Arctic Goose Joint Venture

Summary of Project Proposals From Canada

Arctic Goose Joint Venture
Coordination Office
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Environment Canada | Environnement Canada
Canadian Wildlife Service | Service canadien de la faune

Canada

Arctic Goose Joint Venture: summary of project proposals from Canada.

INTRODUCTION

This document is a compendium of projects proposals and progress reports received by the Arctic Goose Joint Venture Coordination office at the Prairie and Northern Wildlife Centre, Canadian Wildlife Service, Saskatoon. It's purpose is to pull together and summarize individual submissions from Canadian sources for proposed investigations on Arctic-nesting geese. It reflects the Canadian perspective on research requirements, and is intended to provide a framework for discussion at the Arctic Goose Joint Venture meeting in Corpus Christi, Texas, January 26-30, 1991. It should provide a vehicle for integrating Canadian research priorities with ongoing and proposed work on Arctic-nesting geese in the United States.

Also included are summaries of projects for which proposals or progress reports were not submitted, but for which funding requirements were estimated based on 1990 costs. Each project has a project reference number. Most projects were reviewed and discussed by the Canadian Arctic Goose Group (CAGG) on November 1-2, 1990 in Saskatoon. This group included (a) CWS personnel involved in research and monitoring of various goose populations, representatives from (b) the provinces, territories, and from (c) conservation organizations in the private sector, and (d) researchers from Canadian universities. Most proposals were reviewed by the CAGG, but some were received by the AGJV Coordinator only after the November meeting.

Costs and funding for Arctic Goose projects have been summarized by activity and by species for 1990 projects and work proposed for 1991.

TABLE OF CONTENTS

SUMMARY OF PROJECT PROPOSALS FROM CANADA RECEIVED BY AGJV COORDINATION OFFICE, SASKATOON

PROJECT REFERENCE No.	TITLE		PG No. REP.[4]	PG No. PROP.[5]	REVIEW[2] by CAGG	YEAR[3] START	FUNDING FOR 1991[1] (x $1,000) 1991 COSTS[6]	SECURED FUNDS	SHORT-FALL
1	Distribution and survival of White-fronted and Canada Geese from the Canadian Western Arctic.	Hines	121	15	YES	1990	65.0	0.0	65.0
2	Distribution and survival of Geese.	Kerbes	121	NA	YES	1990	97.0	0.0	97.0
3	West Hudson Bay Tall Grass Prairie Canada Goose banding.	Caswell	121	NA	YES	1987	34.0	0.0	34.0
4	Baffin Island Tall Grass Prairie Canada Goose banding.	Caswell	121	NA	YES	1990	50.0	0.0	50.0

[1] in Canadian currency; costs are for 1991 field season; see individual projects for details on budgets.

[2] indicates which projects were discussed and endorsed by the Canadian Arctic Goose Group meeting held in Saskatoon, November 1-2, 1990. NO signifies that proposal was received by AGJV Coordinator after November 2, 1990.

[3] year in which project has been or will be initiated.

[4] page number where progress report can be found; NA signifies that no progress report was received for this meeting.

[5] page number where project proposal can be found; NA signifies that proposal was not received for this meeting.

[6] for thoses projects with no proposal available, project costs were based on 1990 requirements.

5	Distribution and survival of geese in the west-central arctic.	Bromley	131	NA	YES	1987	67.0	0.0	67.0
7	Coordination and Monitoring of marked geese in the USA.	Kerbes	121	NA	YES	1990	85.0	0.0	85.0
8	Distribution and abundance of White-fronted Geese in the Inuvialiut Settlement Region	Hines	NA	21	YES	1989	42.0	0.0	42.0
10	Population Biology of central arctic Geese	Alisauskas	NA	31	YES	DELAY TO 1991	156.6	100.1	55.9
		McKelvey	NA	35	YES	1990	33.0	0.0	33.0 25
* 11	Snow Goose population data acquisition	Alisauskas	158	39	YES	1990	115.6	38.9	76.7
12	Distribution and abundance of geese in the Queen Maud Gulf Migratory Bird Sanctuary.	Reed	145	42	YES	1988	143.0	108.0	35.0
13	Greater Snow Geese on Bylot Island: feeding ecology and habitat relationships.	Reed	152	47	YES	1990	33.5	10.0	23.5
14	Greater Snow Geese in the St. Lawrence estuary: Population monitoring and habitat relationships.	McKelvey	NA	51	YES	1990	12 35.0	0.0	35.0 12
* 15	Quality and quantity of habitat used by Snow Geese wintering on the Fraser River Delta.						108.5	72.0	36.5
		Reed	155	53	YES	1990	100		10.0
16	Goose studies in James Bay, Quebec.	McKelvey	NA	NA	YES	1990	9.0	0.0	9.0
* 17	Snow Goose harvest study.	McKelvey	NA	57	YES	1990	18.0 35	0.0	0.0 +18 May - July
* 18	Population turnover rates and locations of critical habitats for Brant migrating along the British Columbia coast.	Brace	NA	NA	YES	1990	30.0	0.0	30.0
19	Arctic Goose Joint Venture Coordinating Office.	Alisauskas	NA	61	YES	1991	90.0	51.0	39.0
20	Effect of habitat degradation on growth and survival or Ross' and Lesser Snow Goose goslings at Karrak Lake, Queen Maud Gulf Migratory Bird Sanctuary, NWT.								
21	Effect of neckbands on survival of White-fronted Geese from Queen Maud Gulf Migratory Bird Sanctuary.	Alisauskas	158	65	YES	1991	58.0	19.4	38.6

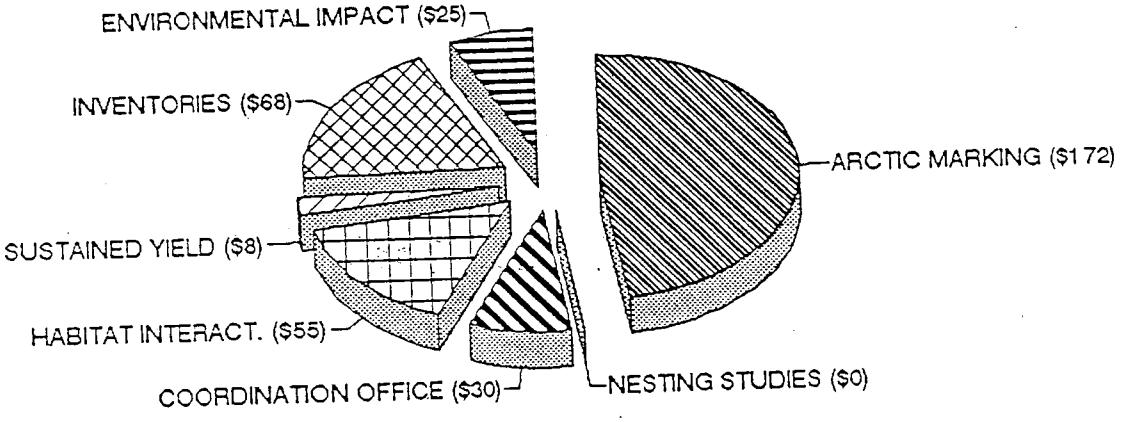
22	Habitat mapping of the Queen Maud Gulf Migratory Bird Sanctuary.	Ferguson	NA	70	YES	1991	84.1	47.8	36.3
23	Spring nutritional ecology of White-fronted and small Canada Geese nesting in Queen Maud Gulf Migratory Bird Sanctuary.	Alisauskas	NA	73	YES	1991 OR 1992	46.2	0.0	46.2
24	Marking of White-fronted Geese at Inglis River, NWT.	Kerbes	NA	76	YES	1991	25.0	0.0	0.0
25	Brood ecology of Canada and White-fronted Geese on the Kent Peninsula, NWT.	Bromley	NA	79	YES	1991	48.0	0.0	48.0
26	Habitats and populations of Pacific Brant in the Canadian western arctic.	Hines	NA	84	NO	1991	203.4	0.0	203.4
✓ * 27	Aerial surveys for geese and swans and banding of Greater White-fronted Geese on Old Crow Flats, Yukon.	Hawkings	NA	96	YES	1991	25.8	0.0	~~25.8~~ 56
28	Movements of Greater Snow Geese in spring.	Giroux	NA	102	NO	1991	68.3	31.7	36.6
29	The LaPerouse Bay Snow Goose Project	Cooke	NA	112	YES		NA	-	-
✓ * 30	Assessment of Habitat use and movements of Wrangel Island LSG.	Boyd	NA	117	NO	1991	17.0	-	17.0

