by means of the implanted thermocouples. Plasma from hibernating ground hogs contains a "hibernation trigger" substance which may affect the animal's thermoregulatory mechanisms. Most of the marmots showed extensive cooling of certain tissues during cold exposure. Cooling was most pronounced in the flank skin and rear leg muscle. The two groups of recipient marmots seemed to respond to cold exposure in a similar manner. A detailed statistical evaluation of the data is underway. The tentative results of this study are twofold: Marmots demonstrate extensive regional heterothermy during acute cold exposure. Plasma from hibernating ground hogs infused into the marmot does not seem to enhance the response to cold exposure.

Establishment of Arctic Marmot Colony at the NARL

During the past three years, arctic marmots have been captured in the Brooks Range for use at the NARL. The animals are very difficult to capture in reasonable numbers. In order to facilitate their use as experimental animals, a self-sustaining colony seemed desirable. They are a "midsized" arctic mammal, approximately ten pounds, that is larger than the numerous lemmings and ground squirrels, yet smaller than wolverines and wolves and approximately the weight of an arctic fox. By June of 1979, 42 were at the Laboratory. They are easily maintained in captivity, and limited attempts at having them reproduce have resulted in litters being born in two of the three years. Utilizing implanted temperature-sensitive radio transmitters, their hibernation pattern has been studied. Such animals housed in outdoor artificial dens seem to be colonial hibernators; that is, several hibernating together. They seem to synchronize their bouts of torpor so that each member of the group enters and arouses from torpor with the others. The results of this effort show that the arctic marmot is an easy-to-handle animal, adapts well to captivity, is a colonial hibernator, and modest reproductive success can be expected from appropriately caged animals.

Monitoring of Health Status of Captive Rodents

Careful attention was given to the treatment of injured marmots, ground hogs, and ground squirrels. Several variations in housing of the animals resulted in more individual freedom for the animals but resulted in more intraspecific fighting. The group housing of

ground hogs and marmots was reasonably successful; however, injured animals required prompt attention. All animals that died were examined at post-mortem. The most common cause of death seemed to be due to septicemia usually resulting from sound injury. Other causes of death included pneumonia, hemorrhage due to cardiac puncture for blood sampling, and neoplasms.

Other Studies

Post-mortem examinations were conducted on 39 ringed seals which had been harvested by the Alaska Department of Fish & Game personnel. Most animals were normal and, in conjunction with Dr. George Migaki at the Armed Forces Institute of Pathology, a historical study set was prepared from normal tissues. Such histological slides are available to those interested in the normal microscopic structure of this animal. Several seals evidenced abnormal conditions. These included an animal with a hypertrophic kidney, an animal with renal hypoplasia, and a seal with an apparent infarct in the myocardium.

During the spring whaling season in Barrow (May), efforts were made to examine captured bowhead whales and collect tissue samples for a variety of examinations. Three whales were examined as part of the NARL study of the bowhead whale entitled, "Project Whales", which is funded by the Bureau of Land Management.

The research of Dr. Gary Laursen entitled, "Decomposition (of Natural Litter) in Arctic Tundra Environments" is concerned with evaluating unit weight and principal component loss in litter of several arctic grass, sedge, and perennial species. In the laboratory, analytical data are obtained which can be used to predict, via extrapolation in some cases, natural biological degradation quantity and quality as the process of decomposition is affected by arctic and cold-persistent environmental conditions, the presence of lignolytic and cellulolytic fungi, time, and oil-induced perturbations on the decomposer (fungal) populations. Litter bags, containing approximately ten grams fresh weight of three principal graminoid species were used. They consisted of standing live (first-year) and standing dead (second-year) plant leaf and culm parts. Litter bags with new and old litter were placed on the 12 plots early during the first field season (1975). Samples have been collected at one-, two-, and three-month and one-, two-, and three-year intervals for analysis. All litter bags placed aboveground have been analyzed completely.

The second phase of the study was begun during the summer of 1978 when 150 new litter bags containing Arctophila fulva, Carex aquatilis, Salix pulchra, and Dupontia fisherii were prepared and put into the field at 4 cm depths on 15 plots. Preparations were made to determine, by quantitative chemical methods, the contents of the neutral soluble components, acid soluble components, cellulose, hemi-cellulose, lignin, and silica. The first set of bags was

retrieved in August 1979 for enzymatic, fungal biomass and lignin-cellulose determinations. Analyses will take several weeks during FY-80.

Field collecting trips were made in and about the Barrow area and to Driftwood Camp. Dr. Joe Ammirati, Professor of Botany, at the University of Washington, joined the field party. August and September of 1979 provided the best collecting season for fungal fruiting bodies (Basidiomycetes) ever experienced during an eight-year collecting program.

During a 27-day period prior to the collecting season, 31 May to 26 June, Dr. Laursen traveled to five universities and field research stations in Denmark, Norway, Sweden, and Finland where he met and talked with administrators of botanical gardens and museums, directors of the Abisko and Kevo subarctic research stations, research staff, and graduate students. His primary interest was Arctic research in terrestrial and botanical sciences. Future direction and the coordination of international cooperation between field stations was an integral part of the discussions.

Interest was mutually shared as to the desirability of generating two conferences in the future. The first conference should be conducted with directors and research coordinators of Scandinavian research facilities with emphasis on Arctic studies. Interest was shown in holding the meeting at the NARL to discuss plans for international cooperative research programs among all the laboratories. Subsequent meetings have been suggested. These discussions will provide ways to promote essential comparative biological studies between Arctic circumpolar sites. The exchange of ideas, techniques, and methods will also provide valuable information for the Arctic scientific community and will stimulate international cooperation. It is the intention that this proposed meeting will also provide an initial five- to ten-year Arctic research plan for investigating similar extreme environments of the Northern Hemisphere.

A second meeting was suggested which would bring together mycologists into the First International Symposium on Arctic Mycology. This conference would result in a symposium and volume publication which would become a valuable contribution to furthering the understanding of Arctic mycology, species evolution, radiation of fungi into tundra environments, processes of decomposition, and the very important ecological roles played by the fungi in tundra habitats.

CETA ARCTIC MAMMALOGY PROGRAM

A proposal entitled, "Arctic Mammalogy: Biology, Mechanisms of Adaptation, Care and Maintenance Training" was conceived, prepared, and submitted to the Department of Labor Alaska Federation

of Natives, Inc., CETA Programs for a "pilot" study-training course for native youths at the ARF. The proposal was accepted and funded at \$13K for the one-week course. Native young people participated in field-related and classroom experiences (Figures 2 and 3).

Introduction: The high arctic has few endemic species of mammals but those that persist as terrestrial and marine. Year-round residents are important to the once subsistence-dominated lifestyle of native Alaskan Eskimos. Research at the Naval Arctic Research Laboratory's Animal Research Facility has emphasized studies on most arctic species of mammals, both terrestrial and marine.

Direction of research performed at the ARF has been in examining mammalian behavior, natural history, adaptive mechanisms, and physiology of 13 principal terrestrial species. Another in-house research project at the NARL, Project Whales, is emphasizing studies of marine mammals, particularly endangered species of whales.

With the ARF and other in-house research projects emphasizing arctic mammalian biology and with the current staff and resident investigator specialists, it becomes opportune to develop a training awareness program for native youth whose lives in the past were so dedicated to utilizing these animals as food sources. Research programs called for trained technical help. The colony of research animals also needs daily assistance in their care, feeding, and maintenance. It is consistent with the philosophy of comprehensive education and training to develop a program that will provide young people with valuable laboratory and field experience in handling, observing, data collecting, data analysis, record maintenance, and applying scientific methods in further understanding native mammal species.

Course Description: A six-day mammalogy course at the NARL/ARF conducted by the NARL with assistance from Hubbs Sea World Research Institute, San Diego, California, was given to provide valuable training techniques, awareness, and investigation by inquiry (hands-on) to eligible CETA students. The course emphasized Arctic mammalogy and capitalized on readily available resources and resource personnel. Biology and natural history, in addition to current research use, care, maintenance, physiology, and behavior of seven terrestrial and five marine mammals was examined. Laboratory, lecture, and field-related experiences allowed hands-on training at a bona fide research laboratory and two field stations, Driftwood and Flaxman Island. Classroom-lecture experience dominated afternoon and evening hours (35 hours) during the week-long program.

Syllabus:

I. Classroom-Lecture (8:30 a.m. to 12:00 noon) Figure 2.

Day One Introduction to mammalogy and scientific terminology.

NOMENCLATURE FOR FIGURES 2 AND 3

FIGURE 2. DOL-AFN CETA participants in Arctic Mammalogy course held at the NARL during September 1979. Pictured from L to R Top Row: Dr. Gary Laursen, PI; Mrs. Marie Morrison, Deputy Director, AFN, Inc.; Sheryl Silva; Mike Elavgak; Steve Oomittuk; Mr. Vladimir Gurevich, Instructor; Clark Lane; Art Oomittuk. Bottom Row: Wilson Ekak; Linda Nayakik; Frank Walunga; Dan Silook; and Mr. George Selby, ARF Supervisor.

FIGURE 3. The classroom situation with visiting guest, Dr. Jeff Everitt, Veterinarian, at the NARL.

2



3



- Day Two Arctic Terrestrial Mammal Biology.
 - Day Three Uses of Terrestrial Arctic Mammals in scientific research.
 - Day Four Application of research knowledge to preserve natural balance.
 - Day Five Arctic Marine Mammal Biology
 - Day Six Human Mammalogy (PHS visitation).
- II. Laboratory (1:00 p.m. to 5:00 p.m., or later) Figure 3.
- Day One Detailed tour of the NARL/ARF.
 - Day Two Handling, care, feeding, and maintenance of terrestrial research animals.
 - Day Three Flight to Driftwood field camp. (Terrestrial mammal field research site).
 - Day Four Game Management, Enforcement (Herb Melchior).
 - Day Five Flight to Flaxman Island field camp. (Marine mammal field research site).
 - Day Six Course conclusion, evaluation, certification.

III. Selective Reading (evenings).

- Endangered Species Act.
- Treaty of Native Utilization of Game Animals.
- State of Alaska Hunting Regulations.
- Species Descriptions (ARF literature).

The course was very successful. We are now preparing an FY-80 four-meeting (one week each) proposal to develop a substantial program expanding on pilot concepts.

