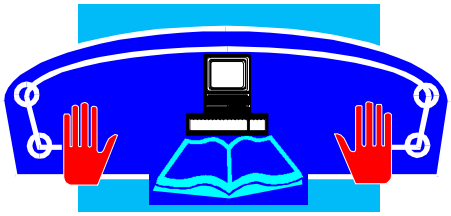

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PTARMIGAN GAMEFARMING IN THE NORTHWEST TERRITORIES: GOALS, COSTS AND IMPLEMENTATION OF A DEMONSTRATION PROJECT

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March 1990

EXECUTIVE SUMMARY

PTARMIGAN GAMEFARMING IN THE NORTHWEST TERRITORIES: GOALS, COSTS AND IMPLEMENTATION OF A DEMONSTRATION PROJECT

EXECUTIVE SUMMARY

Phase One of the present study found that, at the present time, ptarmigan are not being farmed for the commercial market because of various technical and biological difficulties. Expertise in ptarmigan aviculture in North America is very poorly developed. However, state-of-the-art techniques for ptarmigan aviculture and gamefarming are present in Europe, where there is currently considerable interest in ptarmigan. Expertise is most highly developed at the University of Tromsø, Norway, and to a lesser extent at the Institute of Terrestrial Ecology, Banchory, Scotland. Researchers at the former institution have partially resolved some of the major disease, nutritional and housing problems that have been associated with ptarmigan aviculture.

Moderate numbers of ptarmigan can now be raised in Norway with a high degree of success if proper precautions are taken and adequate housing is provided. Although ptarmigan gamfarming has not developed to the point of establishing "turn-key" operations, it is practical to contemplate a ptarmigan gamefarming demonstration project in the Northwest Territories. Such a project would serve to transfer European knowledge and expertise to the N.W.T. and it would also be a centre for modifying proven techniques developed in Norway and Scotland to local conditions in the N.W.T. The demonstration project would also serve to further evaluate the feasibility of pursuing ptarmigan gamefarming in the N.W.T.

During consultation meetings, scope for Phase Two of this project was broadly defined as attempting to establish roughly 10 to 15 breeding pairs of ptarmigan and raising from **50** to 150 young within the next 1 - 2 years. It was agreed that, due to various difficulties that could be expected in initiation of ptarmigan gamefarming in the N. W. T., a "slow", phased approach was the best strategy. The following five items were identified as priorities:

1. *Capture of a small number of adult ptarmigan before the breeding season, placing pairs or trios in large outside enclosures and collecting resultant eggs;*

2. *Collecting eggs of wild ptarmigan;*

3. *Incubating eggs from (1) and (2) above in artificial incubators and rasing the resultant chicks;*

4. *Maintaining some birds from (1) or (3) above over the winter of 1990-91 to establish the first captive breeding stock of ptarmigan in the N. W. T. for production in 1991; and*

5. *Obtaining first hand information from researchers at the Institute of Terrestrial Ecology, Banchory, Scotland, and the Department of Arctic Biology, Tromsø, Norway, in order to further expertise in ptarmigan aviculture.*

The physical plant for the ptarmigan demonstration project in Inuvik would consist of two ATCO-type trailers to house necessary incubators,

hatchers, brooders, breeding pens, storage facilities, office space and a small hospitalisation area. Larger outdoor flight pens would also be constructed. Details of these facilities are provided, as are operational requirements. It is possible that part or all of the physical plant could be located at the Inuvik Research Centre of the Science Institute of the N. W. T., since preliminary discussions have indicated that the Science Institute is interested in furthering knowledge of gamefarming in the N.W.T.

Capital costs for the project are estimated at approximately $26,000 for the first year of operation. Operational costs, including feed but not personnel, are estimated at about $35,000; however $24,000 of this cost is rental of two trailers. it is believed that this cost can be substantially reduced by purchase of two used trailers if they can be located in the lower Mackenzie River region. Personnel costs are estimated at approximately $96,500, which includes costs of professional consultants to initiate the project and to train personnel in Inuvik.

An implementation plan is presented, which identifies a schedule of critical activities for the next 18 months. Topics include cooperative arrangements, permits and licences, obtaining European expertise through

working visits, capture of wild ptarmigan, potential sources of funding and potential technical personnel to initiate the demonstration project. Preliminary discussions indicate that there is a potential to obtain financial or “in kind” support for this project from a number of organizations, including the Science Institute of the N. W. T., Technology Inflow Program, future Economic Development Agreements, the National Research Council of Canada and Department of Renewable Resources.

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INTRODUCTION

The present report is the second part of an ongoing effort to examine the feasibility of establishing a ptarmigan gamefarming demonstration project in the Northwest Territories. The first part of the study (Phase One) was reported by Stallard and Sekerak (1989). Its main objectives were to:

1. examine the feasibility of establishing flocks of captive raised ptarmigan in the Northwest Territories; and

2. investigate interest of local and southern retailers, wholesalers and restaurateurs in ptarmigan as a meat product.

A detailed literature review was performed in order to determine state-of-the-art of ptarmigan aviculture. A total of 127 references were obtained from aviculture magazines, university libraries and computer data bases; the most pertinent were reviewed in their entirety or in abstract form. The owners, managers, chefs or chief buyers of 17 businesses (wholesalers, retailers and restaurants) were contacted to determine potential market demand for farm-raised ptarmigan.

It was found that, at the present time, ptarmigan are not being farmed for the commercial market because of various technical and biological difficulties. Expertise in ptarmigan aviculture in North America is very poorly developed. However, state-of-the-art techniques for ptarmigan aviculture and gamefarming are present in Europe, where there is currently considerable interest in ptarmigan. Expertise is most highly developed at the University of Tromsø, Norway, and to a lesser extent at the Institute of Terrestrial Ecology, Banchory, Scotland. Researchers at the former institution have partially resolved some of the major disease, nutritional and housing problems that have been associated with ptarmigan aviculture. Moderate numbers of ptarmigan can now be raised in Norway with a high degree of success if proper precautions are taken and adequate housing is provided. Although ptarmigan gamefarming has not developed to the point of establishing “turn-key” operations, it is practical to contemplate a ptarmigan gamfarming demonstration project in the Northwest Territories. Such a project would serve to transfer European knowledge and expertise to the N.W.T. and it would also be a centre for modifying proven techniques developed in Norway and Scotland to local conditions in the N.W.T. The demonstration project would also serve to further evaluate the feasibility of pursuing ptarmigan gamefarming in the N.W.T.

Results of the Phase One study suggest that:

1. Willow ptarmigan would be the most suitable species to raise in captivity because:

   a They are presently the most common ptarmigan being raised in captivity in both Europe and North America;

   b. They are the largest of the three species; and

   c. They are likely to yield the highest number of eggs per hen.