16 + 5 cap

1990 allocation of CWS AGJV funds to

Arctic Goose projects, by activity

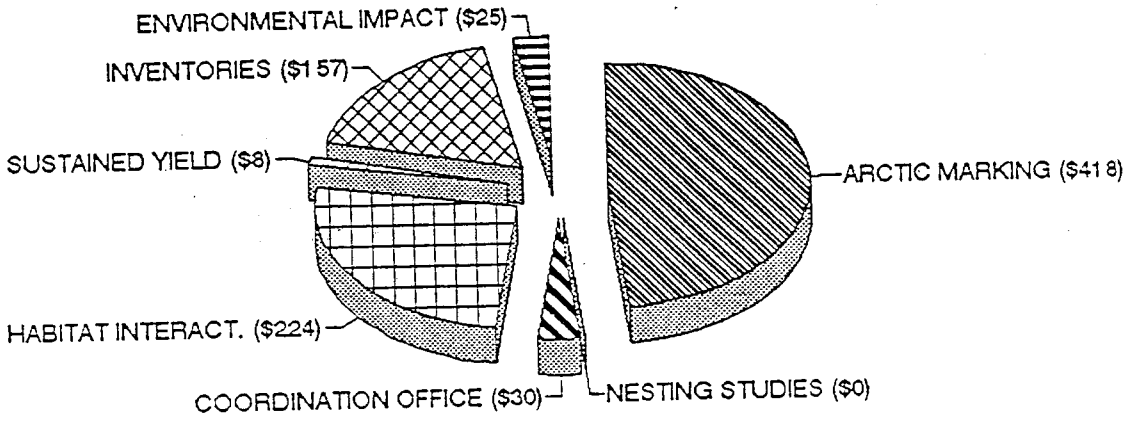
thousands of dollars (Canadian currency)



1990 allocation of all contributions to

Arctic Goose projects, by activity

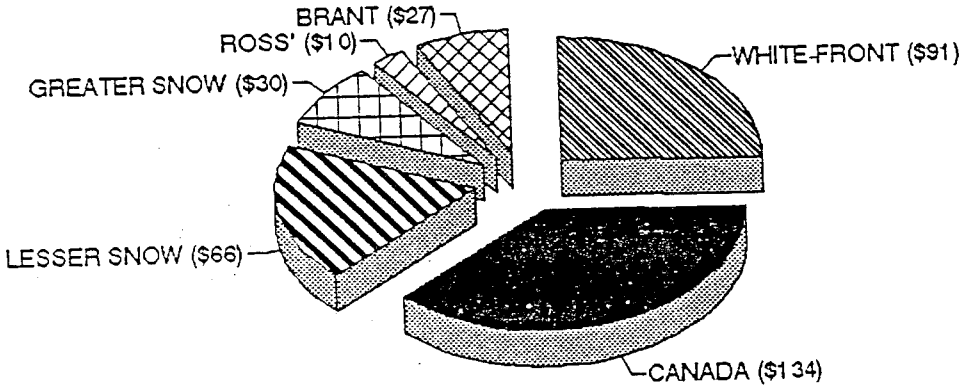
thousands of dollars (Canadian currency)



1990 allocation of CWS AGJV funds to

Arctic Goose projects, by species

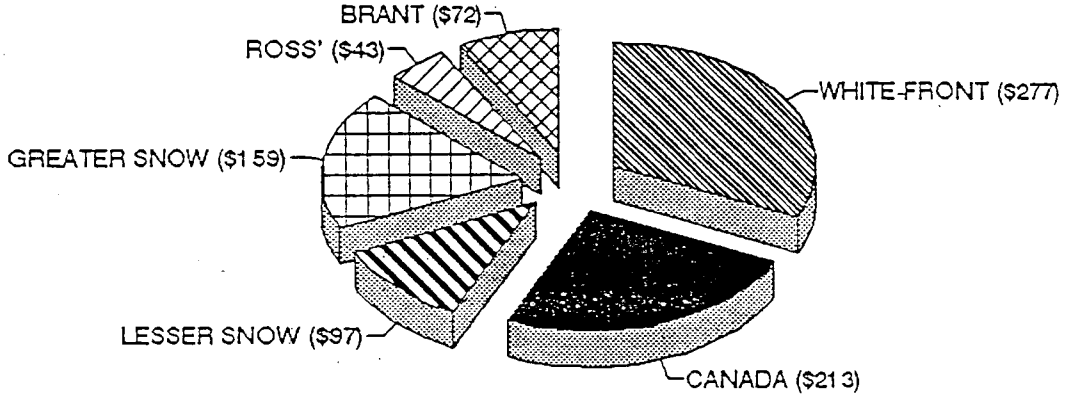
thousands of dollars (Canadian currency)



1990 allocation of all contributions to

Arctic Goose projects, by species

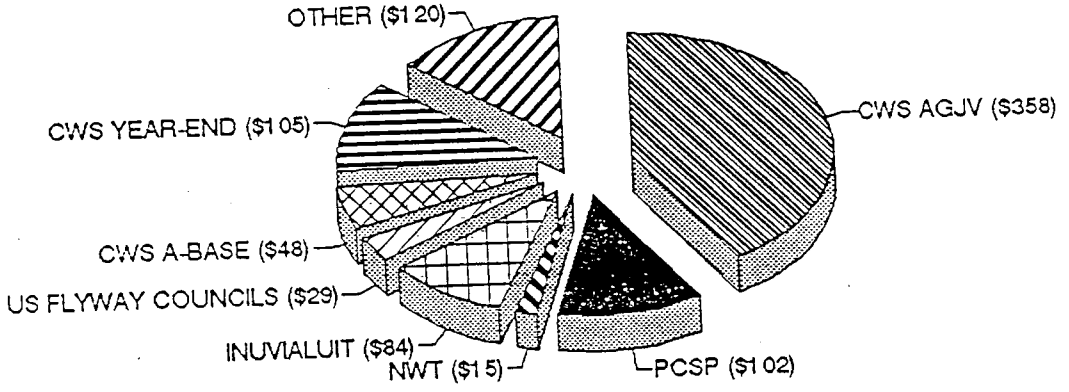
thousands of dollars (Canadian currency)



Sources of funds for total allocations

to Arctic Goose projects, 1990.