FIRST INTERNATIONAL SYMPOSIUM ON ARCTIC MYCOLOGY

A proposal, an outgrowth of Dr. Laursen's fungal decomposition work, was prepared and submitted to ONR for funding review. The concept was approved and funded to have an international meeting, "The First International Symposium on Arctic Mycology (FISAM)" (Appendix II).

The purpose of having an international meeting of mycologists working on fungal problems in high latitude and altitude tundras at the NARL is to ascertain the state of the art, to report on it so that major contributors are brought to a current level of understanding simultaneously, and to develop a plan of direction for the future on a united front. The week-long meeting will provide for the presentation of formal papers, informal interest papers, and all levels of discussion among those constituting the major body of active researchers in the field of mycology on a worldwide basis for arctic and alpine tundra.

The theme of the meeting will be centered on broad ecological concepts, initially, and will then be focused on habit-habitat variations, circumpolar distributions, taxonomic relationships, function, and finally, speculation and prediction on speciation and adaptive radiation of fungi in the arctic, subarctic, and alpine zones. The basic investigations in ten countries will be reviewed. Five countries have arctic tundra that comprise the circumpolar arena and highest latitudes where investigations have been made.

Finally, reports on physiological research will be made with particular reference to higher plant community assemblages and associations.

The NARL continues to be a dominant research and logistic support Laboratory for mycological studies in tundra environment. From its inception, it has also supported many foreign programs. The Library, with its unique collection of mycological reports and papers on various aspects of Arctic tundra ecosystem research, also supports many requests from scientists not able to visit the Laboratory. Mycological research topics on tundra fungi are segregated into many specialized topics. They include: taxonomy; the ecological significance of the presence and abundance of fungi in tundra soils; the importance of the biological activity demonstrated by fungi in decomposition processes; the importance of fungi in nutrient turnover in otherwise nutrient-poor tundra soils; and the comparison of tundra mycology in circumpolar areas around the world (U.S., Canada, Greenland, Norway, Sweden, Finland, Russia).

To date, no formal synthesis of the wealth of this available information has been attempted nor have there been attempts to bring mycologists together who have been involved in mycological research in tundra environments. Mycologists from around the world are eager to share information, to make comparisons between tundra sites, and to examine critically their research direction for future programs.

Valuable information on Arctic mycology, worldwide, will be synthesized for the first time, and the Naval Arctic Research Laboratory is in a position to benefit by sponsoring the meeting. Foreign and domestic investigators would view the NARL's continued potential, as lead laboratory, to continue work in the U.S. Arctic,

to bring programs to the NARL, and to develop international cooperative studies and exchange programs. The results of the meeting presentations will be edited and printed as a symposium volume by Academic Press.

ANIMAL CARE AND MAINTENANCE

During FY-79, a total of 13,609 man-hours (1701 man-days) were spent in providing logistical support for all ARF research projects (Table 3). Almost half, 817 man-days, were spent in maintaining and caring for the animals. The NARL and ARF staffs ushered 465 visitors as VIP or regular tour participants (on odd-numbered Saturdays) through the facilities during FY-79 for an all-time record.

Food costs for the approximate 150 animals totaled \$21,031 for the year. A per-animal and per-species daily per diem cost for feeding has been developed (Table 4) and adjusted to cover all costs of food and shipping. No labor is included in the calculation. Costs per food-item type (Table 5) has also been developed for cost accounting purposes. The number of animals the ARF maintains throughout most of the year is given in Table 6. Total costs to the Navy base contract for operating the ARF during FY-79 came to approximately \$160,238. This provided salaries, fringe benefits, travel, materials and supplies, flights, freight, all Work Orders, food and shipping costs, miscellaneous costs, commitment and encumbered adjustments for the entire operation. Project Whales, Biophysics of Cold Adaptation and Acclimatization, and the CETA grants provided a substantial reimbursement sum to offset the \$160.2K costs to the Navy.

Animal Deaths: During the year, 89 animals were lost from the facility as permitted (Appendix III) and inventoried (Appendix IV). Six of those animals (foxes) actually tunneled out of their run and escaped. Twenty-five ground squirrels were shipped out in support of Dr. John Baust's continuing research. Fifty-two animals actually died, but most of those (28) were lemmings that could not adjust to foods we had been feeding for years and exposure due to holding in temporary quarters. Seven ground hogs, three marmots, and several squirrels died or were euthanized for various reasons but mostly died as a result of heart punctures made during experiments Dr. Albert was conducting. Age was suspected in the case of all three ermine deaths.

The months of May, July, August, and September were the months during which most animals died. For the six wolves that died, April and May were hardest hit. The following wolves died:

1. Name: Mix	Sex: Male
Date: 15 April 1979	Age: 10 years.

Table 3. FY-79 Work Distribution for the Animal Research Facility

PROJECT	Man-hours Worked			Total
	Animal Tech.	Tech/Aide	Supv.	
Animal Care	6,067.75	37.5	429.5	6,534.75
Office Admin.	4	691.5	1,532.5	2,228.
Office Maint.	0	794	3.5	877.5
Philo	171.0	1,018.25	23	1,212.25
Albert	136	288	0	424
Chappell	0	64	0	64
Follmann	60	5.75	0	65.75
77025N/Grizzly	0	32	0	32
RU-579/Whales	0	87.5	36	123.5
CETA	112.5	4	31	147.5
Pet Care Clinic	0	3.5	0	3.5
Laursen	0	12.0	0	12.0
Leave/Holiday	848	384.5	321	1,553.5
LWOP	212	0	52	264
Tours	0	0	66.5	66.5
Totals	7,611.25	3,422.5	2,575.0	\$13,608.75

Table 4. Animal Research Facility Feeding Costs for FY-79

Animal Type	Number of Animals	Daily Cost Per Animal	Annual Cost Per Animal	Total Cost Per Species
Polar Bear	1	\$10.85	\$3,648.00	\$3,648.00
Wolf	21	1.32	417.60	8,769.00
Wolverine	3	1.65	354.40	1,063.20
Fox	15	.55	185.28	2,779.20
Marmot	42	.31	104.16	4,374.72
Ground Hog	20	.31	104.16	2,083.20
Ground Squirrel	25	.31	104.16	2,604.00
Weasel	2	.09	30.24	60.48
Lemming	18	.13	43.68	786.24
Owl	1	.12	40.32	40.32
Total	148			\$26,208.96

Table 5. Animal Research Facility Food Costs for FY-79

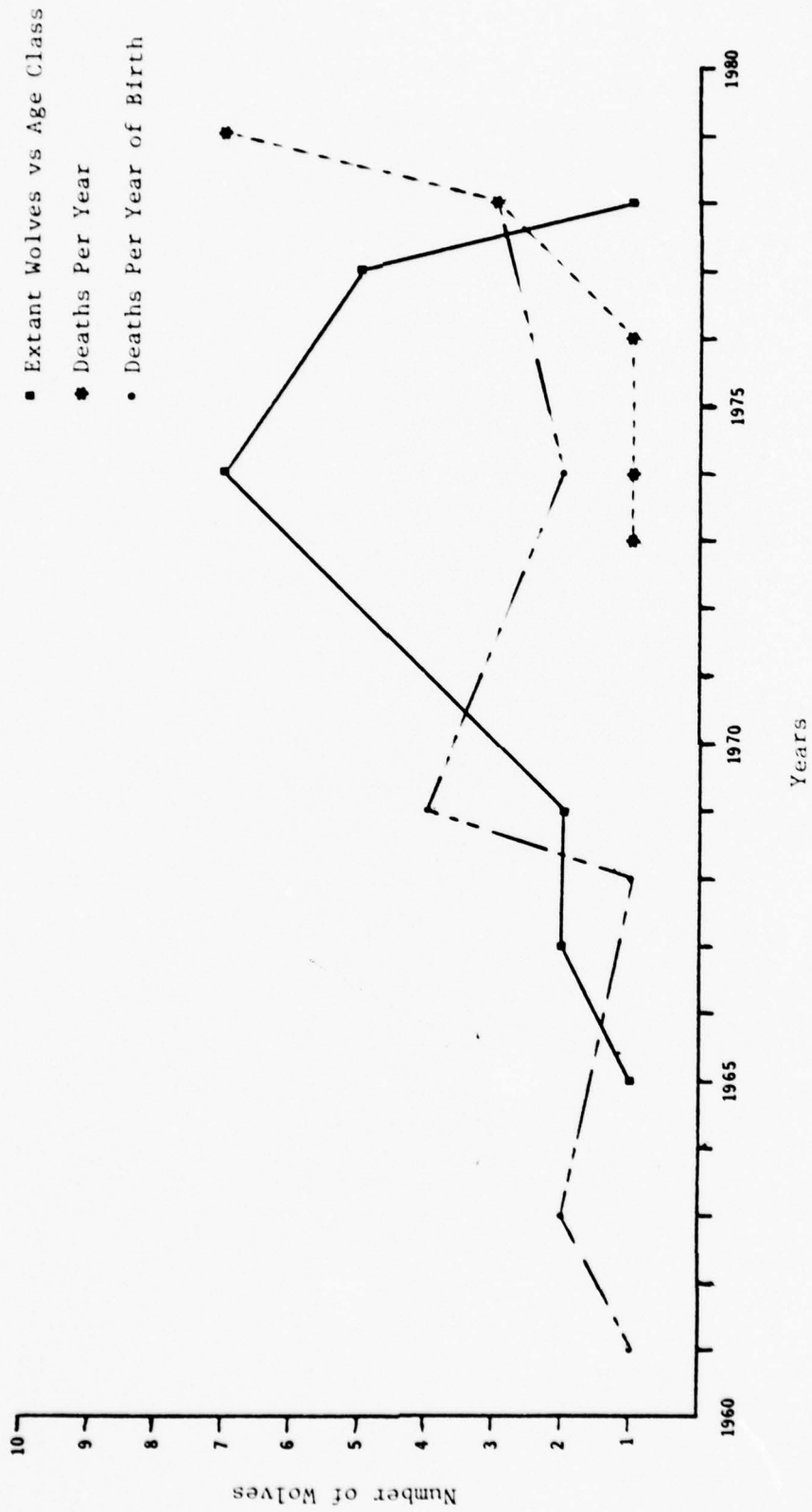
Food Type	No. Species Eating	Price Per Pound	Total Wt. (lbs)	Total Cost Per Annum
Fish	5	.65	10,000	\$ 6,500.00
Feline Diet	4	.58	10,080	5,846.40
Chicken Heads	1	.14	24,000	3,360.00
Chicken Necks	3	.14	8,000	1,120.00
Rat Chow	2	.31	5,810	1,081.10
Apples	3	.35	2,600	910.00
Vitamiacin	4	2.88	300	864.00
Carrots	3	.21	2,600	546.00
Eggs	4	.53/doz.	780/doz.	413.40
Cabbage	2	.15	2,600	390.00
Total			67,700	\$21,030.90