2. Diets and methods developed at the Institute of Terrestrial Ecology, Banchory, Scotland and especially the University of Tromsø, Norway are the most appropriate ways of feeding and housing willow ptarmigan in captivity;

3. Stress and disease control are important factors and potential problems in capture and maintenance of healthy birds;

4. Artificial incubation and brooding of chicks in indoor facilities, followed by rearing of juveniles either out- or indoors at above-freezing temperatures would best ensure high survival rates; and

5. The majority of the wholesalers and retailers contacted were interested in supplying ptarmigan to their customers, and all but two of the restaurants were interested in having ptarmigan on their menus.

OBJECTIVES OF PHASE TWO

The objectives of the second part of the study (Phase Two) were to :

1. Define the goals and time-frame of a ptarmigan gamefarming demonstration project through consultations with the client and representatives of the Government of the Northwest Territories;

2. Provide information on design of facilities of the demonstration project;

3. Estimate capital and operational requirements; and

4. Formulate an implementation plan for the demonstration project.

The following information describes results of Phase Two activities.

GOALS OF THE DEMONSTRATION PROJECT

A consultation meeting was held on 6 February 1990 with the client and representatives of Department of Renewable Resources and Department of Economic Development and Tourism. The results of Phase One were discussed and the scope and timing of a demonstration project were defined. It was agreed that, due to the various difficulties that could be expected in initiation of ptarmigan gamefarming in the NWT, a “slow”, phased approach was the best strategy. The following five items were identified as priorities:

1. Capture of a small number of adult ptarmigan before the breeding season, placing pairs or trios in large outside enclosures and collecting resultant eggs;

2. Collecting eggs of wild ptarmigan;

3. Incubating eggs from (1) and (2) above in artificial incubators and raising the resultant chicks; and

4. Maintaining some birds from (1) or (3) above over the winter of 1990-91 to establish the first captive breeding stock of ptarmigan in the NWT for production in 1991.

5. Obtaining first hand information from researchers at the Institute of Terrestrial Ecology, Banchory, Scotland, and the Department of Arctic Biology, University of Tromsø, Norway in order to further expertise in ptarmigan aviculture.

Scope and Timing

Scope of the project was broadly defined as attempting to establish roughly 10 to 15 breeding pairs of ptarmigan and raising from **50** to 150 young within the next 1 -2 years. Due to unforeseen difficulties that will arise, a number of alternative ways to accomplish this goal should be pursued simultaneously, whenever possible. Thus, 1) and 2) above are different ways to achieve the same goal — establishment of a nucleus of ptarmigan breeders in the NWT. It was agreed that the client should pursue ways to achieve 1) and 2) above at the earliest possible date.

LOCATION

The client lives and works in Inuvik, NWT. We have consequently investigated facilities, cooperative arrangements, costs, etc. for establishing a ptarmigan demonstration project in that area.

CAPITAL EQUIPMENT AND SUPPLIES

Buildings

Two ATCO-type trailers are recommended to accommodate facilities for incubation, brooding, storage, care of sick birds and office requirements. The trailers and the grounds immediately adjacent to them would form the core of the demonstration project. A suggested layout is shown in Figure 1. One trailer is necessary to house incubators, hatchers, brooding and breeding pens, attendant equipment and storage space for supplies. The other trailer would be used to isolate and care for sick birds, and for feed storage. Office space would also be provided in the former trailer. Pen space in Trailer 1 is used to overwinter breeders or for brooders to raise chicks in spring.

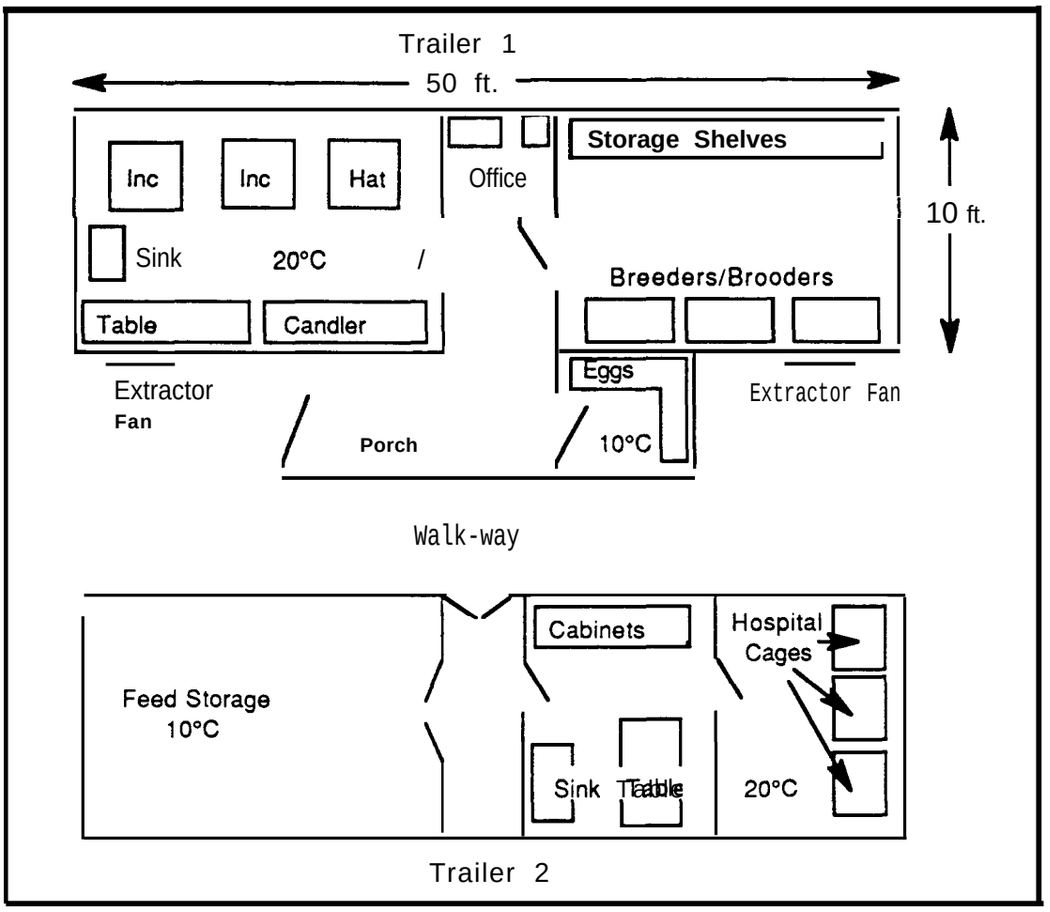


Figure 1. Lay-out of two ATCO-type trailers for incubation, early brooding, storage and hospital facilities for ptarmigan demonstration project. Office space for administration, records, etc. is included.

Incubators and Hatchers

For the initial demonstration project, we recommend Sportsman incubators and hatchers that take up to 500 ptarmigan eggs. The Sportsman incubator and hatcher are inexpensive and reliable, if monitored daily to check temperature and water levels. The incubator is equipped with automatic turners which rotate the eggs every 2 hours, water tray, circulation fan, ventilation ports and thermostats. Hatchers are similarly equipped except that automatic turners are not needed. More expensive incubator/hatcher systems are available; these reduce the amount of monitoring required, and they are generally larger. However, we feel that the recommended Sportsman incubators and hatchers are appropriate for a pilot project.