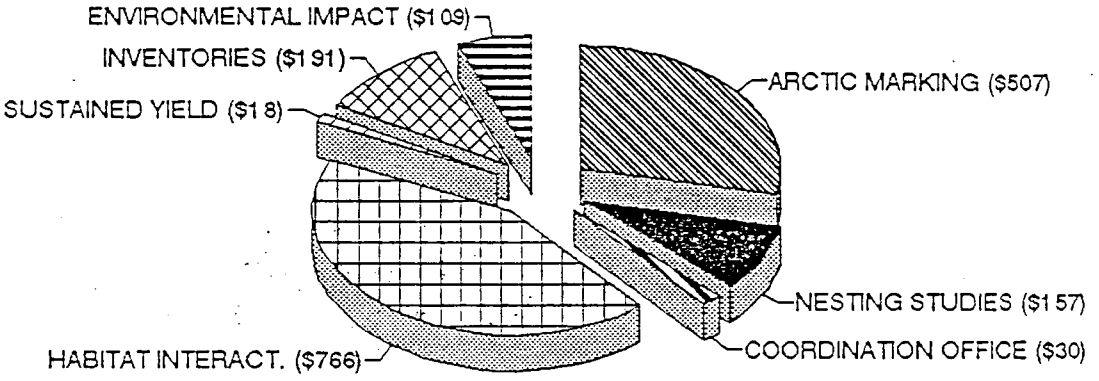
thousands of dollars (Canadian currency)



Cost of Arctic Goose project proposals

for 1991 summarized by activity

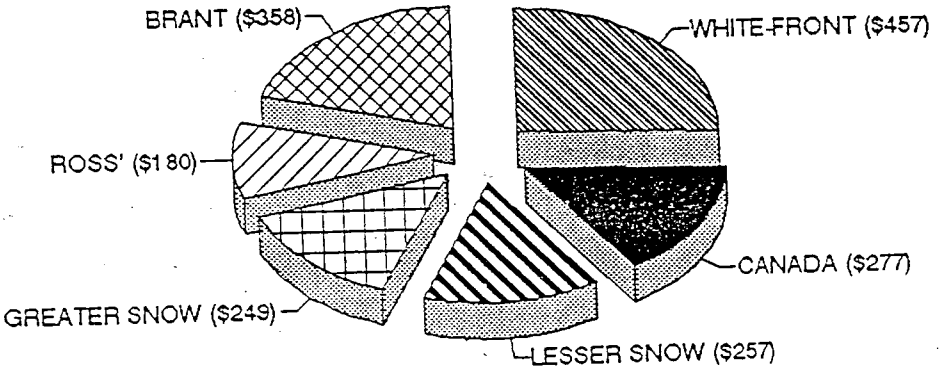
thousands of dollars (Canadian currency)



Cost of Arctic Goose project proposals

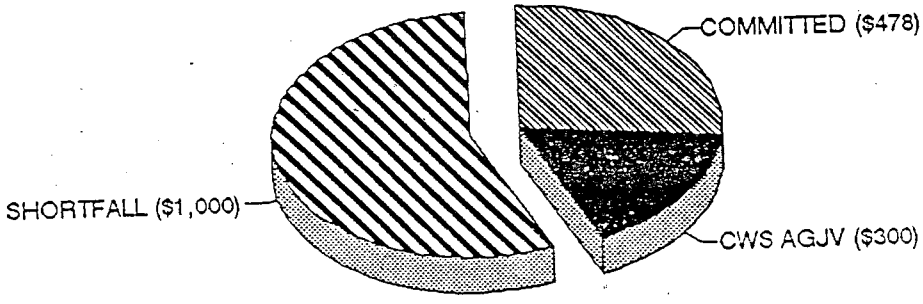
for 1991 summarized by species

thousands of dollars (Canadian currency)



Funding of 1991 Arctic Goose projects
in Canada

thousands of dollars (Canadian currency)



ARCTIC GOOSE JOINT VENTURE PROPOSAL: DISTRIBUTION AND SURVIVAL OF WHITE-FRONTED GEESE AND CANADA GEESE FROM THE CANADIAN WESTERN ARCTIC

January 1991

Canadian Wildlife Service
Western and Northern Region
Yellowknife, Northwest Territories

DISTRIBUTION AND SURVIVAL OF WHITE-FRONTED GEESE AND CANADA GEESE FROM THE CANADIAN WESTERN ARCTIC

Background and Justification

Although Greater White-fronted Geese (Anser albifrons) are important to subsistence hunters in northern Canada and to sport hunters and naturalists farther south, basic management-related data concerning the population attributes, ecology, and habitat of this species are lacking. Current information about white-fronts is not only inadequate, but in many instances, it is contradictory. For example, annual harvests of white-fronts in most years far exceed the sustainable kills expected from estimates of winter population size (SEIS 88). With increasing demands placed on white-front populations, these geese cannot be managed on the basis of such inadequate data. As a result, white-fronted geese have been given the highest priority for management studies as part of the Arctic Goose Joint Venture (AGJV).

Canadian concerns are centered around the Mid-continent Population of white-fronted geese, which nests in the western and central arctic and stages in the prairie provinces (Figure 1). The particular knowledge deficiencies which must be addressed for successful management of this, and other populations of white-fronted geese fall into six general categories (McLandress 1984, Arctic Goose Scoping Committee 1986, Dzubin 1987): (1) population size; (2) habitat; (3) distribution during breeding, migration, and wintering seasons; (4) causes and rates of mortality; (5) productivity; and (6) harvest.

The need for a coordinated banding effort across the breeding range of the mid-continent population, in order to provide information about distribution, mortality, and harvest, has been emphasized by several management agencies (e.g., Ladd 1989). To this end, major banding and neck-collaring studies are now under way in Alaska the Canadian Arctic.

The fall and winter distribution, and annual survival/mortality rates of Canada Geese from the Short-grass Prairie Population are poorly understood. In the Western Artic,

Canada Geese frequent many of the same areas as white-fronted geese, and are readily captured during banding drives. Given the lack of information about the Short-grass Prairie geese, it is appropriate to band and neck-collar Canada Geese as an additional goal of the study.

Objectives

Specific objectives of the proposed study are similar to those indicated by Pospahala (1989):

(1) Determine the distribution of white-fronted geese and Canada geese from the western arctic on staging areas and wintering grounds, and the temporal and seasonal distribution of the harvest of geese from the region;

(2) Determine the degree of mixing of geese between breeding areas; and,

(3) Determine mortality rates of white-fronted geese from the western arctic;

(4) Obtain an independent mark-recapture estimate of the mid-continent population of white-fronted geese.

Methods

Flightless geese will be captured by helicopter "drives" (Timm and Bromley 1976), banded with standard USF&W Service bands, and colour-marked with plastic neck-collars. (The observations on wintering areas and staging areas will be conducted as a separate program under the AGJV). Flightless non-breeding adults will be banded during mid-summer, and young birds and successful breeders will be banded later in the summer. A minimum of 500 adult geese of each species, and as many young of the year as possible, will be the banding goal for each year of study.

To obtain useful data, the investigation should be conducted for a 5-year period. The present proposal is for the first and second years of study only but, as the AGJV comes into place, additional sources of funding can be considered. In future years, the program can be modified to include areas outside the Inuvialuit Settlement Region and to increase the intensity of the banding or reobservation programs if necessary.

This investigation will be closely integrated with ongoing studies of waterfowl in the Inuvialuit Settlement Region including the inventory of white-fronted goose populations supported by the Inuvialuit and CWS. Logistics will be simplified, costs significantly reduced, and the overall quality of the results greatly enhanced by coordinating all projects.

Study Area

The initial study area will be the Mackenzie Delta-Tuktoyaktuk Peninsula-Liverpool Bay area of the Inuvialuit Settlement Region. The area is characterized by abundant wetlands, patterned ground, and lush low arctic tundra that supports abundant waterfowl populations (Barry 1967, Alexander et al. 1988, Johnson and Herter 1989). The study area comprises an important part of the breeding range of mid-continent white-fronts (Figure 1) and the geese breeding and moulting in this area are an important source of food for the local people (Inuvialuit).

Some of the potential banding sites in the region include the Anderson River delta, Harrowby Bay, Campbell Island, the delta of the Smoke and Moose rivers, and the Big Lake-Mallik Bay area of the MacKenzie Delta.

Outputs

(1) Annual progress reports on the distribution and mortality of white-fronted geese and Canada geese from the region (by 1 February 1992-95).

(2) Final report and journal publication of results on distribution and mortality of white-fronted geese and Canada geese (1995).