Table 6. Animals Maintained at the Animal Research Facility FY-79

Species	1979 Number	Acquisitions	Losses	Current Total
Polar Bear	1	0	0	1
Wolf	24	0	6	18
Wolverines	3	0	0	3
Red Fox	3	0	0	3
Ermine	3	0	3	0
Marmots	44	0	3	41
Ground Hogs	23	2	7	18
Brown Lemmings	3	25	28	0
Snowy Owl	1	1	2	0
Arctic Ground Squirrel	35	15	32*	18
Wolverine	3	0	0	3
Arctic Fox	9	0	8**	1
Total	152	43	89	106

* 25 Animals were shipped to Dr. Baust
 ** 6 Foxes escaped from the fox run

Figure 5 NARL Wolf Colony Age and Death Distributions



ORGANIZATIONAL CHART OF THE NAVAL ARCTIC RESEARCH LABORATORY SCIENCE DEPARTMENT

FIGURE 6.

SPRING 1979

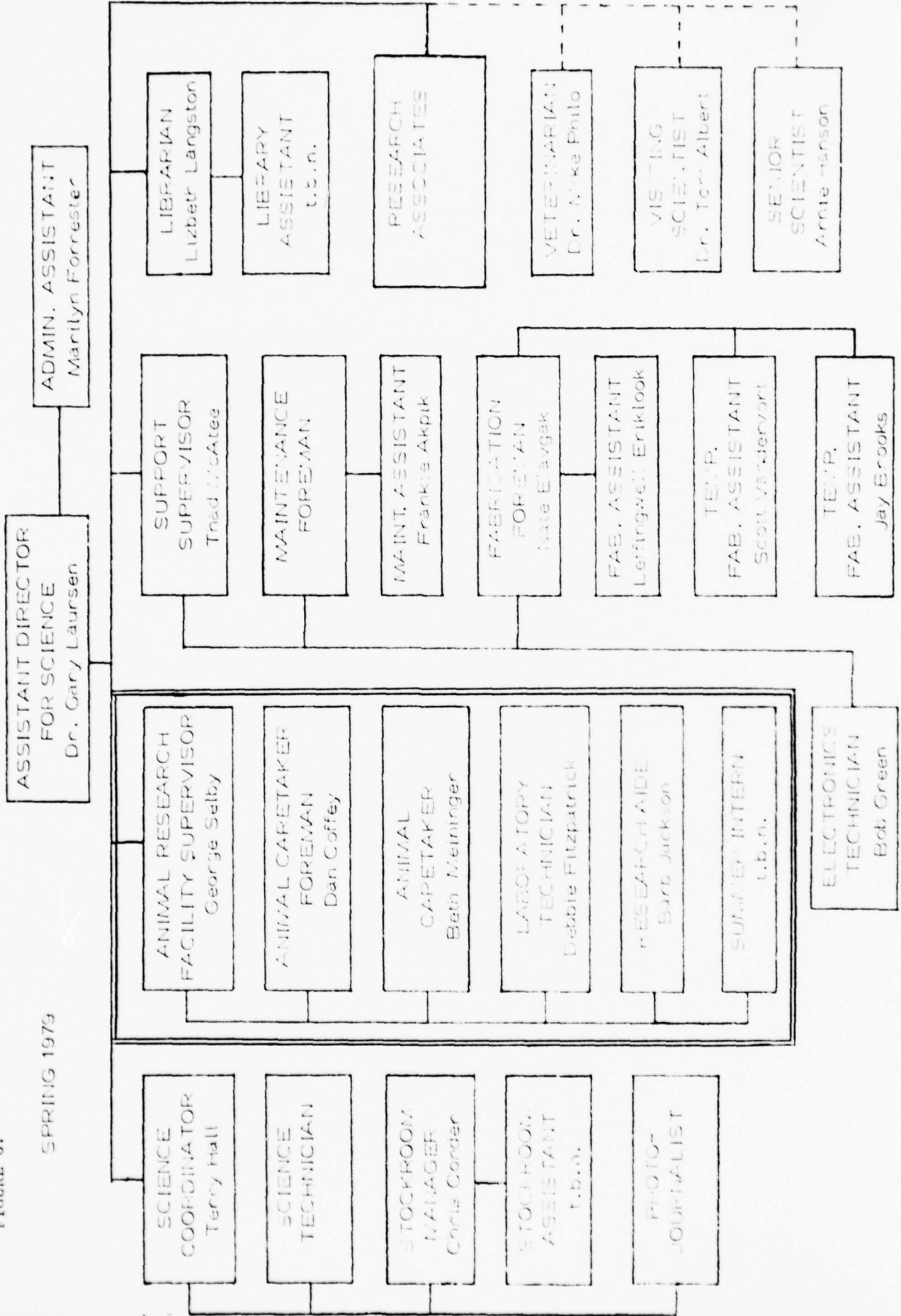


Table 7. Staff Changes at the Animal Research Facility

Position	Individual	Date of Arrival	Date of Departure
Facility Supervisor	George M. Selby	2/14/78	Still employed
Lab. Technician	Debby Fitzpatrick	3/6/78	5/31/79
Research Aide	Barbara Jackson	5/4/78	5/18/79
	Becky Gay	6/10/79	Still employed
Chief Animal Caretaker	Dan Coffey	5/1/79	7/27/79
	Connie Carter	8/8/79	Still employed
Animal Caretaker	Mary Meninger	7/24/78	8/21/79
Summer Intern	Connie Carter	6/10/79	8/7/79
CETA	Steve Oomittuk	5/15/79	Still employed
	Michael Elavgak	6/6/79	Still employed
Veterinarian	L. Michael Philo, V.M.D.	7/1/75	9/28/79
	Les Dalton, D.V.M.	9/29/79	

was assisted by three Department of Labor Alaska Federation of Native (CETA) youths and one North Slope Borough School District Work Study student. During the year, a total of 94 Work Orders were submitted by the staff; 41 to ITT and 53 to U of A facilities. Sixty-three were completed, 18 were canceled, 4 resubmitted, 4 recycled, and 5 are still pending.

Main tasks completed during FY-79 were the Utilidor hookup to Buildings 350 and 448; new skids under outdoor wolverine and fox cages; completion of the observation tower; installation of the auxiliary generator; general cleaning by moving buildings, barns; and general disposal of material and equipment through the excess program.

The Animal Research Facility comprises several buildings (15,000 square feet) situated on a 3.12-acre (1.26 ha) site. There are 72 exterior cages for housing all large animal species. Most rodents and other mammals and birds are housed inside. A staff of six, and up to 12, including a full-time resident veterinarian, maintain the facility and its 13 species. Buildings within the facility consist of two enclosed high-rise observation units that overlook fox and wolf runs, nine buildings dedicated to indoor animal enclosures, an aviary, an ambient temperature laboratory, and five large freezers for animal food storage. The ARF also contains a food preparation kitchen, a cage-washing facility, a clinical lab, a treatment room, a recovery room, four office and lab spaces for staff and visiting scientists, a surgery suite, metabolic and telemetry laboratories, and a fully equipped X-ray Room. Ample laboratory and office space is available for resident and visiting scientists. The facility also provides veterinary service to facility animals as well as to the native community.

The ARF complex of buildings (Figure 7) is divided into four sections according to the division of labor. They are the Building 350 complex (Figure 8), which houses laboratories, offices, surgery, clinic, treatment and X-ray room, the Isolation Corner, the Building 448 (Figure 9) where small and/or specialized cage facilities (polar bear) are maintained with caretaker's office, kitchen, cage sterilization, and work shop rooms, and the outdoor cage facilities for wolves, wolverines, and foxes.