Brooders

Young chicks will be housed in portable, aluminum (easy to keep clean) brooders (0.8 X 1.5 m; 2.5 X 4.5 ft) with 1.25-cm (1/2 in) wire mesh floors, and two 250-watt brooder lamps to maintain temperature at 350C (Figure 2). About 40 chicks can be housed together. A trap door in the brooder unit may be opened to allow chicks access to a small outside run. The run is a simple (1 .75 m X 3.5 m; 5 X 10 ft) rectangular pen covered with poultry mesh (Figure 3).

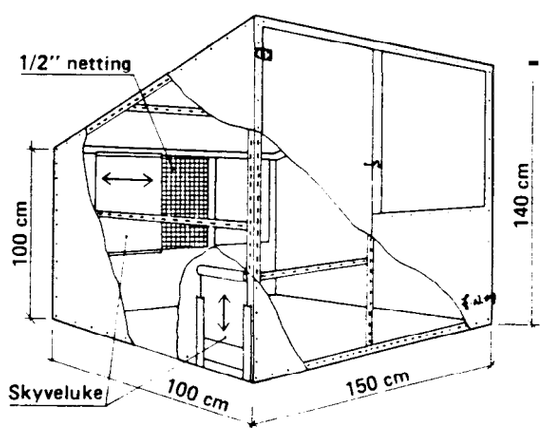


Figure 2. Chick cage for ptarmigan (from Ness 1989).
The frame is angle-iron (e.g., Dexion). Walls are a double layer of 1 mm aluminum screwed on with 5 cm insulation in between. Roof: 2/3 single 1 mm aluminum and 1/3 clear fibreglass. Front window is clear fibreglass (or glass). Floor: frame of 23 X 48 mm with 1/2" poultry mesh and sliding trap-doors to regulate ventilation. [Skyveluke = sliding trapdoors.]

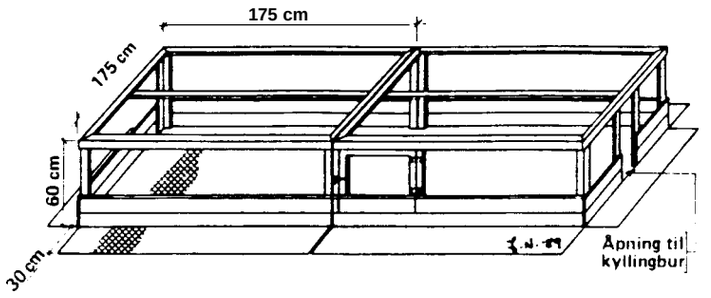


Figure 3. Run for ptarmigan chicks - 2 units (from Ness 1989).
Roof sections made with 23 X 48 mm laths and 2 X 90 cm poultry mesh. Wall sections made with 23 X 48 mm laths, 2 19 X 98 mm boards and 90 cm poultry mesh. Sections are held together with wire. To keep it level lay turf or stones on the netting. [Apning til kyllingbur = opening to chick cage.]

Breeding Units

Breeding birds will be housed in two types of accommodations (flight pens and smaller breeding units) to determine which type best meets the requirements of the Inuvik region. Breeding units are relatively small pens constructed of plywood and wire mesh (Figure 4). Cages are constructed with wire floors and a sand-filled nest box. Each unit houses a pair of adults with a divider to separate them if the cock becomes too aggressive or two hens and one cock if the mck proves to be gentle.

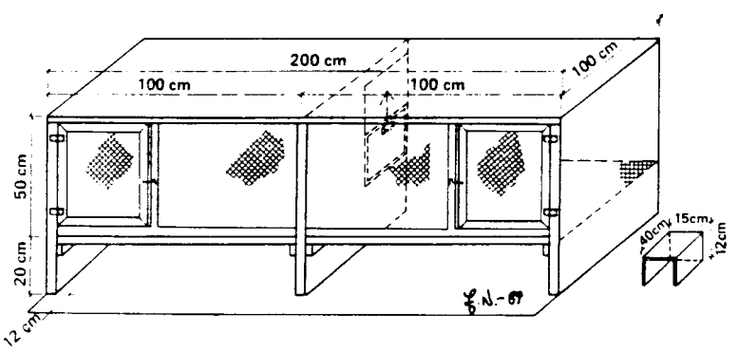


Figure 4. Indoor aviary for ptarmigan breeders (from Ness 1989).
Cages can be built two or three together and placed in two levels, the lowermost 40 cm from the floor. Roof, sides and back: 6 mm plywood. Framework: 23 X 48 mm and 48 X 48 mm laths lined with 20 mm insulation. Floor: 1 X 1" plasticised netting stretched tightly on a frame (23 X 48 mm) which can be removed for cleaning. Droppings tray made of strong plastic is removable for emptying and washing. Inside the cage is a roost and a board and a box which ptarmigan can hide themselves in; the box is shown in the sketch.

Flight Pens

Large, wire-enclosed outdoor flight pens are commonly used in the production of gamebirds such as turkeys and pheasants. For our purposes, we will use flight pens for:

1. Growing young ptarmigan from the age of about 6 weeks to 5 months old (at which time they would be ready for market); and

2. As seasonal or year-round accommodations for breeding pairs or trios of ptarmigan (see 1. in Goals of the Pilot Project).

Flight pens are attractive alternatives to other means of housing, mainly because they are low cost and require little cleaning or maintenance. However, flight pens have not been particularly successful for ptarmigan because of disease problems. When in confinement, ptarmigan have a tendency to reinfect themselves with metazoan parasites (mainly nematode worms) by eating their own droppings (Stallard and Sekerak 1989). Flight pens are also often surprisingly difficult to predator-proof, especially against such animals as weasels.

Low densities of ptarmigan in flight pens will increase chances of breeding, survival and good health. Pens should be 6 X 6 X 2.5 m high (Figure 5) constructed on willow stands and grass. One breeding pair or trio is housed in each pen. Grow-out pens for young ptarmigan should be stocked at densities of no more than about 2 m^2/bird or about 18 birds per pen. Construction of 10 flight pens in two rows of five is recommended for this project.