(3) Evaluation of mark-recapture estimates of population size (1995).

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ALEXANDER, S.A., T.W. BARRY, D.L. DICKSON, H.D. PRUS, and K.E. SMYTH. 1988. Key areas for birds in coastal regions of the Canadian Beaufort Sea. Canadian Wildlife Service, Edmonton, Alberta.

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Personnel

The principal investigators for the project are Jim Hines, Population Biologist and Mike Fournier, Population Technician, both of Canadian Wildlife Service, Yellowknife, Northwest Territories. Both investigators will be involved in all aspects of the project.

Budget

The annual O&M budget is $65 K and the personnel requirements for the study are 0.4 PY. The total commitment over the next four years will be $260 K and 1.6 PY. Support for the study is being requested through Inuvialuit Implementation Funding and the Polar Continental Shelf Project (Energy, Mines, and Resources Canada).

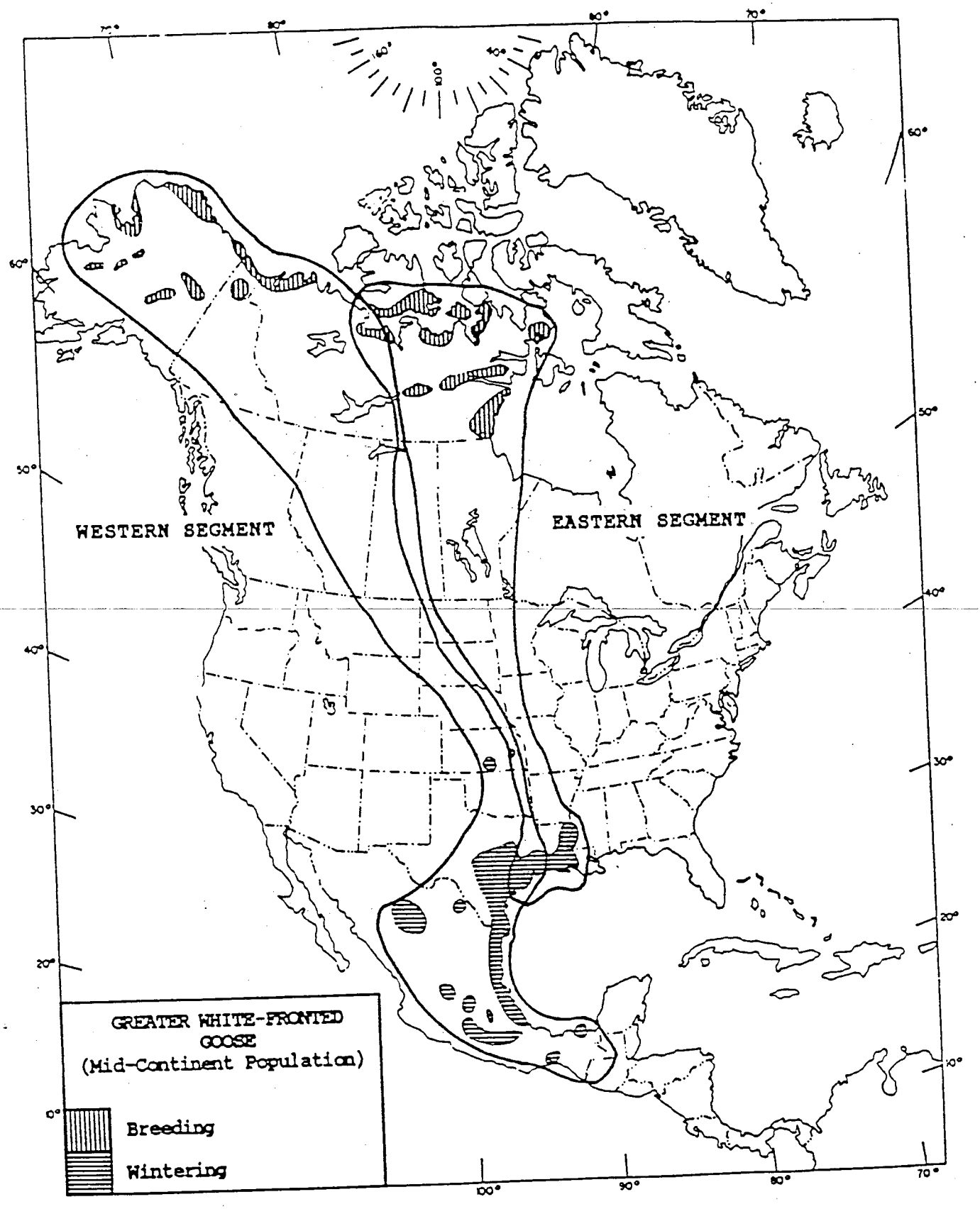

FIGURE 1. Approximate breeding and wintering distribution of the Mid-continent Population of Greater White-fronted Geese.

ARCTIC GOOSE JOINT VENTURE PROPOSAL: DISTRIBUTION AND ABUNDANCE OF WHITE-FRONTED GEESE IN THE INUVIALUIT SETTLEMENT REGION (CANADIAN WESTERN ARCTIC)

January 1991

Canadian Wildlife Service
Western and Northern Region
Yellowknife, Northwest Territories

Background and Justification

Greater white-fronted geese (Anser albifrons) are important to subsistence hunters in northern Canada as well as to sport hunters and naturalists farther south. Despite the apparent socio-economic value of the whitefront, the ecology of the species is poorly understood, and a sound information base on which to build management plans is lacking. Recently concerns have been expressed about the Mid-continent Population of white-fronted geese, which nests in the western and central arctic and stages in the prairie provinces (Figure 1). As a result of these concerns, the species has been given the highest priority for future management studies as part of the Arctic Goose Joint Venture.

The Inuvialuit Final Agreement (IFA 1984) guarantees that the native people of the western Canadian arctic have preferential access to the allowable harvest of white-fronted geese and other waterfowl in their land-claim settlement region. In order to responsibly manage the harvest of white-fronts, it is essential to understand a number of population attributes including goose numbers, productivity, mortality, and habitat affinities during breeding, migration, and wintering seasons (McLandress 1984, Arctic Goose Scoping Committee 1986, Dzubin 1987). Although the Inuvialuit Settlement Region is known to be important to white-fronted geese (Barry 1967, Alexander et al. 1989), the abundance of geese in the area needs to be determined so that allowable harvests can be set.

Information on breeding populations of white-fronted geese is valuable from a continental viewpoint as well as from a regional perspective. The current mid-winter surveys used to estimate white-front populations produce variable and less than reliable results. In the long run, breeding ground surveys may prove to be a useful management tool for goose populations, just as they are for ducks.

Although white-fronted geese will be emphasized in this study, the project will provide useful information on the distribution and abundance of other species of waterfowl, particularly tundra swans (Cygnus columbianus) and Canada geese (Branta canadensis).

Objectives

(1) Estimate the number of white-fronted geese in the Inuvialuit Settlement Region and the distribution of geese within the region.

(2) Estimate numbers and distribution of tundra swans and Canada geese in the mainland portion of the Inuvialuit Settlement Region.

(3) Determine annual population trends of white-fronted geese in the Inuvialuit Settlement Region.

Methods

Aerial surveys, modified after the methods used for estimating breeding populations of ducks in North America (Anonymous 1987), have been used to count geese and swans in the region for the past two years (Hines et al. 1990). The surveys are conducted during mid-June when the geese and swans are widely dispersed as breeding pairs. A Bell 206B helicopter is flown along straight transects at an elevation of approximately 45 m and a ground speed of 80 km/hr. Observations of all geese and swans sighted within 200 m of the helicopter are recorded on tape and transcribed within one or two days of the survey.