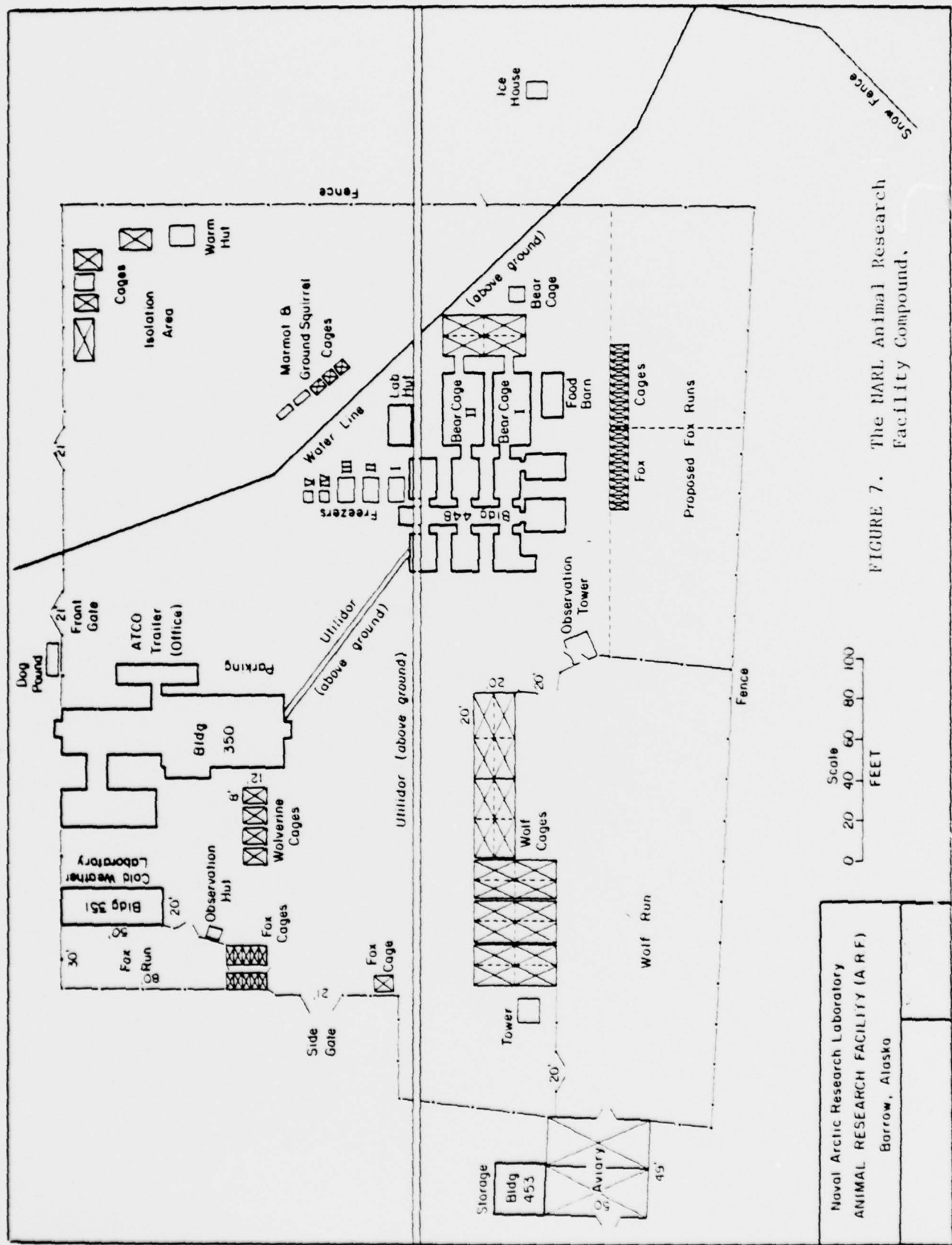
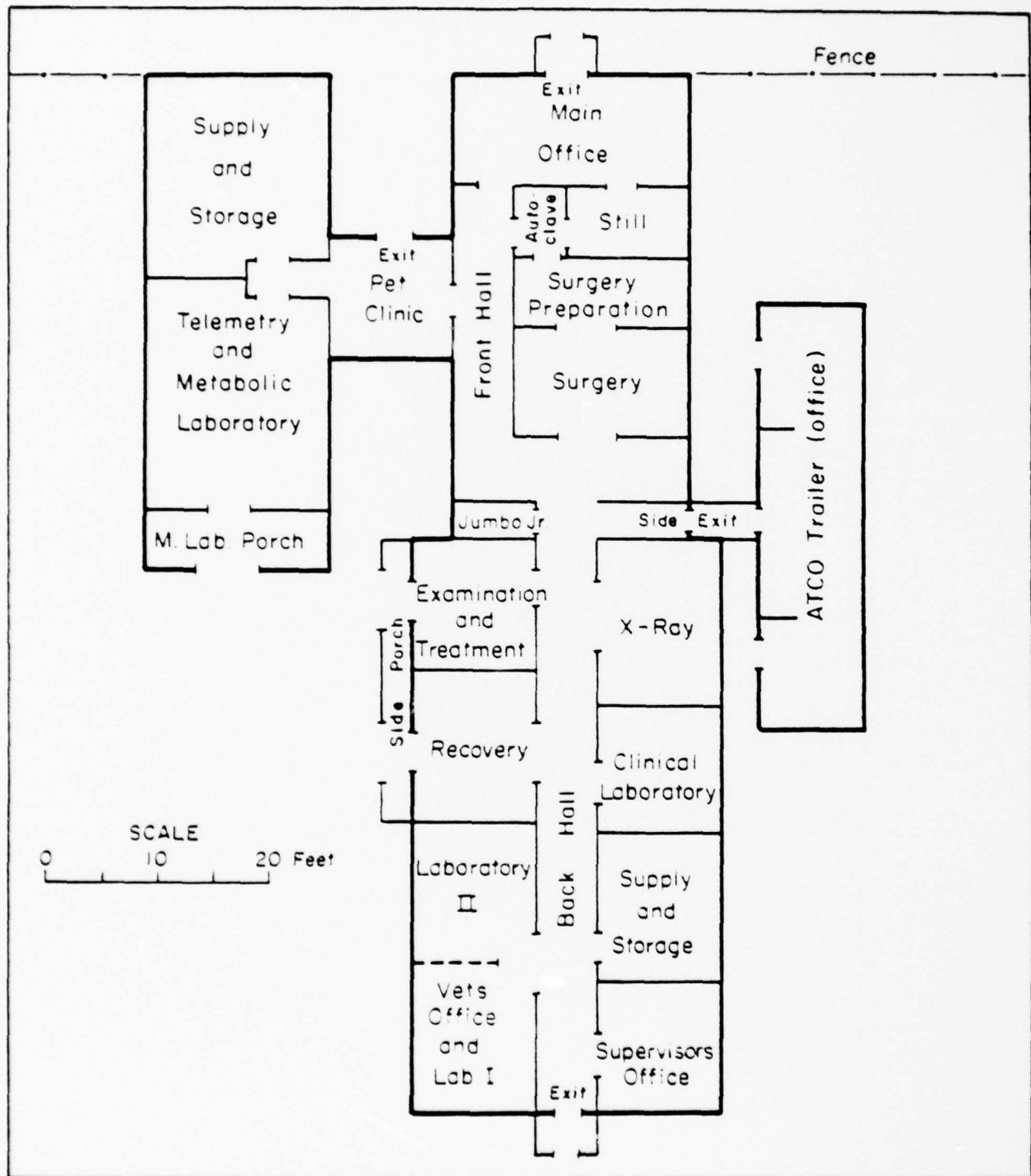


FIGURE 7. The NARL Animal Research Facility Compound,

Naval Arctic Research Laboratory
 ANIMAL RESEARCH FACILITY (A.R.F.)
 Barrow, Alaska



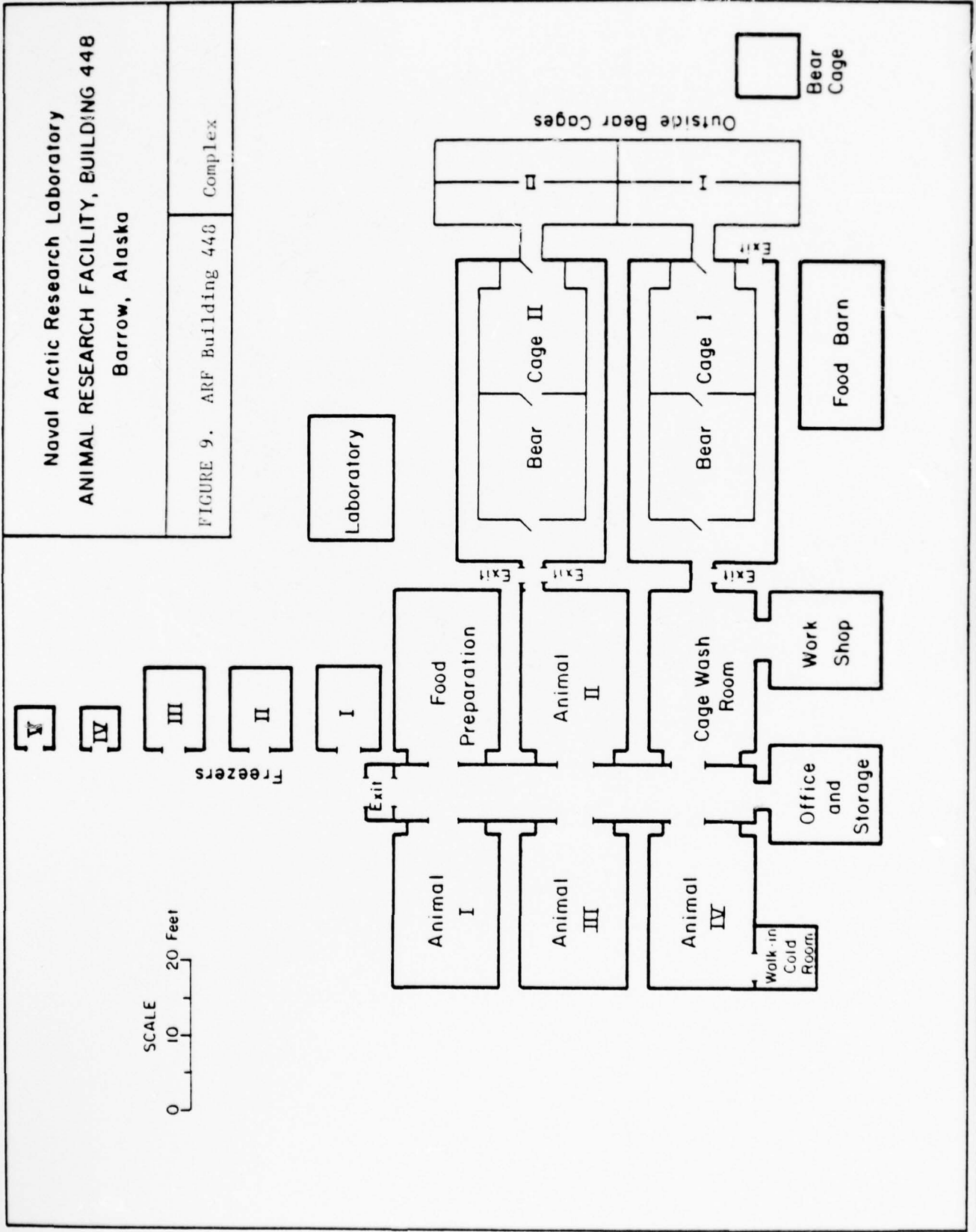
Naval Arctic Research Laboratory
 ANIMAL RESEARCH FACILITY, BUILDING 350
 Barrow, Alaska

FIGURE 8. ARF Building 350

Complex

Naval Arctic Research Laboratory
 ANIMAL RESEARCH FACILITY, BUILDING 448
 Barrow, Alaska

FIGURE 9. ARF Building 448 Complex



APPENDIX I

ATTACHMENT NUMBER 12

PROCEDURES OF THE NARL ANIMAL RESEARCH FACILITY

1.0.0 Facilities: The present facilities of the NARL Animal Research Facility (ARF) include the following:

1.1.0 Building 448 - Small Housing and Food Preparation. This building complex consists of 10 rooms and work areas joined together by a common hallway. There is a food preparation room, a cage washing facility, a work shop, a dry food storage building, office and storage areas. There are six animal housing rooms, excluding outside bear housing cages, which are connected to Building 448. The building is connected to the NARL utilidor for running water. Toilet facilities are available. Each room is fully powered and has temperature control capability.