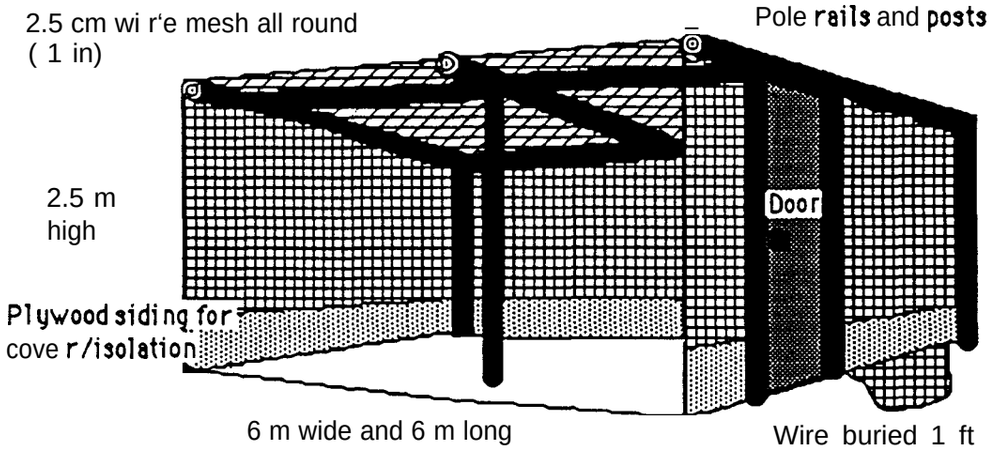


Figure 5. Flight pen for growing or breeding ptarmigan.

NUTRITION

It is recommended that the diets currently in use by the Tromsø team (Ness 1989) be adopted, as these diets have been rigorously tested on willow and rock ptarmigan (Tables 1 and 2). Different diets are required for chicks, maintenance (juveniles and adults two weeks after and six weeks before the breeding season) and breeding (adults during the breeding season). It should be noted that these formulations are slightly different from those outlined in detail in Phase I of this study (Stallard and Sekerak 1989). This formulation is made for the Tromsø researchersby Stormøllen A/S I.C. Piene & Son, Fjorgt. 3, 7000 Trondheim, Norway (Phone: 011-7 52 82 00). As supplements, fertilised willow twigs and branches should be made available daily, making sure that the chicks are not fed too much woody material, as this can cause intestinal blockages. When birds are kept on wire, grit must be either mixed in with the feed, or presented in a separate container.

Table 1. Composition (%) of different ptarmigan diets (from Ness 1989).

Composition	Chick Diet	Breeding Diet	Maintenance Diet
Herring meal	10	5	2
Soymeal	18.8	10	
Whole corn	25	5	15
Whole barley		6	8
Whole oats		6	12
Whole wheat	20.4	6	10
Grass meal		34	31
Wheat bran	16.5	20.6	12
Brewers Yeast	2	1	1
Soya Oil	2	2	2
Kelp meal		1.5	2
Limestone	1.5	0.7	1.5
Calcium phosphate	2	1	2
Feather meal?	0.4	0.4	0.4
Vitamin premix	1	0.3	1
Ascorbic acid	0.2	0.2	
$MnSO_4$-H_2O	0.1	0.2	
Tannin	0.1	0.1	0.1
Payzone (Nitrovin)	10 mg/kg	10 mg/kg	10 mg/kg

Table 2. Analysis of different ptarmigan diets (from Ness 1989).

Analysis		Chick Diet	Breeding Diet	Maintenance Diet
Dry Matter	%	90.6	89.7	90.1
Raw protein	%	20.3	19.4	14.1
Oil	%	5.2	5.1	5.1
Fibre	%	5.3	11	10.8
Ash	%	7.2	7.3	8
Salt (NaCl)	%	0.4	0.6	0.4
Ca	g/kg	13.8	9.1	9.7
P	g/kg	7	6.9	8.2
Mg	g/kg	2.1	2	1.8
K	g/kg	7.8	13.5	12.8

We have estimated the amount of feed necessary to maintain approximately 30 adults for 12 months and 150 young for 5 months, based on feed consumption of pheasants (Summers and Leeson 1985) (Table 3).

Table 3. Estimated feed consumption of 150 young ptarmigan for 6 months and 50 breeders for 12 months.

Diet	No. of Weeks	Kg/bird	No. of Birds	Total kg.
Chick	6	0.83	150	124.5
Maintenance (young)	14	6.40	150	960.0
Maintenance (breeders)	36	20.64	50	1032.0
Breeder	16	9.17	50	366.8

C) PERATION

Incubation and Hatching

Eggs from wild-caught ptarmigan or eggs collected from nests of wild ptarmigan are collected as they become available. Eggs that have not been incubated by the hen may be stored for 7-10 days at 10°C. Incubation time is approximately 19-21 days at 37.6°C and humidity of 26.7-28 .7°C. The latter is monitored with a wet-bulb thermometer. Temperature is controlled by two thermostats set at 37.6°C and 39°C (backup); failure of the main thermostat wafer when the heat is on will not generally lead to death of the embryos from too high a temperature if the problem is corrected within 12 hours. If the heat is off when the thermostat fails, the temperature will drop to ambient; although this will not kill the embryos if corrected within 12 hours, growth and development can be slowed to the detriment of the hatchlings. Power failures which cool, as well as prevent turning of the eggs, can be fatal to embryos at very early (1-2 days) or very late **(2-3 days prior** to hatching) stages of development if more than 12 hours in duration (pers. obsv.). Failure to maintain water in the moisture trays at all times can lead to drying out of the eggs and death of the embryo. Fluctuations in outside temperature and humidity can affect conditions in the incubators and adjustments are necessary in these cases.

On day 19, eggs are transferred from the incubator to the hatcher. Temperature in the hatcher is maintained at 37°C, but higher humidity is required — about 31.1 'C. Hatchlings are left in the hatcher for 12-24 hours, until dry and fluffed out.

Candling

Candling is performed to separate infertile and dead eggs from healthy, developing embryos. Candling is carried out in a darkened room (a table in the incubator room itself is most suitable), by shining a bright light through each egg. A simple candler can be made from a coffee can, a light fixture and a 40 watt lamp (Figure 6). Candling is normally performed on day 7 and day 15 of the incubation period.

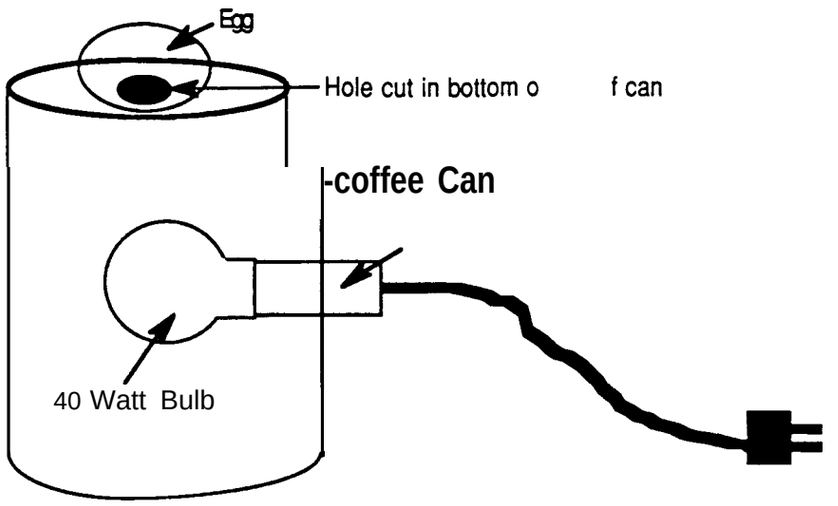


Figure 6. **A** simple candler for testing fertility of eggs.