Transects are oriented in a North-South manner. Most are spaced at 10-km intervals, although a few are located only 5 km apart in potentially "good" habitats where it is desirable to sample more intensively. About 5% of the total area is sampled each year.

Transect lengths vary according to the width of the study area, averaging about 35 km in length. Each transect is divided into 2-km segments which serve as a basis for recording data. The helicopter pilot is responsible for navigating the aircraft and informing the two observers (one seated in the left front seat, one seated in the right rear seat) of the current segment number.

As a concession to unpredictable weather conditions, timing of surveys varies from 0800 to 1800 hrs. In general, we attempt to carry out surveys only when winds are less than 25 km/hr and the ceiling exceeded 150 m as recommended by Butler et al. (1987, 1988).

In past years, these specifications have been exceeded on one or two transects due to the vagaries of the arctic weather, logistic constraints, and the high costs of conducting helicopter surveys. It is doubtful that the minor violations of survey protical had any significant effect on the overall results.

Estimates of total numbers and the number of "indicated" breeding pairs of geese and swans are computed for each transect. For Tundra Swans, which are highly visible and are not apt to be missed during surveys, all sightings of one or two birds are summed and then divided by two to give the number of indicated breeding pairs on the transect. Female Canada Geese are seldom seen from the air if they are on nests; therefore, each observation of one or two Canada Geese is treated as an indicated breeding pair. The number of breeding pairs of white-fronted geese is computed in two different ways: (i) each sighting of one or two geese is treated as an indicated breeding pair (the same as for Canada Geese), and (ii) each sighting of 1-5 geese is treated as an indicated breeding pair. The rationale for the second method is that young white-fronted geese (i.e., non-breeders hatched the previous year) may remain with the breeding adults well into the nesting cycle (Barry 1967).

Stratification, the division of a heterogeneous population into homogeneous sub-populations, allows one to look at regional or habitat-related variations in population density and tighten the confidence limits for population estimates. For these reasons, the study area is stratified into several major physiographic regions. Average population densities ($\pm$ standard errors) are determined for each stratum, as is an estimate of the mean ($\pm$ SE) for the stratified sample (Snedecor and Cochran 1967:520). Because of unequal transect lengths, the ratio method for estimating means and variances is applied to the individual strata (Jolly 1969).

Not all waterfowl present on transects are sighted during aerial surveys. In order to produce accurate population estimates, it is necessary to calculate sightability correction factors by comparing ground counts to air counts. Parts of transects will be "re-sampled" more intensively by flying the helicopter back and forth accross the transect at

lower elevations (< 25 m) and lower flight speeds (30 km/hr) in an attempt to count all geese and swans present. The results for the regular and intensified counts will be compared to develop the correction factors.

This investigation will be closely integrated with ongoing studies of waterfowl in the Inuvialuit Settlement Region including a remote-sensing study of migratory bird habitat in the Kendall Island Bird Sanctuary, and the banding collaring program for white-fronted geese and Canada geese. Logistics will be simplified, costs significantly reduced, and the overall quality of the results greatly enhanced by coordinating all projects.

Study Area

An area of more than 25,000 km^2 will be surveyed during this investigation. Emphasis during the first two years of study was placed on the Mackenzie Delta, Tuktoyaktuk Peninsula, and Liverpool Bay areas of the Inuvialuit Settlement Region (Figure 2) as previous investigations indicated that the areas were important to waterfowl, particularly white-fronted geese (Barry 1967, Alexander et al. 1988, Johnson and Herter 1989). The geese breeding and moulting in this area are an important source of food for the local people and make a significant contribution to the North American population of white-fronted geese (Bellrose 1976:103).

The study area lies within the Arctic Coastal Plains physiographic region (Bostock 1970), and is characterized by a variety of landscapes (Mackay 1963). Drainage is greatly impeded by the presence of permafrost throughout the area and the low relief along the coast. Thus, wetlands (high and low center polygons, fens, marshes, and shallow water) cover 25-50% of the area (National Wetlands Working Group 1988). Plant communities are typical of the Low Arctic with dwarf shrubs and lichens prevailing on upland sites, thickets of willow (Salix spp.) and dwarf birch (Betula) existing on slopes and along the edges of rivers and streams, and sedge (Carex) - cottongrass (Eriophorum) tundra most frequent in the lowlands. In the southern part of the survey area, spruce (primarily Picea glauca) reaches its northern limit, and shrubby willows, birches, and alders (Alnus) are frequent. Further details on the

vegetation of the region are presented by Mackay (1963) and Corns (1974) and the numerous references cited therein.

Outputs

(1) Annual progress reports on the distribution and abundance of white-fronted geese, Canada geese, and tundra swans in the Inuvialuit Settlement Region (by 1 February 1992-95).

(2) Final report and journal publication of the above results (1995).

(3) An evaluation of breeding ground surveys as a tool for long-term population monitoring of white-fronted geese (1995).

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Personnel

The principal investigators for the project are Jim Hines, Population Biologist and Mike Fournier, Population Technician, both of Canadian Wildlife Service, Yellowknife, Northwest Territories. Both investigators will be involved in all aspects of the project.

Budget

The annual O&M budget is $42 K and the personnel requirements for the study are 0.4 PY. The total commitment over the next four years will be $168 K and 1.6 PY. Support for the study is being requested through Inuvialuit Implementation Funding and the Polar Continental Shelf Project (Energy, Mines, and Resources Canada).