1.2.0 Building 350 - Animal Facility Administration and Research. This building consists of two quonset huts joined by a connecting hallway with a newer wing attached to one end of a quonset unit. One quonset is divided into two rooms which serves as metabolism and telemetry laboratories. The other quonset serves as the main office; surgery preparation area; surgery suite; and animal surgical preparation area. The new wing has nine rooms. Contained within are x-ray facilities; a clinical laboratory; an examination and treatment room; a recovery room; a storage and supply area for surgical supplies and drugs; and three office/laboratory areas. In addition, there is one three-room office/laboratory suite (Atco trailer) with sleeping facilities. Building

350, like Building 448, is also connected to the NARL utility for running water. Toilet facilities are also available.

1.3.0 Miscellaneous Wani-gans and Small Buildings - A number of small buildings and one trailer are associated with the Animal Research Facility and are utilized for warehousing, bedding, storing equipment and supplies, and special research purposes, i.e., telemetry monitoring and behavior observation stations. Six walk-in refrigerators are provided for the storage of food.

1.4.0 Cages.

1.4.1 The cages provided for small rodents (lemmings, voles and mice) are rack-mounted metal cages measuring either 18 x 25 x 15 cm or 41 x 25 x 15 cm. Weasels are caged in expanded metal cages measuring 122 x 53 x 53 cm.

1.4.2 Medium to Large-Sized Mammals - The cages provided for ground squirrels, marmots and groundhogs are stainless steel professional rabbit hutches. Those for foxes, wolverines, and wolves are sled-mounted, expanded metal cages measuring 6 x 12 m for wolves, 3.6 x 2.4 m for wolverines, and 1.2 x 2.4 m for foxes. All cages for large mammals are partitioned with expanded metal walls into halves or quadrants, and interconnected with sliding doors. The cages are maintained out-of-doors in accordance with AAALAC accreditation standards and the research philosophy of the ARF.

1.4.3 Bears are housed in cages constructed of 5 cm pipe and measuring 9 x 4 m. For safety purposes, these cages

are contained in sled-mounted houses which are heated, if needed, and lighted. Inside bear cages are connected to outside cages measuring 6 x 12 m. They are also constructed of pipe and divided into four quadrants.

1.4.4 Large Birds - Birds are housed by species in an aviary consisting of two partially walled, gravel-floored rooms measuring 14 x 8 m. The top 1 m of three of the walls are screen-covered. An observation platform in a heated building attached to one of these rooms is equipped with one-way glass.

1.5.0 Special Equipment - In addition to the equipment and supplies maintained in the main laboratory for the use of all research scientists, a number of items of equipment normally associated with animal experimentation are maintained at the ARF. These include a variety of surgical instruments, anesthesia equipment, special cages, (including metabolic, transfer, capture, and holding cages) and equipment associated with food preparations and handling. A variety of metabolic equipment is also available, including a large open-flow chamber capable of measuring O_2 consumption and CO_2 production in animals ranging in size from lemmings to wolves in chamber temperatures ranging from $+50^{\circ}$ to -80° C.

2.0.0 Responsibilities The Director, Naval Arctic Research Laboratory, is responsible for all NARL Animal Research Facility operations, and has established the following areas of responsibility and control:

2.1.0 Assistant Director for Science is responsible for the recommending of procedures and policies pertaining to the Animal Facility and its overall operations and maintenance. The Assistant Director for Science reports to the Director, NARL.

2.2.0 Science Coordinator - Under the Assistant Director for Science, the Science Coordinator is responsible for the coordination of the scientific activities at the NARL. These responsibilities include promulgation of policies and procedures, and coordination of scientists' needs with Animal Facility capabilities.

2.3.0 Animal Research Facility Supervisor - The primary responsibility of this position is to manage the NARL ARF and to assist in the supervision of personnel in support of research programs under the general supervision of the Assistant Director for Science. The individual holding this position works closely with resident and non-resident scientists providing advice and support necessary for research projects.

2.4.0 Animal Caretakers - Individuals holding these positions are responsible for the day-to-day operation and maintenance of the animal housing, care, maintenance and training. The primary responsibility of this position will be the care of the animals comprising the colony. In addition, under the supervision of the Animal Research Facility Supervisor, these people will assist scientists in the conduct of

their research, particularly in the areas of pre-experimental conditioning and preparation, and post-experimental care.

2.5.0 Research Aide - The individual holding this position is primarily responsible in assisting the Animal Research Facility Supervisor in performing routine Animal Facility operational duties, which would include clerical, secretarial, and janitorial responsibilities. The position would supervise the Animal Facility stockroom and maintain scientific equipment in operating condition. It would assist in research conducted by the Animal Facility Supervisor, the Resident Veterinarian, and Visiting Scientists.

2.6.0 Laboratory Technician - This position is filled when the research workload calls for clinical laboratory work. The Laboratory Technician assists the veterinarian; conducts serum chemistry and hematology work; maintains daily data collection and charts for research projects and animals. This position also cares for, maintains, orders and operates laboratory equipment, selected surgical equipment, and selected x-ray equipment. The Technician also assists the Animal Facility Supervisor with in-house research and routine procedures.

2.7.0 Resident Veterinarian - This position is filled by a military veterinarian assigned by the U. S. Army. The primary responsibility of this position is to provide veterinarian services to the Animal Facility and the NARL as a whole, including treatment of animal injury and sickness,

zoonotic monitoring, and conducting programs of animal inoculation and other preventative medicine programs. The Resident Veterinarian will perform all major surgery on Facility animals and oversee minor surgery practices. The Resident Veterinarian has the professional responsibility of insuring that all pertinent animal welfare regulations and practices are adhered to by scientist and staff at NARL. The Resident Veterinarian is also expected to conduct independent research, as time permits. Perhaps the most important responsibility of this position is to advise the ARF Supervisor, the Science Coordinator, the Assistant Director for Science, and the Director on new Federal and State animal welfare regulations, on methods of improving the Animal Facility's capability, on methods of maintaining animals, and on policies, procedures and drugs.

3.0.0 Research Procedures:

3.1.0 All persons wishing to utilize the facilities of the NARL must receive authorization to do so from the Office of Naval Research via the CO, NARL, as far in advance of arrival as possible. In addition, use of the NARL Animal Research Facility or animals must be cleared with the Assistant Director for Science, the Resident Veterinarian, and the Animal Research Facility Supervisor (i.e., the Animal Utilization Committee). Notification of intent to utilize these facilities should be received by the Assistant Director for Science prior to the proposed starting date.

The investigator must include an estimate of animal, drug, and instrument or other equipment requirements, as well as an outline of the proposed experiment. All plans for anesthesia, drug administration, surgery, and research procedures must also be approved by the Resident Veterinarian.

3.2.0 Prior to implementation, all experimental procedures and protocols involving use of NARL animals will be reviewed by an Animal Utilization Committee, comprised of the Assistant Director for Science, the Resident Veterinarian, and the ARF Supervisor. This Committee's concerns will be to determine that a) the use of intended species will give desired results, b) proper drugs are to be used, c) the procedures are feasible and d) requirements are within the capabilities of the Animal Facility to provide.

3.3.0 Since some of the facilities of the Animal Facility are limited, a certain amount of coordination between scientific investigations will be necessary. Coordination will be particularly necessary for species utilization, but will also include use of equipment, supplies, and laboratory spaces. The criteria used in assigning utilization priorities will be the date a notification of intent to use was received by NARL. Whenever possible, time sharing schedules for use of limited facilities will be designed by the research scientists in question and the Animal Utilization Committee.

3.4.0 Anesthesia and other drug use procedures. The NARL ARF will maintain a stock of anesthesia agents and drugs.

All anesthetics, tranquilizers, and other drugs will be administered or supervised by the Resident Veterinarian or, in his absence, the ARF Supervisor. Only under exceptional conditions will recommended persons other than Animal Facility staff be permitted to administer drugs. For those experiments requiring the use of animals under anesthesia or tranquilizers, the Principal Investigator must notify the ARF Supervisor or Resident Veterinarian at least 24 hours in advance of need. Normally, Animal Facility personnel will isolate animals from cage mates and food for approximately 24 hours prior to administration of drugs. Animal Facility personnel will capture the animal, administer tranquilizers as prescribed by the Resident Veterinarian, and deliver the anesthetized animal to the laboratory at the time specified by the Principal Investigator and the Animal Facility Supervisor. Animal Facility personnel will be present throughout the period when the animal is under anesthesia to attend to the needs of the animal, and shall take charge of the animal for recovery procedures at the termination of the experiment. Recovery procedures include keeping the animal in a recovery cage in the recovery room under controlled temperatures until the animal is fully ambulatory. During this period, the animal will be observed periodically if recovery appears to be going well, or continuously if any abnormal symptoms are observed. When fully ambulatory, the animal will be returned to his cage

but will continue to be isolated from cage mates for at least 24 hours. Exceptions to the above procedures will be at the discretion of the Animal Utilization Committee.

3.5.0 Surgical procedures - The Resident Veterinarian will conduct or supervise all surgery done on animals. The Principal Investigator of the project will be expected to assist the Veterinarian in the conduct of the surgery to the limit of his professional competence, and will be expected to operate and monitor all data acquisition equipment associated with the surgery, or provide technicians to serve these functions unless use of NARL technicians in these functions has been authorized in advance by the Resident Veterinarian. All surgery will be conducted in the NARL surgery suite with the following exceptions: small mammals and birds, i.e., lemmings and passerine birds can be operated on in regular laboratories, and large mammals, i.e., bears and caribou/reindeer, will have to be operated on in their cages. Under these conditions, extreme care will be taken to create adequate sterile areas for the surgery.

3.6.0 Use of NARL Technicians - The NARL has staff positions for scientific technicians whose functions are to collect data for scientific projects. Scientists utilizing the ARF can request their assistance if required. It is the responsibility of the Principal Investigator to train the assigned technicians in the methods he wishes to be used in the conduct of the experiment. Requests for technician's time will be coordinated

by the Science Coordinator or the Assistant Director for Science.