Brooding

After remaining in the hatcher for up to 24 hours, the chicks are removed to portable, aluminum (easy to keep clean) brooders (Figure 2), equipped with two 250-watt brooder lamps adjusted so that the chicks are maintained at 35°C. About 40 chicks can be housed together. Because of weather restrictions in Inuvik, it may not be feasible to keep these units outside on grass and willows continually, as is done in Tromsø, Norway. Depending on day-to-day weather conditions, brooders can be kept in the trailer facility or outside on a bed of vegetation. As the chicks become older, they will be able to withstand cooler temperatures and they will therefore spend more and more time outside. Feed trays containing feed, drown-proof waterers and grit trays are provided; bunches of grass, willows and other suitable greens are hung on the walls, to give the birds **exercise and** keep them from becoming bored, as well as to supply essential nutrients. It is recommended that two sets of feeders and waterers be used, one set in use, the other being cleaned and sterilised. A trap door in the brooder units may be opened to allow the chicks access to a small run.

Grow- Out

After chicks are 6-8 weeks old and are well-feathered, they no longer require heat and are placed in flight pens (Figure 5) for their grow-out period. At this time, they are fed maintenance food and are also given daily supplements of locally collected greens. Automatic feeders and waterers are checked twice a day and waterers are cleaned daily,

Breeding

Breeding pairs or trios during the breeding season will be kept in flight pens and in breeding units. In the latter, a cock is paired alternately with two hens, which are kept in adjoining cages with a sliding partition to reduce handling. Since more space will be available in flight pens, onset of breeding may be evidenced by nuptial displays of the male.

Breeders are switched from maintenance diet to breeder rations 4-6 weeks before laying is expected. Breeder rations contain substantially more protein than the maintenance diet; however, the high protein is harmful to the birds on a year-round basis. Daily feeding and watering are required.

Overwintering

It is recommended that two methods of overwintering breeders be attempted:

1. Outside flight pens at ambient conditions; and
2. Breeding pens housed in Trailer 1 at temperatures slightly above 0°C.

Crude shelters may have to be provided in outside flight pens. Maintenance food and water should be supplied daily. Winter water requirements of ptarmigan in the flight pens are unknown. If maintained on a diet of dry prepared food, they may require free (i.e., unfrozen) water at least twice a day and perhaps more often.

Medication and Disease Control

Medication given to the chicks includes 0.012% amprolium in the drinking water on days 8-12 and 18-22, to control coccidiosis; 0.2% ascorbic acid (to supplement the chick's own manufactured Vitamin C) and 0.1 % rutin and quercetin (flavonoids) are also given in the food if these supplements are not already part of the feed formulation. Birds, especially those not kept on wire, may develop infections of metazoan parasites, primarily nematode worms. Infections should be monitored for parasite eggs by microscopic examination of droppings on a weekly basis. If infections are noted, a veterinarian should be consulted to prescribe anthelminthic drugs.

Daily Tasks

Daily operations would commence with a routine check of the temperature and humidity of the incubators and hatchers. Opening these machines for a short time does not affect the hatching process. During the check, water can be added to the humidity trays if needed, and any bad eggs (detected by their odour and beads of exudate on their surface) removed. Stored eggs that are not yet in the incubator are turned.

In the brooder unit, the young birds are given clean feeders containing fresh food, and waterers containing fresh water. Casualties are removed, and a close observation of behaviour of the birds is carried out. Any highly aggressive individuals should be either isolated or fitted with a beak bit or spectacles, and/or have the tip of the beak removed. If signs of sickness are observed (drooping wings, closed eyes, listlessness), the affected bird must be removed immediately and either killed (if it looks to sick to recover) and autopsied, or medicated appropriately. As a precaution, the house-mates of any sick bird should also be appropriately treated. Removal of sick or dead birds must be done immediately, since failure to act can result in the spread of disease and loss of an entire batch of chicks.

In the grow-out pen, the same procedure as in the brooder unit is carried out—daily feeding and watering and checking for sick birds.

In the breeding units, the birds are fed and watered **as** above and eggs are collected. Each egg is inscribed with a pencil according to date and breeder number (see Record Keeping), and eggs are stored at 10°C prior to incubation. If the breeding season is in progress, the cocks are transferred to new mates **every** 2-3 days.

Daily records must be maintained, in files, notebooks and/or on computer. Records should include:

1. history of breeding pairs (origin, age, sex, band number, pen number, etc.) (Figure 7); (If these remrds are kept in a database on computer, they can be accessed and listed by any chosen datum);

2. incubator records — number of eggs in, parents, due date for hatching, number of infertile eggs at candling, number of eggs hatching on each day, pipping without success or dead-in-shell (DIS), etc. (Figure 8);

3. deaths, sickness, autopsy, treatment, etc. (recorded in the comments section of the individual record sheet);

4. weather (extreme weather conditions may cause problems, e.g., overheating, high/low humidity, freezing, etc.) can be recorded on a **pad**-type daily calendar;

5. eggs collected from each pair of birds (calendar);

6. any unusual occurrences (calendar).

Bird Number: _____	**Sex:** M ❑ F ❑
Date of Birth: _____	Parents: Hen — Cock
Origin of Bird: Wild-Caught Hatched	Date of Capture: _____ Hatch Number: _____
Cage/Pen No: _____	Previous Cage/Pen(s) _____
Mate Number: _____	Comments: _____

Figure 7. Sample of a record sheet for a ptarmigan.