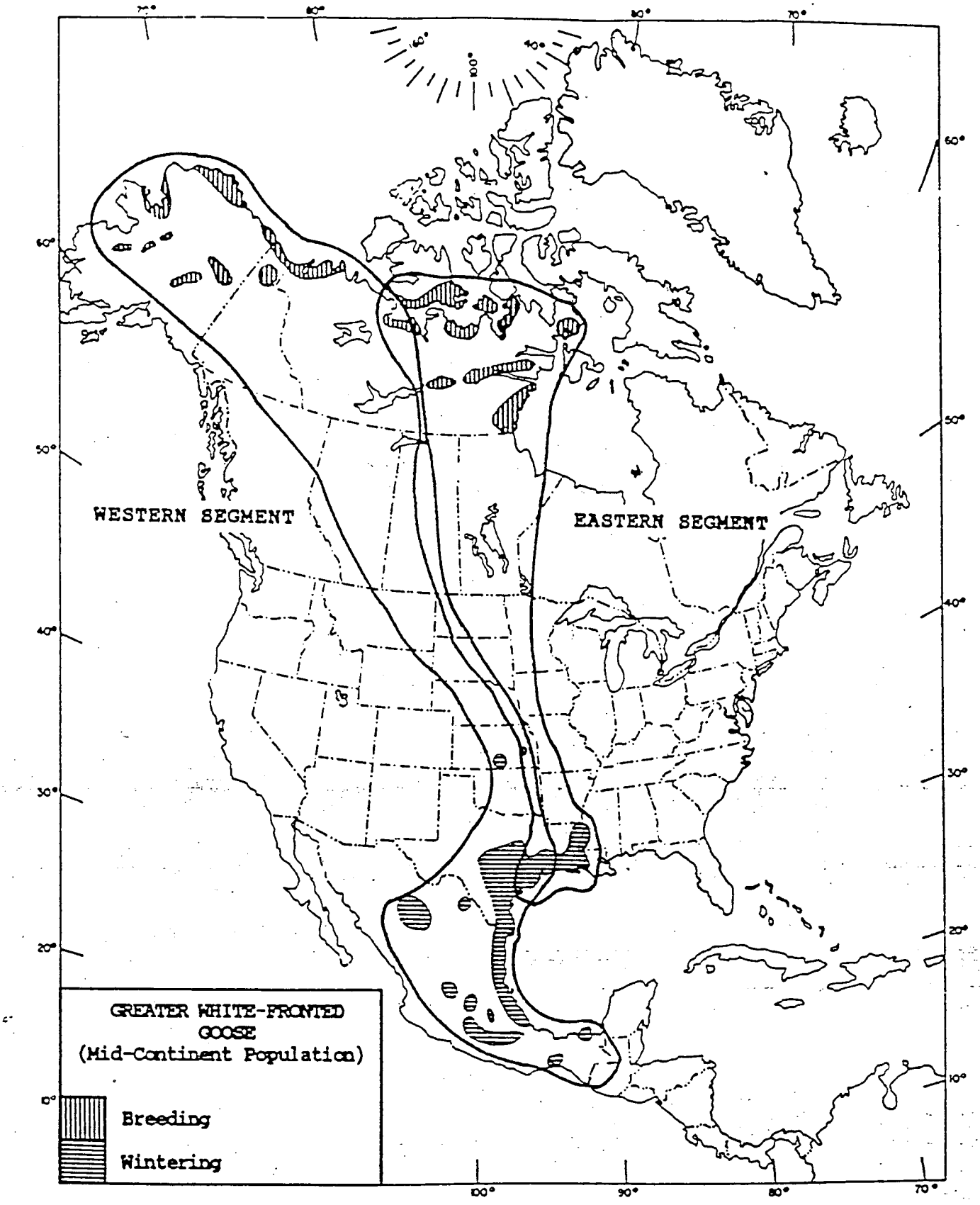

FIGURE 1. Approximate breeding and wintering distribution of the Mid-continent Population of Greater White-fronted Geese.

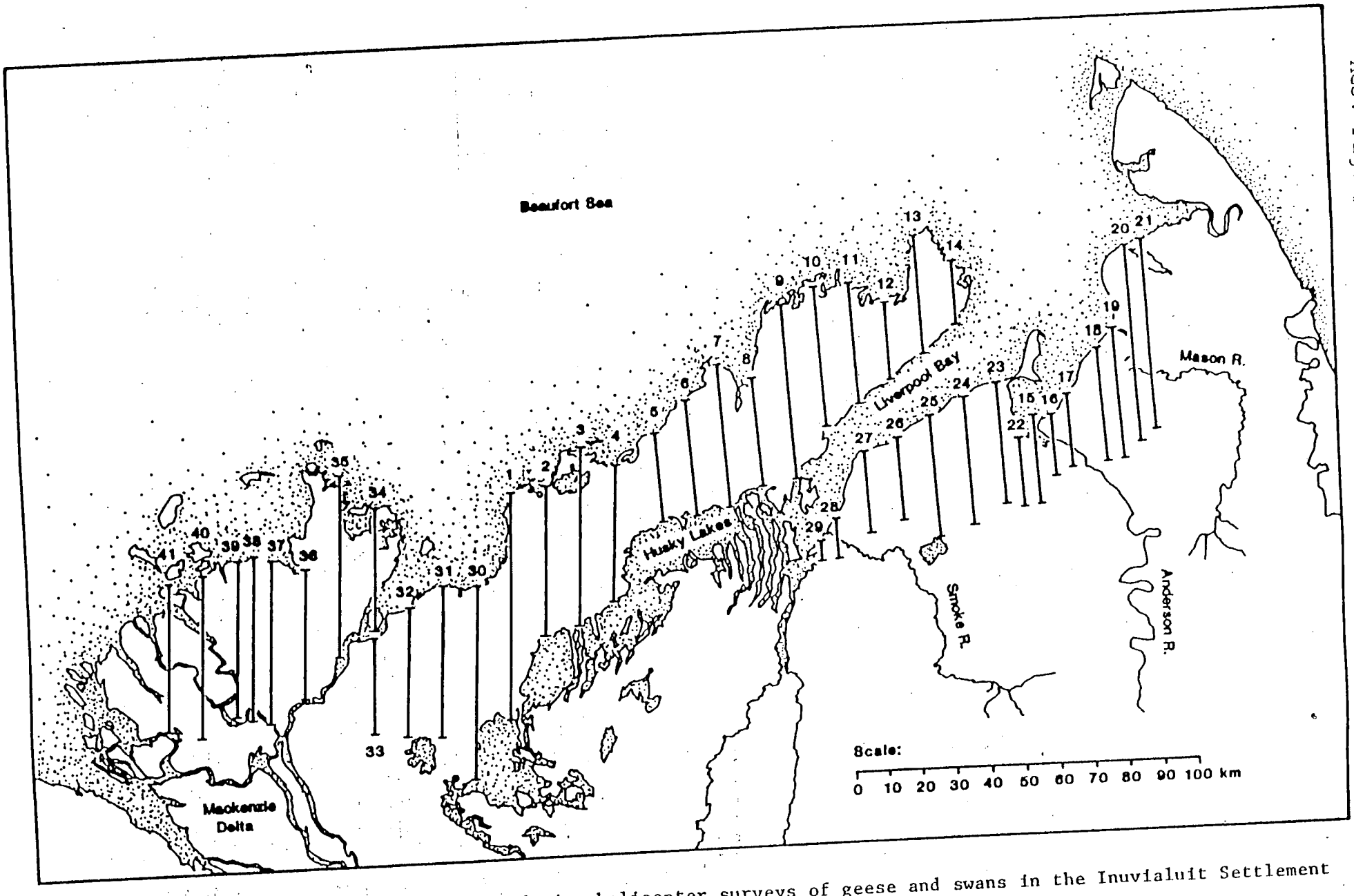

FIGURE 2. Locations of transects flown during helicopter surveys of geese and swans in the Inuvialuit Settlement Region, Northwest Territories, 1989.

POPULATION BIOLOGY OF CENTRAL ARCTIC GEESE

PRINCIPAL INVESTIGATOR: *Ray T. Alisauskas*, Research Scientist, Canadian Wildlife Service, Prairie and Northern Wildlife Centre, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4, (306) 975-4556, FAX (306) 975-4089.

BACKGROUND: Published descriptions on the nesting grounds of Ross' Geese were unavailable until the 1940's (Gavin 1940). Basic natural history and breeding biology of Ross' Geese were unknown until Ryder (1967, 1972) conducted pioneering work in the Queen Maud Gulf Mainland of what is now a migratory bird sanctuary. McLandress (1982) conducted research on nest spacing of Ross' Geese for a single season in 1976. Other than these studies, there has been no attention to events affecting productivity by Ross' Geese. Ross' Geese are currently the only species covered by the Arctic Goose Joint Venture which is not receiving long-term monitoring during the nesting season.

Ross' Geese have increased in numbers in recent years, but associated with that increase has been an even greater increase in the numbers of Lesser Snow Geese nesting in association with Ross' Geese (Kerbes pers. comm.). Basic information about population biology such as age at first reproduction, annual variation in clutch size, and production of goslings is unknown. There is no information about factors which affect productivity and numbers of Ross' Geese. Finally, there is no knowledge of impacts that rapidly increasing populations of Lesser Snow Geese will have on the global population of Ross' Goose population, with which they increasing nest in association.

JUSTIFICATION: The Arctic Goose Joint Venture calls for greater knowledge about factors throughout the annual cycle that influence population size of arctic nesting geese. Also listed in the AGJV Prospectus is a need to better understand various aspects of disease transmission and natural sources of mortality. Scant attention has been directed at events (such as during spring migration or during brood rearing) as they affect demographic parameters of North American goose populations. This has especially been true for Ross' Geese.

Long-term attention of events during the nesting season exists for four of the five goose species listed in the Arctic Goose Joint Venture. Unlike Brant, White-fronted Geese, Canada Geese, and Snow Geese (Lesser and Greater), nesting Ross' Geese are currently not receiving research attention. There is no database from current nesting ground studies that link banded samples of birds to nesting locations for Ross' Geese.