3.7.0 Necropsy - A complete necropsy will be performed on every medium and large sized animal that dies for unknown reasons as soon after death as practical. Necropsy may be performed on all dead species. If an animal has died due to some experimental procedure, the Principal Investigator will be expected to be present during the necropsy, and to assist in its conduct, if at all possible.

3.8.0 Cleaning Up - Persons using ARF facilities will be responsible for helping to clean up. This includes placing dirty laundry in cold water to soak overnight, returning equipment to proper storage areas, and putting away, cleaning, and drying instruments on the day of use to prevent rusting, etc.

3.9.0 Record Keeping Responsibilities of Principal Investigator - Each procedure performed on a NARL animal must be included in that animal's records. It is the responsibility of the Principal Investigator to see that the Animal Research Facility Supervisor receives the proper information and properly filled out forms. Forms (see below) will be provided by the ARF Supervisor.

4.0.0 Touring: Since the Animal Facility is the pursuit of scientific research, touring of the colony will be minimized. The procedures of touring the animal colony are specifically described in a memo "Touring the NARL Facility," dated 11 January 1975.

5.0.0 Miscellaneous Procedures:

5.1.0 There will be no smoking, eating, or drinking at any time in the surgery, recovery, or preparation areas of Building 350, or in the animal food preparation room, animal rooms or cage washing areas of Building 448.

5.2.0 Investigators should consult the ARF Supervisor for emergency power failure procedures.

5.3.0 All personnel performing work in the Animal Facility must become familiar with the fire alarm system and with the location and type of fire extinguishers, exits, and specialized equipment on-hand.

5.4.0 All persons working with the NARL animals should have an annual physical examination and tetanus boosters. A pre-exposure rabies immunization is recommended. Boosters are suggested quarterly.

5.5.0 All bites and scratches to personnel from any of the animals will be reported to the ARF Supervisor, who will report them to the Assistant Director for Science, and to a physician for treatment if required.

6.0.0 Maintenance Procedures: The following are routine procedures of maintenance for the research animals. (See Appendix III, FY 78 Annual ARF Report.) Certain research protocols may require modification of some of these procedures. Exceptions must be authorized by the Animal Utilization Committee.

6.1.0 Feeding - See Caretaker's Manual on Maintenance, Feeding, and Care for NARL/ARF Animals.

6.1.1 Small Mammals - Small herbivores, such as lemmings, voles, and mice, will be provided fresh vegetables -- mainly carrots -- daily, except Sunday. In addition, each animal will be provided Purina Rat Chow pellets, ad lib. Water will also be provided ad lib, and changed daily. Small carnivores will be given equal portions of fish and fresh meat daily, except Sundays, and occasionally live white mice.

6.1.2 Large Terrestrial Mammals and Birds - Wolverine, and all large predator and scavenger birds will be provided portions of Zupreem, Chicken Mix and white fish, as required for each animal species. Wolves and foxes are provided portions of Chicken Mix, and Zupreem, as required for each species of animal. Foxes are provided two pounds each of white fish each week, in addition to Zupreem and Chicken Mix. Polar bears are provided ca. 20 lbs. of seal carcass or fish per day.

6.2.0 Cage Cleaning and Maintenance - Will be the responsibility of the animal caretakers as directed.

6.2.1 Small Mammals - The cages for lemmings and weasels are cleaned three times a week. This includes replacement of waste material absorbent and bedding. Uneaten fresh food is removed from the cages daily, except Sunday. Cages are scrubbed and sanitized once every two weeks or as needed, whichever is shorter.

6.2.2 Large Terrestrial Mammals and Birds - During the summer months when ambient temperatures are above freezing,

waste materials are removed from the cages housing large mammals and birds either three times a week or daily, depending on the size of the animal, the amount of waste material (feces and food) produced, and the number of animals in the cages. During these periods when temperatures are below freezing, when waste materials are solidly frozen and mixed with snow, cages are cleaned whenever needed or once a month. Cleaning consists of removing all snow from the cages except for fresh snow provided as a source of "drinking" water. Fresh hay for shelter houses is replaced at each cleaning. The aviary is cleaned in all seasons when necessary. The Animal Facility Supervisor is responsible for making the decisions concerning cage cleaning schedules.

6.2.3 Marine Mammals - The polar bear cages are cleaned at least weekly, or more frequently if needed. During winter months when temperatures are below freezing, cleaning includes removal of waste material, uneaten food, and changing the cage hay. During the warm months, in addition to the above, the cage floors and bars are scrubbed on a weekly basis. Water in the tanks is filtered continuously and changed when needed.

6.3.0 Facility Inspections:

6.3.1 Daily - The Animal Research Facility Supervisor is expected to conduct an inspection of the facilities of the facilities on each work day. Each animal in the colony is

observed and its condition and state of health are noted. Any occurrences of injury or sickness are reported to the Resident Veterinarian. All cages should have some (but not excessive amounts) of uneaten food just prior to feeding. Water in all cages should also be adequate at all times. During the inspection, cleanliness of cages and the grounds surrounding the cages will also be observed and substandard conditions brought to the attention of the Animal Facility Caretakers for correction. The ARF Supervisor will also conduct a lock inspection to check that all cages are locked just prior to quitting time.

6.3.2 Irregular inspections will be conducted periodically by the Assistant Director for Science, the Science Coordinator, and/or the Resident Veterinarian. Observations during inspections will be similar to those discussed in Daily Inspections. Any discrepancies observed will be reported to the ARF Supervisor.

6.4.0 Seasonal Maintenance Projects:

6.4.1 Snow Removal From Cages and Grounds - During winter, removal of snow as soon after storms as possible is required. NARL staff members, especially heavy equipment operators and laborers, are used to assist Animal Facility personnel in these endeavors. Snow depths in all cages, other than Arctic fox, are not allowed to exceed an average depth of 0.5 meters throughout the cage. Greater snow depths

are allowed in fox cages because of these animals' ability to dig extensive dens.

6.4.2 Canvas Covering On Cages - Outside cages are covered with canvas during winter months to control the accumulation of snow in the cages. Canvas is placed on cages immediately after freeze-up in the fall and is removed in the spring as soon as thaw begins. Timing is critical. It has been found that leaving a six-inch gap between the top and bottom canvas panels allows some snow to enter cages but within tolerable limits.

6.4.3 Movement of Cages - Outside cages for wolverine, and some fox are constructed so that waste material falls from the cage into the natural gravel pads beneath the cages. It is necessary to move the cages two or three times during the summer months and remove contaminated gravel and replace it with fresh gravel. Normally, this procedure is done as soon after thaw as possible, again in late July/early August, and just prior to freeze-up. Cages are moved more often if required. Every few years, cages are relocated within the animal colony area to facilitate area cleanliness.

6.5.0 Irregular Maintenance Projects:

6.5.1 Cage Repair - At any time that damage to a cage is observed during a daily inspection, repairs are initiated. Animals are isolated from the damaged area or are moved to another cage. The ARF Supervisor initiates a Work Order and requests the services of qualified personnel to correct the

damage.

6.5.2 Building and Cage Painting - The O & M Contractor is responsible for painting all buildings at the NARL. All buildings are painted once every three years, inside and out. The bars of bear cages are painted at least that often, or more frequently if required. Paint is not required on any of the other cages.

6.5.3 Major Improvement Projects - A number of major improvements have been implemented in the Animal Facility, and similar projects are anticipated. It is one of the primary responsibilities of the Animal Utilization Committee to initiate these suggestions, however, ideas are solicited from all persons associated with the NARL or the Animal Facility, especially from the research scientists utilizing the Facility. Once an improvement project has been accepted as a desirable improvement by the Animal Utilization Committee, it is the responsibility of the Assistant Director for Science to seek the necessary funds from the Office of Naval Research, or other funding agencies. Once funding has been secured, Work Orders are prepared by the ARF Supervisor for project implementation.

6.6.0 Acquisition of New Animals - Principal Investigators will consult with the Animal Utilization Committee if it becomes evident that a particular research regimen requires animals not then maintained by the Animal Facility. If it can be shown by the Principal Investigator that no satisfactory alternative data acquisition method exists, the Committee can

request authorization to acquire more animals from the Director. The methods of acquisition shall include: a) initiation of a breeding program utilizing resident animals, b) utilization of Barrow area native trappers for a fee to secure animals, c) sending the Principal Investigator and/or NARL staff members into the field on trapping expeditions, or d) other such appropriate methods.

6.7.0 Supply and Equipment Procurement - Authorized projects utilizing the Animal Facility will be able to use the supplies and equipment maintained by the NARL in the Main Laboratory. Requests for such materials are submitted to the Stockroom Manager. Those projects requiring special or extensive quantities of equipment or supplies must submit their requests to the Assistant Director for Science at least three months in advance of intended use, or bring their own. Those projects authorized to utilize the NARL facilities on a reimbursable basis will be required to pay for such orders. All equipment and supplies by the Laboratory are the property of the U. S. Navy and are kept on the University of Alaska Inventory.

6.8.0 Work Order Initiation - An investigator requiring the use of any NARL personnel, including Animal Facility staff, support shops, or technician assistance, submits a request for services to the Animal Facility Supervisor or Science Coordinator or Assistant Director for Science. The Science Technicians and Research Aides provide investigators with assistance in data

collection and preliminary analysis. The Project Support Shop is a wood and metal shop that can fabricate such items as marking stakes, packing boxes, field wanigans, variable speed wind tunnels, and the like. The Field Project Support Services provide investigators with laborers, vehicle drivers, and field guides.

6.9.0 Purchase Order Initiation - Those projects requiring supplies and equipment not in stock at the NARL can request the Laboratory to make purchases for them. Reimbursable projects will be expected to pay for these purchases. Nonreimbursable project requests will be authorized if funds are available. For all items that cannot be purchased locally, at least three months lead time should be allowed for the order to be processed and delivered to the Laboratory.

6.10.0 Disposal of Animals From the Facility - As a general rule, the Facility will not support any animal for which there are no research requirements. Individuals will be eliminated from the colony if research interest in that species declines due to the termination of a project. The species can easily be replaced should interest redevelop. The Animal Utilization Committee will pick one of the following procedures with which to dispose of animals.

6.10.1 Release - The most preferred method of disposal will be to release the animal, either close to the area from which it was procured, or in optimal habitat. Decision to release will be based on the animal's chances of survival if released.