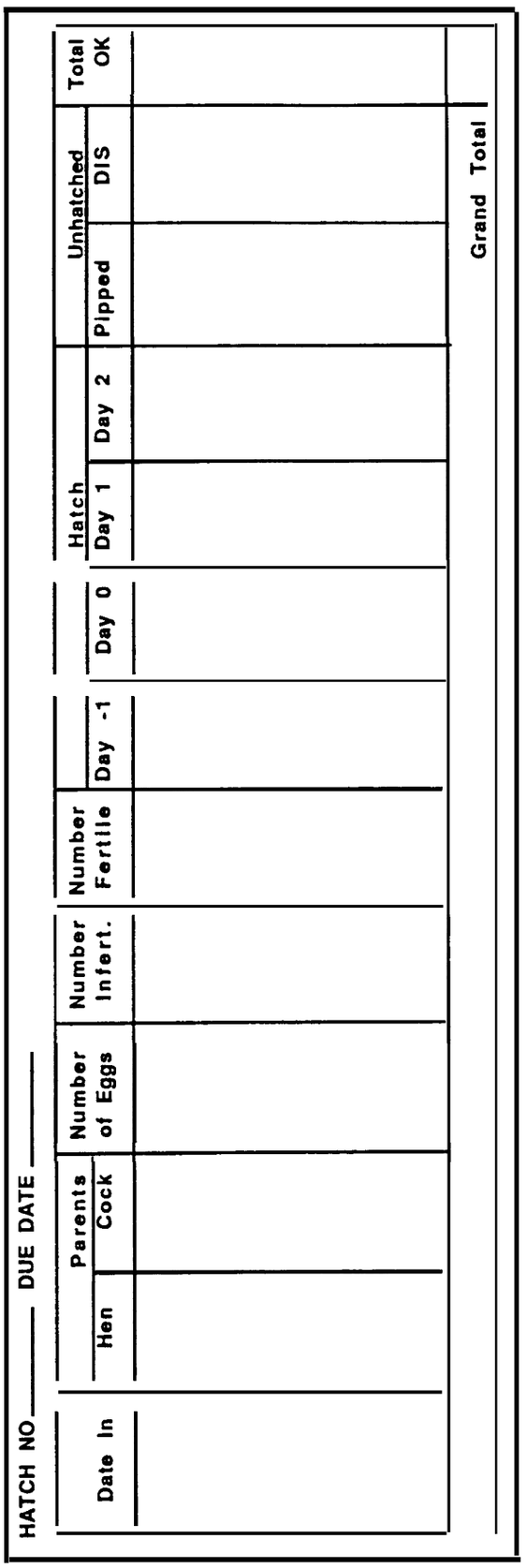


Figure 8. Sample of a hatch sheet.

Weekly Tasks

In addition to daily tasks, each week the droppings trays in all brooders and breeder pens must be cleaned and replaced, and outside runs cleaned of excess droppings. If moveable pens are involved, they should be moved to new ground, and the old ground cleaned and disinfected with lime.

It is also recommended that a sample of ten chicks be weighed once a week to monitor their growth and development. This will give good comparative data for future years, and will alert the operators to any abnormalities, due possibly to diet or disease.

Annual Tasks

In late summer and fall, breeding pairs may be placed in larger groups until the onset of breeding activities the following spring. However, it is stressed that the same birds should be paired for breeding every year in early spring, unless there is a good reason not to (e.g., death of one of the birds). Birds of similar aggressiveness are more compatible than an aggressive bird paired with a timid bird. Once a good pair combination has been found, it should be maintained year after year (Rivard pers. comm. 1990). In spring, birds must be separated before breeding behaviour begins, or the cocks (and sometimes the hens) will fight, sometimes killing one another.

When the incubators and hatchers are not in use, they should be thoroughly cleaned before storage. This consists of washing with soap and water and sterilizing by placing a dilute solution of formalin in the water trays and running the fan. During this process, fumes must be vented to the outside, as they are unpleasant and harmful to humans. All incubator trays must be washed with a strong disinfectant solution and dried prior to storing. Hatchers are similarly treated. The incubator room itself should be thoroughly cleaned-chicks produce a surprising amount of feather dust in the short time they are in the hatcher, as well as the broken shells and other effluvia from the egg. Thermostat wafers should be replaced annually.

After use, brooder and breeder units should be scrubbed, sprayed with disinfectant and stored in a dry place. Any damaged wire or other parts must be repaired or replaced prior to the new season.

PERSONNEL REQUIREMENTS

An experienced aviculturist will be required to initiate this project and train residents in Inuvik. Optimally, further experience for the former person should be provided by arranging for working visits to ptarmigan research centres in Scotland and Norway. The aviculturists should be available on a full-time basis from approximately April to July of the first year and intermittently therafter. That person's duties would include supervision of trailer installation, supervision of construction and installation of various pens and brooders, ordering necessary equipment, incubation of eggs, brooding of young and care of breeders.

A full-time technician trainee should be available from April to August and placed on a part-time basis thereafter. This person would resume full-time work in April of the following year.

COSTS

Capital Costs

Costs of major items of equipment and types of shelters, etc. are estimated at approximately $26,000 (Table 4). Cost estimates for pens and shelters include "on-site" construction costs in Inuvik.

Operational Costs

Table 5 lists estimated operational costs on the basis of maintaining breeding stock year round and seasonal production of young (i.e., from May to September or October). Rental of land for facilities has not been included, since the client has indicated that there is available land at no cost for flight pens and preliminary discussions with personnel of the Science Institute of the NWT suggest that trailers could be placed on their land at no cost. As shown, the majority of the operational costs involve rental of two ATCO trailers. We have investigated the costs of new units (approximately $17,500 for a standard 10' X 50' shell) in Edmonton and transportation costs to Inuvik ($4,500 each). Depending on funding support, it may be desirable to buy trailers. Purchase of trailers is strongly recommended if multi-year support is expected.

Table 4. Major equipment requirements and estimated costs FOB Inuvik, NWT.

Equipment/ Supplies	Description	No. Required	Unit Cost	Total cost
ATCO trailers		2	Rental is included in Operational Cost Estimates	
Fans	Ventilation for trailers	2	700"	1400
Brooders	Angle iron frame, insulated, aluminum siding, fibreglass window and roof	2	2500*	5000
Brooder Runs	Plywood, framework, wire mesh	2	300'	600
Breeding Pens	Plywood, framework, wire mesh	5	600'	3000
Flight Pens	6 X 6 X 2.5 m, pole frame, wire mesh covering	10	500"	5000
Incubators	Sportsman, wooden cabinet model 1250, including spare parts	2	1200	2400
Hatchers	Sportsman, wooden cabinet model 1250, including spare parts	1	950	950
Shelving	Standard	20 m	1 5/m	300
Tables	Folding	3	100	300
Desk	Standard	1	600	600
Sinks	Stainless steel	2	900	1800
Filing Cabinet	3-drawer	1	300	300
Storage Cabinet	4-shelf upright	1	200	200
Weighing Scale	Mettler Electronic Balance (±0.1 g)	1	2000	2000
Chick Feeders	Aluminum	20	6	120
Chick Waterers	Plastic	20	6	120
Adult Feeders	Galvanised	20	25	500
Adult Waterers	Galvanised	20	25	500
Miscellaneous				1000
Total				$26,090

•Cost includes materials and construction.

Table 5. Operational requirements and associated costs for a 12-month cycle, excluding personnel.

	Description	No. Required	Unit Cost	Total cost
ATCO Trailer	10 X 50 shell	2	1000/mo rental from Mackenzie Construction, I nuvik*	24,000
Heating fuel oil	Heating 1 trailer for 12 mo & 1 trailer for 2 mo		175/mo	2,100
Electricity			75/mo	900
Transportation			1500/yr	1,500
Communications	Telephone, FAX, copy, etc.		120/mo	1,440
Veterinarian costs			100/mo	1,200
Cleaning Brushes	Box of 50	1		50
Glassware	Assorted		200	200
Office Supplies	File folders, paper etc.		300	300
Cleaning Supplies	Soap, disinfectant, etc.		200	200
Medications, food additives, etc.			500	500
Miscellaneous supplies and operation costs			200/mo	2,400
Total				$34,790

*Includes maintenance and on-site set-up.