Ross Geese are collectively a good model for understanding the ecology of spring migration and its effects on production possibly for other arctic-nesting geese. They are localized in their distribution such that a large proportion of the global population is concentrated in time and space over most of the year. This facilitates monitoring of radio-marked individuals.

This long-term study will examine the connection between habitat use, nutrition, activity, and weather on spring

nutrition, subsequent nesting effort, nesting success, disease transmission and brood survival in Ross' Geese. It will integrate agricultural land use on the prairies, habitat use on the prairies and taiga, and productivity and nesting mortality in the arctic. This monitoring will lead to increased knowledge of movements and habitat requirements of Ross Geese from when they depart Western Saskatchewan until they arrive at Karrak Lake in the QMG MBS.

Information about annual variation in productivity will be used in conjunction with annual survival estimates to examine events during the annual cycle which most influence changes in RG population size. Such information will be useful in making harvest management recommendations.

OBJECTIVES:

-Measure association between spring weather and habitat use by Ross' Geese (RG) on the Canadian Prairies, and their subsequent breeding performance at Karrak Lake, Queen Maud Gulf Migratory Bird Sanctuary (QMBMBS).

-Improve estimates for age of first reproduction for Ross' Geese, and examine factors which influence it in marked cohorts of females.

-Initiate a long-term study that encompasses the lifespan of most of a Ross' Goose cohort to examine factors which factors significantly affect their life-time reproductive output.

-Examination of mortality rate of nesting RG females and young.

-Examine factors which influence the transmission of avian cholera among nesting females.

METHODS: Measure clutch size, body size, nesting success, and gosling survival of a large sample of Ross' Geese that also includes radio-marked birds. Circular plots will be randomly assigned to provide balanced spatial coverage of Karrak Lake Colony.

Twenty-five adult female Ross Geese will be radio-marked for another study on brood ecology throughout the annual cycle, with particular emphasis placed on movements of birds during spring migration in Saskatchewan. Phenology of arrival of radio-marked Ross Geese as well as that of unmarked RG and LSG will be monitored. Goslings will be web-tagged at pipping stage so connection can be made to nesting females when goslings are leg-banded. Correlations between activities of individual RG during late spring migration and their nesting activities will be evaluated. Through cooperation with State and Federal agencies in the US, habitat use, movements, and survival of RG will be monitored year-round.

Each year, nutrient reserves of RG will be measured twice during spring migration through southern Canada, and once upon arrival at Karrak Lake.

A permanent structure will be built to facilitate logistics in future years, and also to provide a base camp closer to the Simpson River, the inland sedge lowlands, and generally to be more centrally located in the sanctuary.

STUDY AREA: The Karrak Lake colony in the Queen Maud Gulf Migratory Bird Sanctuary will be monitored. There is a historical data base about the size of the colony extending back to Ryder's work in the 1960's (Kerbes pers. comm.).

TIMING/ANTICIPATED OUTPUT: Annual reports and progress notes on course of study. Several papers in refereed scientific journals. A global population model for Ross' Goose based on updated and currently unknown information about their demography will result. This model will be a valuable tool used for making harvest management decisions.

LITERATURE CITED:

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PERSONNEL: Principal investigator, 2 CWS technicians, 2 casual workers (northern residents from Cambridge Bay), 2 contracted technicians.

BUDGET:

Personnel requirements

1)	2 x casual help	40 days @$150.00/day**	$12,000.00
2)	2 contracted technicians	40 days @$150.00/day	$12,000.00
			$24,000.00

** Includes food

Operating expenses

1)	Travel (Saskatoon<->Cambridge Bay) 7 people @$1,350.00/person	$9,450.00
2)	Travel (Cambridge Bay<->Karrak Lake) Twin Otter (3 trips @$2,500.00/trip)	$7,500.00
3)	Travel (Cambridge Bay<->Karrak Lake) Turbo Beaver (2 trips @$1,250.00/trip)	$2,500.00
4)	Sea-lift materials for Research Station (Hay River, NWT-->Cambridge Bay, NWT)	$1,446.38
5)	Airlift materials for Research Station (Cambridge Bay->Karrak Lake) Twin Otter (5 trips @$1,250.00/trip)	$12,500.00
6)	Accommodation during travel (20 person-nights @$75.00/person-night)	$1,500.00
7)	50 Telonix radio-telemetry transmitters @ $350.00/unit	$17,500.00
8)	Helicopter Charter 25 hrs @$700.00/hr	$17,500.00
9)	Fuel 18 drums @$171.62/drum	$3,081.60
10)	Fuel caching with Twin Otter 18 drums	

	@$800.00/drum	$14,400.00
11)	Contract to build plastic tarsal bands	$6,000.00
12)	Materials for plastic tarsal bands	$2,000.00
13)	Shipping	$3,000.00
14)	Miscellaneous supplies (nest markers, tape measure, compasses, notebooks, hip waders, web tags, etc.)	$5,000.00
		$103,377.98

Capital costs		
1)	2 Jutland insulated tents	$9,000.00
2)	2 SSB HF radios	$5,772.00
3)	2 hand held VHF radios	$2,000.00
4)	2 Telonix Scanning receivers	$8,000.00
5)	Construction materials for Research Station	$4,000.00
6)	2 206b helicopter kit for receiving antennae	$500.00
		$29,272.00

Total first-year costs	$156,649.98
Annual Costs after first year	$63,955.00

Total first-year Matching Funds	
CWS (year-end funds) [spent]	$7,446.38
CWS (AGJV Capital) [spent]	$17,000.00
CWS (regular Capital) [spent]	$7,772.00
CWS (a-base O&M) [spent]	$500.00
CWS (NAWMP O&M) [spent]	$43,981.60
2 Volunteer assistants [committed]	$24,000.00
CWS (AGJV funds) [requested]	$49,449.40
Polar Continental Shelf Project [requested]	$42,500.00
First-year shortfall	$55,950.00

Snow Goose Population Data Acquisition
A Project Proposal

R. McKelvey
CWS Delta

Problem

Basic population data for the Wrangel Island snow goose colony is fragmented. It can be obtained on the northern wintering ground, but not in California, because of mxing with the western Canadian arctic population. Good estimates of the annual breeding effort on Wrangel Island exist, but total population counts do not. Harvest estimates in British Columbia suffer from inadequate sample size due to the very restricted location of the hunt and to the sampling proceedures available in the National Harvest Survey. Accurate population and harvest monitoring of the Wrangel Island population are needed for effective management.

Proposed Course of Action

Population counts are required on the northern wintering area and on the breeding ground. By subtraction the size of the southern wintering population will be calculated. This project proposes to: (1) conduct aerial photo counts on Wrangel Island of both breeding and molting birds; (2) conduct aerial photo counts on the northern wintering grounds; (3) institute a special annual harvest survey in British Columbia; and (4) continue reading neck collars.

Wrangel Island

This component must be developed in conjunction with the Soviet Union and should become part of the Canada/Soviet Union agreement on the exchange of information on snow geese. The project will consist of the following:

1) aerial photo survey of the Wrangel Island goose colony;
2) ground surveys of the goose colony;
3) aerial photo survey of molting flocks on the Tundra of the Academey.

Canadian biologists will provide cameras and film, processing and photo interpretation, assist with conduct of photo counts, and assist with ground surveys. Soviet biologists will arrange for and provide helicopters to conduct surveys, assist with aerial surveys, and coordinate ground counts.

Travel between the two contries may be required prior to commencement of the project, in order to procure a formal agreement on project cooperation.

Populations of the Northern Wintering Grounds

This part of the project will be conducted in cooperation with the Washington Dept. of Wildlife, and will consist of the following:

1) 6 annual aerial photo surveys of snow geese in the Fraser and Skagit rivers deltas;
2) airphoto interpretation, analysis and reporting.