Alternate methods of disposal will be used if it is felt that the animal in question is too old or too inexperienced (i.e., was born in the colony) to be released, or if conditions in the environment do not warrant release (i.e., the habitat is already overpopulated with that species).

6.10.2 Transfer - If the animal cannot be released, the next most preferred method of disposal will be to transfer the animal to another institution, such as a zoo or another research laboratory. Any institution wishing to receive animals from the NARL must be able to document that their facilities for holding and caring for the animal are adequate.

6.10.3 Termination - Those animals that cannot be released or transferred will be terminated. If it becomes necessary to terminate, the most humane method possible will be used under the direction of the Resident Veterinarian. Prior to termination, the Animal Utilization Committee will attempt to locate a project requiring terminal animals.

7.0.0 Records: The following records are maintained by the Animal Facility:

7.1.0 Records submitted by Investigators.

7.1.1 Proposed Experimental Work Involving Animals - This form is sent to each investigator as soon as the NARL becomes aware that a project intends to utilize the facilities of the Animal Facility. The investigator records enough pertinent information on this form so that the Animal Facility Supervisor can plan for the investigation and integrate the study with

other animal colony activities and studies. The major information requested includes anticipated surgery and postoperative care, species and numbers of animals required, maintenance equipment required, special diets or treatment, and any other special instructions.

7.1.2 Daily Experimental Agenda - This form is to be submitted to the Animal Facility Supervisor the day before an experiment involving an animal of the colony is to occur. Its purpose is to alert the Animal Facility staff of intended animal use. Information indicated on the form includes the date of use, time when animals are expected in the Laboratory, times when drugs should be given and approximate time when post-use treatment should begin. A separate agenda should be prepared for each animal to be used.

7.1.3 Animal Facility Usage Report - Information for this form is gathered during an experiment, and records of the procedures used on an animal, i.e., drug dosages, time of experimental applications, etc., and the animal's reaction to those procedures.

7.1.4 Drug Usage Report - This form chronicles the experimental administration of all drugs on animals at the Facility. Drugs administered for routine anesthesia or sickness or injury treatment are not included. The form indicates the date, time of administration, name of drug, concentration and dosage, intended effect, and a chronology of effects until full recovery.

7.2.0 Daily Records - The following records are kept by



the Animal Facility staff:

7.2.1 Daily Log - This form is essentially a check sheet the function of which is to insure that essential maintenance functions are performed. As each species is fed and watered, the species is checked off on the form. Other chores, i.e., cage cleaning, floor sweeping, and lock checks are also indicated. General health of animals, animal usage by investigators, and other observations are also recorded.

7.2.2 Daily Diet Record - This form is used to record the daily amounts of food given to each animal or communal cage, and is kept on all species, except microtine rodents and mice. The number of animals in the cage, the amount of food left in the cage prior to feeding, the amount provided and the type of food are indicated.

7.2.3 Daily Staff Timesheet - This form is maintained by the Animal Facility Supervisor. The number of hours each staff member works each day is recorded. At the end of the week, each staff member signs the sheet, and it is turned in to the Payroll Department for processing.

7.3.0 Records Kept on Individual Animals:

7.3.1 Chronological Record - This is the main record kept on each individual animal. On this form, all procedures done on, activities occurring to, and observations made on each animal are recorded. Experimental participation, reproductive activity, body weights, food consumption (if observed), injury,

sickness, and anecdotal observations are included in chronological order.

7.3.2 Body Weight Records - Whenever body weights are taken, they are noted on this special form, in addition to the chronological record, since body weight and particularly sudden changes in body weight are an indication of state of health.

7.3.3 Reproductive History - This information is also taken from the Chronological Record. All births, matings, litter sizes, and similar data are recorded.

7.3.4 Necropsy Report - This form is prepared on each animal (except rodents) that dies in the colony by the Resident Veterinarian and the responsible investigator, if any. Both an internal and an external examination are performed, tissues are cultured, if required, and complete diagnosis is conducted.

7.3.5 Injury and Sickness Treatment Log - This form details the treatment afforded all sick or injured animals. The nature of the sickness or injury, type, dosage and scheduling of all drugs administered, diet provided, and special caging required are indicated.

7.4.0 Miscellaneous Forms: Fish and Other Meat Shipments - This form records the purchase of fish and other meat from local sources. It shows the kind and amount of purchase, and the person providing. The form serves as an inventory control form.

ANIMAL COLONY POPULATION

The population of the animal colony varies throughout the year, depending upon research needs. Generally, however, the species populations fall within the ranges given below:

<u>Large Animal Species</u>	<u>Population</u>
Wolves	19-25
Arctic Fox	5-10
Wolverines	3
Polar Bear	1-2
 <u>Bird Species</u>	
Arctic Snowy Owl	2
Arctic Raven	5-7
 <u>Small Animal Species</u>	
Lemmings and Vole	20-80
Ground Squirrel	10-20
Weasels	2-10
White Mice	30-50
Rabbits	10
Marmots	5-20
Seals	0-5

APPENDIX II

PROPOSAL
TO
OFFICE OF NAVAL RESEARCH

FIRST INTERNATIONAL SYMPOSIUM ON ARCTIC MYCOLOGY

Code Name: FISAM

NARL Project No.: 79028

Account No.

Principal Investigator:

Dr. Gary A. Laursen
SS# 531-38-8205
Assistant Director for Science

Total Cost: \$33,560

Duration: FY-80

Date of Proposal: TBA

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Michael E. Brown, LCDR/USN
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Date: _____

SCHEDULE OF EVENTS

FY-79	June	Informal discussions with European mycologists on potential for First International Symposium Arctic Mycology (FISAM)
	July	Letters of Intent to notify potential contributors Academic Press approach for volume publication
	August	Identify funding source (See proposed Budget) Proposal Completion
	September	Secure funding for FY-80
FY-80	October	Letters of invitation to contributors on purpose and intent of Symposium
	November	Produce final participant list Call for Papers
	December	Establish final Meeting Agenda
	January	Initiate Travel Arrangements Request Abstracts
	March	Assemble Abstracts
	May	Complete Meeting plans Mail Abstract Compendium to all Participants
	July	Assemble papers for Symposium Handout
	August	Meeting
	September	Complete Editorial Review
FY-81	October	Send Copy to Publisher
	November/December	Publication Distribution

FISAM PRELIMINARY AGENDA

Sunday	17 August	Arrival, Registration, Orientation
Monday	18 August	Papers, 0900-1130, 1330-1630
Tuesday	19 August	Papers, 0900-1130, 1330-1630
Wednesday	20 August	Field Work, Barrow Vicinity
Thursday	21 August	Forum - Arctic Mycology: The Future, 0900-1200; Point papers and drafts, 1330-1700 (mini papers)
Friday	22 August	Field Work, Meade River Camp
Saturday	23 August	Cleanup, Departure, Barrow Village
Sunday	24 August	Departure

FISAM INTRODUCTION/ORIENTATION PACKET CONTENTS

1. Abstracts
2. Participant listing, title
3. Field Camp Map
4. NARL Map
5. NARL FY-79 Research Report
6. Meeting Agenda - Itinerary
7. FISAM Patch
8. Name Tag
9. Orientation Information
10. Lab and Room Assignments

FISAM PAPER PRESENTATION SUGGESTIONS

Monday 18 August

0900 Welcome Dr. John Kelley
Director, NARL

0910 Orientation and Program Review Dr. Gary Laursen
Asst Director for Science

Mycological Studies: An Ecological Review

0930	Alaska	G. Laursen
0945	Austria	M. Moser
1000	Canada	D. B. O. Saville
1015	Finland	P. Kalio
1030	France	R. Kuhner
1045	Greenland	P. M. Petersen
1100	Japan	Y. Kobayasi
1115	Russia	
1130	Sweden	S. Ryman

1130-1230 DINNER

Physiological Studies

1330	Alaska	A. Linkins
1400	Sweden	N. Fries

Taxonomic Studies: Ascomycetes

1430	Alaska	Y. Kobayasi
1500	Greenland	H. Dissing
1530	Norway	S. Sivertsen
1600		O. Skifte
1630		R. Korf

1700-1800 SUPPER

Taxonomic Studies: Basidiomycetes

Tuesday 19 August

0900	Alaska	G. Laursen (lt. spore arctic tundra)
0930		J. Ammirati (Dk. spore arctic tundra)
1000		O. Miller (alpine tundra)
1030	Austria	M. Moser (alpine tundra)
1100	Finland	H. Heikkila (subarctic tundra)

1130-1230 DINNER

1330		E. Ohenoja (subarctic tundra)
1400		Y. Makinen (subarctic tundra)
1430	France	R. Kuhner (alpine tundra)
1500		D. Lamoure (alpine tundra)
1530	Greenland	M. Lange (alpine tundra)
1600	Norway	G. Gulden (alpine tundra)
1630		K. Hoiland (alpine tundra)
	Russia	(arctic tundra)
1700	Sweden	S. Ryman (arctic tundra)

1700-1800 SUPPER

FISAM Short Subjects - Informal Presentations

2000	Nordic Fungus Flora work	H. Knudsen
	Arctic Research Stations	G. Laursen

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Dr. Yrjo Makinen
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APPENDIX III



FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

NAVAL ARCTIC RESEARCH LABORATORY
BARROW, ALASKA 99723

2. AUTHORITY - STATUTES

16 USC 704
REGULATIONS (Attached)

50 CFR 21.23

3. NUMBER

PRT 2-24 AK

4. RENEWABLE

YES
 NO

5. MAY COPY

YES
 NO

6. EFFECTIVE

1/30/79

7. EXPIRES

12/31/79

8. NAME AND TITLE OF PRINCIPAL OFFICER (If not a business)

DR. GARY LAURSEN, ASS'T DIRECTOR FOR SCIENCE

9. TYPE OF PERMIT

SCIENTIFIC COLLECTING

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED

STATE OF ALASKA

11. CONDITIONS AND AUTHORIZATIONS

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY OR RENEWAL OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN STATE, LOCAL OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE, and any person who is under the direct control of the permittee. Written notice of sub-delegation authority shall be forwarded to the issuing officer prior to accomplishing the purpose authorized herein.