Feed Costs

Costs of feed were estimated on the basis of using 20 kg bags formulated in Missisauga, Ontario, by Ralston Purina and trucked to Inuvik. This information is listed in Table 6.

Table 6. Estimate of feed consumption and costs.

Diet	No. of Weeks	Kg/bird/ Week[1]	No. of Birds	Total kg Required	Total 20 kg Bags	No. Cost/ Bag[2]	Total cost
Chick	6	0.14	150	126	7	15.95	111.65
Maintenance							
Chicks	12	0.48	150	1008	50	10.50	525.00
Breeders	36	0.57	40	821	41	10.50	430.50
Breeder	16	0.57	40	365	19	12.50	237.50
				2320 kg			$1237.03
						Freight[3]	$1954.00
						Total	$3191.03

1 From pheasant diet estimates provided by Summers and Leeson (1985)
2 Estimated cost from Purina Feed Company
3 Based on estimate of $38.30/100 lb from points North Trucking, Edmonton

Unbagged bulk feed is considerably more economical to use than bagged feed, since it costs approximately 50% of the latter. However, bulk feed is only available in 2-3 tonne lots, which is considerably more than is needed for the present small demonstration project. Future reductions in feed cost per unit weight can be expected when larger quantities are required.

Personnel Costs

Personnel costs are outlined in Table 7.

cost Summary

A summary of the estimated costs of initiation of a ptarmigan gamefarming project in Inuvik is as follows:

Table 7. Estimate of professional and technical manpower costs.

Personnel	Apr	May	Jun	Jul	Aug	Sep	∞	Nov	151 d Dec - Mar	Total Time	Rate	Total Cost
Aviculturist	30	31	30	15	10	5	5	2	10	138	350/d	48,300
Senior Aviculturist	10	5	2	1		1		1	1	21	625/d	13,125
Technician	30	20	20	20	31	30	31			182d	150/d	
								90h 3h/d for 30 days	302h 2h/d for 151 days	392h	20/h	35,140
Total												$96.565

Capital Costs	-$26,000
Operational Costs (12 months)	‘ $35,000
Feed Costs (12 months)	$3,191
Personnel Costs	$96 565
	$160,756

While these costs are appreciable, it should be realized that a large proportion of the total cost of the project is associated with the cost of trailer rental ($24,000 of the operating costs) and technical expertise (about $60,000 of the personnel costs). Although these costs are necessary on a pilot project basis, they can be reduced or eliminated when initial problems and uncertainties are resolved. In addition, we believe that further investigation may reveal that used trailers are available in the Inuvik area, that can be purchased at a fraction of the rental costs used in this cost estimate.

Major Costs and Their Reduction over Time

While initiation of this project will involve appreciable costs, very large cost reductions are expected in subsequent years after the project is set up and expertise is established in Inuvik. In this regard, annual “maintenance” costs of an established ptarmigan demonstration project in Inuvik are roughly estimated at $20,000 per annum — $4,000-$5,000 for small capital expenditure and $15,000-$16,000 for operational disbursements. Personnel costs are exclude from this estimate, because the “owner-operator” is expected to make this contribution.

IMPLEMENTATION PLAN

To carry this study on to the next step, the following activities should be performed by the client or his representative in the near future.

Cooperative Arrangements

Preliminary discussions have indicated that the Science Institute of the Northwest Territories is interested in cooperative arrangements with the ptarmigan demonstration project and that space may be available at their facility in Inuvik for two trailers and some of the other project requirements. More detailed talks should be held and firm arrangements made. In particular, talks should determine if warehouse space is available for feed storage, or if any other type of housing is available for part or all of the year. If such space is available, there is a very good potential to reduce the number of trailers needed from two to one. This would reduce operation costs by over $12,000 per year and would be a very significant contribution.

Contact persons for the Science Institute of the Northwest Territories are as follows.

Dr. Doug Heyland Director Science Institute of the NWT Yellowknife, N.W.T.	(403) 873-7592
David Shearstone Director of Research Facilities Science Institute of the NWT Yellowknife, N.W.T.	(403) 873-7592
Gary White Director of Inuvik Research Centre Inuvik, N.W.T.	(403) 979-3838

Space for Facilities

The client has indicated that space has been arranged for flight pens in the Inuvik area. Preliminary discussions with the Science Institute of the NWT have indicated that space may be available (at no cost to the project) for trailer facilities adjacent to their research building in Inuvik. More detailed discussions should take place with appropriate representatives (see above).

Permits and Licences

Collection and keeping of native game birds is regulated by Department of Renewable Resources, Government of the Northwest Territories. Permits are necessary for :

1. Trapping wild ptarmigan or collecting eggs from wild ptarmigan nests; and
2. Keeping ptarmigan in captivity.

The contact person for these permits is:

Doug Stewart
Director, Resource Development and Conservation
Department of Renewable Resources, GNWT
Yellowknife, N.W.T. (403) 920-8716

The regional supervisor in Inuvik may also be contacted regarding these licences.

If ptarmigan are to be kept within the Inuvik city limits, a special permit to do so may be necessary. In this regard the municipal government should be contacted:

Bylaw Officer
Town of Inuvik
Inuvik, N.W.T. (403) 979-2607

Technical Training—European Expertise

The present study has documented that ptarmigan aviculture is in its infancy in North America, but that there has been a considerable interest in this subject in Europe, especially within the last 10 years. In addition, this study has shown that techniques of ptarmigan aviculture and gamefarming are presently rapidly evolving, but that, due to a number of problems (disease, nutrition, housing, breeding requirements) ptarmigan gamefarming cannot be contemplated without a relatively high level of expertise, close attention to detail and monitoring to solve basic problems in starting such initiatives.

While this study has obtained a wealth of information from European studies that have taken place within the past five years, much European technical expertise remains to be transferred to North American workers. It is strongly suggested that a priority in the implementation plan should be arranging for working visits to research institutions in Scotland and Norway for the client and/or his representatives. Appropriate contacts at these institutions are :

Robert Moss
Institute of Terrestrial Ecology
Banchory, Scotland, UK 44-33- 02-3434/8

John Ness
Department of Arctic Biology
University of Tromsø, Norway 47-7-94-40-22

Potential funding for such technology transfer is identified in further material.

Capture of Wild Ptarmigan

Wild ptarmigan or eggs from nests of wild ptarmigan are needed to initiate this project. Wild ptarmigan can be easily captured in late winter (i.e., March) and eggs are normally available in late May to June. Contact and discussions with biologists in Inuvik should be initiated to determine their level of support for this phase of the project. An optimal arrangement would be for Department of Renewable Resources to take the responsibility of supply of ptarmigan and/or eggs for the project.

Funding

This project is attempting to establish ptarmigan aviculture and gamefarming in the NWT so that, when techniques have been adequately developed, appropriate industries will follow. Gamefarmed ptarmigan could become significant as an import substitution product and as a product to satisfy local and distant gourmet markets.

Future support for this project should be available from a number of sources. The client or his authorized representatives should contact the following groups and organizations. This is a crucial stage in the continuation of this project.

Director (Position presently vacant)
Economic Development Agreement
Yellowknife, N.W.T. (403) 920-8744

Doug Stewart
Director, Resource Development and Conservation
Department of Renewable Resources, GNWT
Yellowknife, N.W.T. (403) 920-8716

John Best
Harvest Coordinator, Resource Development and Conservation
Department of Renewable Resources, GNWT
Yellowknife, N.W.T. (403) 920-6401

Sam Ranom
Director, Renewable Resource Development
Department of Economic Development and Tourism
Yellowknife, N.W.T. (403) 873-7391

Gerd Fricke
Renewable Resource Development Officer
Department of Economic Development and Tourism
Inuvik, N.W.T. (403) 979-7102

Craig d'Entremont
Industrial Technology Advisor
National Research Council Canada
Yellowknife, N.W.T. (403) 873-7592

Mr. d'Entremont administers programs **to help new,** developing industries solve technical difficulties so that they can enter the marketplace as viable businesses. In this regard, the ptarmigan pilot project appears to be a potential project for his involvement. The IRAP program of NRC could make a significant contribution toward initiation of the project in Inuvik. A Technology Inflow Program (TIP) also administered by Mr. d'Entremont could defray costs of a working visit to Scotland and Norway.

The Economic Development Agreement is currently expiring and negotiations within the federal government for a new agreement are in progress. Funds could be available from this source in the next fiscal year.

Mr. Doug Stewart administers a Demonstration Fund for Department of Renewable Resources. This fund is aimed at development of such activities as aquiculture, fur farming and game farming, and as such could be a potential **source of support** for the present project.

The Department of Economic Development and Tourism (Mr. Gerd Fricke in Inuvik) was instrumental in the initiation of the present effort. Continued support from this department should be solicited.

Personnel

Initiation of Phase Three of this project will require a full-time experienced aviculturist for the first several months and intermittent advice and guidance thereafter. Senior input may also be necessary. If the client desires, the authors of the present report would be available for these duties and can be contacted as follows:

Aaron Sekerak
Manager, Applied Environmental Services
Box 1148, Yellowknife, N.W.T. (403) 873-2090

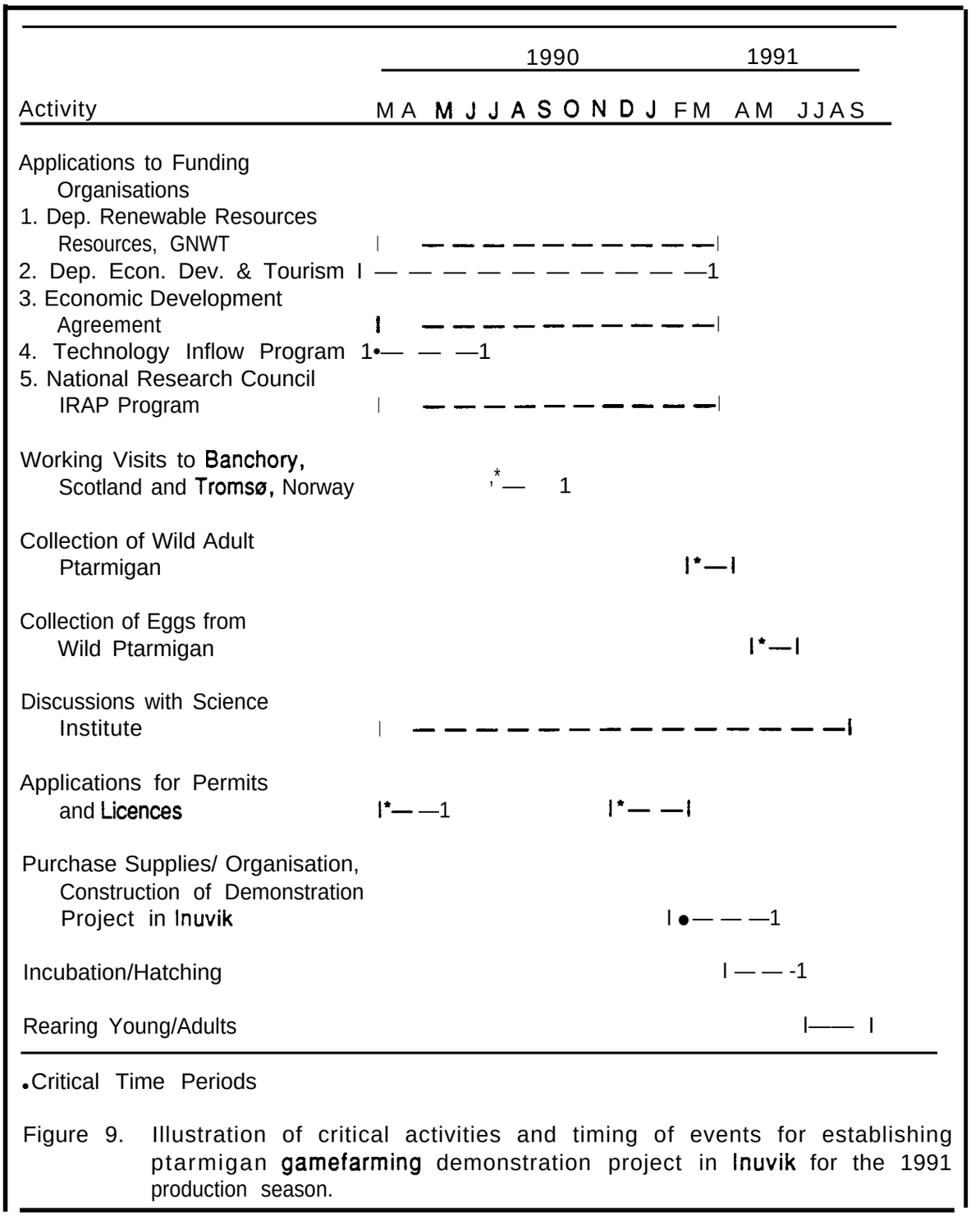
Nell Stallard
Assistant Manager, Vancouver Island Aviaries
Box 514, Saanichton, B.C. (604) 479-1889

A technical assistant hired in Inuvik would also be necessary.

Schedule and Milestones

Figure 9 illustrates and schedules the activities that must take place to successfully initiate a ptarmigan gamefarming demonstration project in Inuvik for the 1991 production season. Critical times, activities and milestones are appropriately indicated.

It should be recognised that considerable time is now available to apply for funding from a variety of organizations. This time must be be put to **good** use, especially in regard to support from the Technology Inflow Program for working visits to Europe. Other critical times are for collection of wild ptarmigan stock and initiation of the project by purchase, construction and organisation of supplies in Inuvik.



•Critical Time Periods

Figure 9. Illustration of critical activities and timing of events for establishing ptarmigan gamefarming demonstration project in Inuvik for the 1991 production season.

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