- D. Authorized to hold and possess five (5) live Snowy owls for research.
- E. Authorized to collect not more than two (2) specimens of the various species of migratory birds occurring in the Barrow area. All specimens collected are to be deposited at the University of Alaska Museum, Fairbanks, Alaska.
- F. All dead migratory birds salvaged are to be retained at the Naval Arctic Research Laboratory Vertebrate Museum.
- G. Carry this permit whenever exercising its authority.
- H. Does NOT authorize trespass on private property, nor areas selected for claim by Native corporations and villages.
- I. The authority granted by this permit is invalid until like authority has been granted by the Alaska Department of Fish and Game, in the form of a written permit. Contact Director of Game, Subport Building, Juneau, Alaska 99801.

ADDITIONAL CONDITIONS AND AUTHORIZATIONS ON REVERSE ALSO APPLY.

12. REPORTING REQUIREMENTS: A report must be provided the Division of Law Enforcement, U. S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99503, by January 10 of each year. The report must be submitted on a Form 3-430A, supplied by the U. S. Fish and Wildlife Service.

ISSUED BY

Larry J. Hood
LARRY J. HOOD

TITLE

ASSISTANT SPECIAL AGENT-IN-CHARGE

DATE

January 31, 1979

ORIGINAL

SAC LE; FBX LE; NOME LE; ANCH LE; KETCHIKAN LE; ADF&G JUN;



STATE OF ALASKA
ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

PERMIT

to

- TAKE
- POSSESS
- HOLD ALIVE
- BAND OR TAG
- ~~IMPORT INTO ALASKA~~
- EXPORT FROM ALASKA

- ~~BIRDS OR THEIR EGGS~~
- MAMMALS
- ~~FISH OR THEIR EGGS~~

FOR SCIENTIFIC, EDUCATIONAL, OR PROPAGATIVE PURPOSES, as described below.

Issued February 2, 1979 Expires December 31, 1979

Permit No. 79-79 Authorizing Dr. Gary A. Laursen, Asst. Director for Science

of Naval Arctic Research Laboratory, Barrow Alaska 99723

Representing Same

To conduct the following described activities, SUBJECT TO THE CONDITIONS, EXCEPTIONS, AND RESTRICTIONS EXPRESSED HEREON AND ON THE REVERSE SIDE HEREOF, in accordance with the "Fish and Game Code of Alaska" (Chapter 94, SLA 1959):

Authority is granted to take, possess, hold alive and export arctic mammals (i.e., tundra voles, lemmings, arctic ground squirrels, arctic foxes and marmots) in numbers not to exceed those necessary to conduct research programs supported by the NARL. Authority is further granted to maintain populations of 24 arctic wolves, 15 arctic red foxes, 4 wolverines, and 1 polar bear.

Cont.

THIS PERMIT DOES NOT ALLOW PEREGRINE FALCON, ALEUTIAN CANADA GOOSE, EAGLES OR THEIR EGGS.

THIS PERMIT MUST BE CARRIED BY THE PERMITTEE WHEN OPERATING THEREUNDER and be exhibited to any person authorized to enforce state or federal laws who requests to see it. This permit is nontransferable, and will be revoked, or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No re-delegation of authority may be allowed under this permit.

A DETAILED REPORT, including numbers, species, dates, and disposition of each specimen; the dates and places collected, their sex, age and breeding condition, lengths and weights of fish, and weights of birds and mammals SHALL BE SUBMITTED WITH RETURN OF THIS PERMIT WITHIN 10 DAYS AFTER ITS EXPIRATION DATE. Permits will not be renewed until such report has been received by the Commissioner.

ALASKA DEPARTMENT OF FISH AND GAME

Robert A. Harrison
Commissioner

Ronald O. Skoog
Commissioner or Authorized Representative

Permit 79-79
Continued

Under no circumstances are any additional big game animals to be acquired or transferred without first obtaining an amended permit from the Department of Fish and Game.

Authority may be delegated by permittee to individuals under his supervision. Such delegation must be in writing with a copy to this office prior to beginning collecting activities.



STATE OF ALASKA
ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

PERMIT

to



TAKE
 POSSESS
 HOLD ALIVE
 ~~EXHIBIT~~
 ~~EXPORT FROM ALASKA~~
 ~~EXPORT FROM ALASKA~~



BIRDS OR THEIR EGGS



~~MAMMALS~~



~~FISH OR THEIR EGGS~~

FOR SCIENTIFIC, EDUCATIONAL, OR PROPAGATIVE PURPOSES, as described below.

Issued March 12, 1979 Expires December 31, 1979

Permit No. 79-150 Authorizing Dr. Gary Laursen, Asst. Director for Science
of Naval Arctic Research Laboratory, Barrow, Alaska 99723

Representing Same

To conduct the following described activities, SUBJECT TO THE CONDITIONS, EXCEPTIONS, AND RESTRICTIONS EXPRESSED HEREON AND ON THE REVERSE SIDE HEREOF, in accordance with the "Fish and Game Code of Alaska" (Chapter 94, SLA 1959):

Authority is granted for the following activities:

1. Possess and hold alive five (5) Snowy Owls for research.
2. Collect not more than two (2) specimens of the various species of migratory birds occurring in the Barrow area.
3. Salvage dead migratory birds for research purposes.

Federal permit PRT 2-24 AK must be in possession.
THIS PERMIT DOES NOT ALLOW PEREGRINE FALCON, ALEUTIAN CANADA GOOSE, EAGLES OR THEIR EGGS.

THIS PERMIT MUST BE CARRIED BY THE PERMITTEE WHEN OPERATING THEREUNDER and be exhibited to any person authorized to enforce state or federal laws who requests to see it. This permit is nontransferable, and will be revoked, or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit.

A DETAILED REPORT, including numbers, species, dates, and disposition of each specimen; the dates and places collected, their sex, age and breeding condition, lengths and weights of fish, and weights of birds and mammals SHALL BE SUBMITTED WITH RETURN OF THIS PERMIT WITHIN 10 DAYS AFTER ITS EXPIRATION DATE. Permits will not be renewed until such report has been received by the Commissioner.

ALASKA DEPARTMENT OF FISH AND GAME

Robert A. Hummer
Division Director

Ronald O. Skoog
for
Commissioner or Authorized Representative

APPENDIX IV

This report is required by law (7 USC 2143). Failure to report according to the regulations can result in an order to cease and desist and to be subject to penalties as provided for in Section 2150.

UNITED STATES DEPARTMENT OF AGRICULTURE ANIMAL AND PLANT HEALTH INSPECTION SERVICE VETERINARY SERVICES ANNUAL REPORT OF RESEARCH FACILITY <i>(Required For Each Reporting Facility Where Animals Are Held And An Attending Veterinarian Has Responsibility)</i> HCS # 34-VS-66	1. DATE OR REPORT PERIOD ENDING SEPT. 30, 1979	FORM APPROVED OMB NO. 40-R-777
	2. HEADQUARTERS RESEARCH FACILITY (Name & Address, as registered with USDA, include Zip Code) NAVAL ARCTIC RESEARCH LABORATORY	

INSTRUCTIONS: Reporting Facility complete items 1 through 24 and submit to your Headquarters Facility. Attach additional sheets if necessary. Headquarters Facility complete items 25 through 27 and submit on or before December 1 of each year for the preceding Federal fiscal year (October 1, to September 30) to the Veterinarian in Charge for the State where the research facility headquarters is registered.	3. REGISTRATION NO.
	4. REPORTING FACILITY (Name and Address, include Zip Code) ANIMAL RESEARCH FACILITY N. A. R. L BARROW, ALASKA 99723

REPORT OF ANIMALS USED IN ACTUAL RESEARCH, TESTING, OR EXPERIMENTATION - Section 2.28 of Animal Welfare Regulations requires appropriate use of anesthetics, analgesics, and tranquilizing drugs during research, testing, or experimentation. Experiments involving pain or distress without use of these drugs must be reported and a brief statement explaining the research.

ANIMALS COVERED BY ACT	Number of animals used in research, experiments, or tests involving no pain or distress.	Number of animals used in research, experiments, or tests where appropriate anesthetic, analgesic, or tranquilizer drugs were administered to avoid pain or distress	Number of animals used in research, experiments, or tests involving pain or distress without admini- stration of appropriate anesthetic, analgesic, or tranquilizer drugs. (Attach brief explanation.)	TOTAL
5. Dogs	0	0	0	0
6. Cats	0	0	0	0
7. Guinea Pigs	0	0	0	0
8. Hamsters	0	0	0	0
9. Rabbits	0	0	0	0
10. Primates	0	0	0	0
Wild Animals - <i>(Specify)</i>				
11. Polar bear	1	0	0	1
12. Wolves	0	25	0	25
13. Arctic foxes	0	5	0	5
14. Red foxes	3	0	0	3
15. Weasels	0	0	0	0

CERTIFICATION BY ATTENDING VETERINARIAN FOR REPORTING FACILITY - I, the undersigned, certify that the type and amount of anesthetic, analgesic, and tranquilizing drugs used on animals during a test or experiment, including post-operative and post-procedural care was deemed appropriate to relieve pain or distress to the extent possible.

16. SIGNATURE OF ATTENDING VETERINARIAN <i>Dale M. Dalton, DVM</i>	17. TITLE Resident Veterinarian/NARL	18. DATE SIGNED 7 Nov '79
19. SIGNATURE OF FACILITY SUPERVISOR <i>George M. Sibley</i>	20. TITLE Facility Supervisor	21. DATE SIGNED 7 Nov 77
22. SIGNATURE OF ASSISTANT DIRECTOR/SCIENCE <i>Gary Jensen</i>	23. TITLE Assistant Director/Science	24. DATE SIGNED Nov 7, 79
CERTIFICATION BY HEADQUARTERS FACILITY I certify that the above is true, correct, and complete and that professionally acceptable procedures were used to insure the appropriate use of anesthetic, analgesic, and tranquilizing drugs during actual research, testing, or experimentation. Experiments involving pain or distress without use of these drugs must be reported and a brief statement explaining the research.		
25. SIGNATURE OF HEADQUARTERS FACILITY <i>Art A. Miller</i>	26. TITLE Technical Director/NARL	27. DATE SIGNED Nov 7, 79

ANNUAL REPORT OF RESEARCH FACILITY

page 2

A	B	C	D	E
Marmots	0	31	0	31
Ground hogs	0	11	0	11
Ground squirrels	0	30	0	30
Wolverines	0	3	0	3