Harvest

This will be conducted in cooperation with the British Columbia Ministry of Environment and will consist of the following:

1) harvest questionnaire based on the Fraser Valley Special Area Permit sampling universe;
2) bag checks and hunter performance assessment;
3) analysis and reporting.

Collar Reading

This is a continuation of the effort to date and should continue for another three years by:

1) recording collars in the Vancouver area;
2) organizing sightings in a retrieval system.

Cost

Wrangel Island

		90/91	91/92	92/93
travel		6K	3K	3K
film and processing			1K	1K
interpretation	40 days @ .15K/d		6K	6K
reporting	20 days @ .15K/d		3K	3k
total		6K	13K	13K

Population on the Northern Wintering Ground

	90/91	91/92	92/93	93/94
flying 9 hr/yr @130/hr	1.2K	1.2K	1.2K	1.2K
photo anal. 40d @ .15K/d*	6K	6K	6K	6K
reporting 12d @ .15K/d	1.8K	1.8K	1.8K	1.8K
tech support 3d @ .15K/d	.5	.5	.5	.5
total	9.5K	9.5K	9.5K	9.5K

* Analysis could be conducted digitally for a capital outlay of 10K; annual costs could then be reduced by 4.8K

Harvest

		90/91	91/92	92/93	93/94
questionnare	20d @ .15K/d	3K	3K	3K	3K
bag check	20d @ .15K/d	3K	3K	3K	3K
analysis and reporting	20d @ .15K/d	3K	3K	3K	3K

total		9K	9K	9K	9K

Collar Reading

		90/91	91/92	92/93	93/94
tech support	38d @ .12K/d	4.5K	4.5K	4.5K	4.5K
total		4.5K	4.5K	4.5K	4.5K

Total Cost

90/91	91/92	92/93	93/94
26K	33K	33K	20K

DISTRIBUTION AND ABUNDANCE OF GEESE IN QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY

PRINCIPAL INVESTIGATOR: *Ray T. Alisauskas*, Research Scientist, Prairie and Northern Wildlife Centre, Canadian Wildlife Service, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4. (306) 975-4556, FAX (306) 975-4089.

BACKGROUND: The Queen Maud Gulf Migratory Bird Sanctuary (QMG MBS) is the largest sanctuary in Canada encompassing 62,780 km² of low arctic mainland and marine habitat of Queen Maud Gulf. The sanctuary harbours large and rapidly expanding numbers of nesting Ross' and Lesser Snow Geese (Kerbes, pers. comm.), and early reconnaissance surveys during brood rearing (Barry 1962) indicated that it was an especially important area for Canada and White-fronted Geese. Aside from fairly regular photographic census of Ross' and Snow Goose colonies, no systematic surveys of Arctic Geese or other waterfowl have been conducted (Lumsden 1964, Kuyt et al 1971, but see Alisauskas 1990).

JUSTIFICATION: The Arctic Goose Joint Venture Prospectus identifies a lack of knowledge regarding breeding distributions of geese in the arctic. The Prospectus also points out that the AGJV is an opportunity to direct more research toward geese in the arctic than has been done in the past. Surveys of arctic geese on their nesting grounds is in itself a priority product of the AGJV; however, such surveys are also a necessary first step toward focused research on the nesting grounds, and toward understanding the factors that influence the distribution and abundance of Arctic Geese.

Although helicopter surveys are being used more extensively to census White-fronted and Canada Geese, knowledge about visibility bias for these species during nesting is lacking. There is a great need to coordinate aerial surveys with extensive ground-verification of nesting White-fronted and Canada Geese.

The distribution and abundance of White-fronted and Canada geese should be considered as higher priority than even neck-collaring programs, because we know less about detailed nesting distributions than we do of wintering distributions.

OBJECTIVES:

-Describe dispersion of Canada Geese, White-fronted Geese, and Atlantic/Pacific Brant during nesting in QMGMBS.

-Locate concentrations of nesting geese of target species to define target areas for future studies of breeding biology.

-Describe nest sites in terms of macrohabitat and macrohabitat selection by nesting Canada, White-fronted Geese and Atlantic/ Pacific Brant, and compare to sites known not to have nesting geese, as well as to random sites.

-Inventory suitable nesting sites for each species within the QMGMBS, and model potential carrying capacity.

-Assess annual variation in dispersion of nesting concentrations of target goose species.

-Provide ground verified data on the abundance of nesting White-fronted and Canada Geese, and use this to correct bias associated with poor visibility of dark geese.

METHODS: Annual surveys would be conducted over about a 7-10 day period between June 15 and July 5. In 1990, surveys were conducted between June 20 and June 27 from a Bell 206b helicopter with floats. Procedures of Hines *et al.* (1990) were followed. Transects were flown at an altitude approximating 50 m at a ground speed of about 100 km/h; counts of all target species within 200 m of flight lines were recorded. Transects within the Sanctuary were aligned with 10 km easting and northing lines for UTM zones 13 and 14. The pilot navigated by following prescribed transects on 1:250,000 NTS map sheets. Transects were segmented every 2 km and the pilot informed observers when a new segment had been entered. Counts of different target species were recorded by segment; group size was noted for each encounter of target species.

The refuge was sampled in two stages. The first stage involved flying north/south transects 20 km apart to establish the extent of the distribution of White-fronted Geese inland from the coast. When this was established, sampling was intensified within the coastal strata to acquire more precise estimates of distribution and abundance of White-fronted Geese where they occurred.

An additional effort in 1991 compared to 1992 is the need to conduct ground verification of flight transects, if estimates of population size are to be realized (see Alisauskas for further details and justification).

PRELIMINARY RESULTS: Refer to Alisauskas (1990).

STUDY AREA: Queen Maud Gulf Migratory Bird Sanctuary, Northwest Territories.

TIMING/ANTICIPATED OUTPUT: Systematic surveys were initiated in June 1990. A second field season is required to expand survey to sample entire sanctuary, and must include a ground crew to provide a correction for visibility bias. After this research is completed, spatial distribution of geese will be finalized, and ongoing surveys within resulting strata should continue for duration of AGJV.

Outputs include:

-Estimates of population size of White-fronted, Canada geese, Brant, Tundra Swans, Sandhill Cranes, Common Eiders, King Eiders, Pintails, Oldsquaws, Loons, and Ptarmigan in QMGMBS during the nesting season.

-Projections about the influence of climate change on nesting distributions and abundance of geese and other waterfowl in the QMGMBS.

-Greater knowledge about factors which affect nest site selection by Canada and White- fronted Geese, and Brant.

LITERATURE CITED:

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Kuyt, E., C. H. Schroeder, and A. R. Brazda. 1972. Aerial Waterfowl Survey, Queen Maud Gulf, N.W.T., July-August, 1971. Unpublished progress report, Canadian Wildlife Service, Edmonton, 33 pp.

Lumsden, H. G. 1964. A Goose survey on the Perry River plain. Unpublished report on file, Canadian Wildlife Service, Ottawa, 19 pp.

PERSONNEL: Principal investigator, 3 CWS biologists, casual help (6 northern residents from Cambridge Bay area), helicopter pilot, helicopter engineer.

BUDGET:

Personnel Requirements	
casual help 14 days x 6 people @$150.00/day...	$12,600.00
	$12,600.00
Operating expenses	
1) Travel (Saskatoon<->Cambridge Bay) 4 people @ $1,350.00/person.....	$5,400.00
2) Travel (Cambridge Bay<->Perry River) Twin Otter 2 trips @$2,000.00/trip.....	$4,000.00
3) Helicopter Fuel 40 drums @$171.62/drum.....	$6,864.80
4) Fuel Caching with Twin Otter 40 drums @$800.00/drum.....	$32,000.00
5) Helicopter Charter 75 hrs @$700.00/hr.....	$52,500.00
6) Accommodation during travel (16 person-nights @$75.00/person-night).....	$1,200.00
7) Miscellaneous (tents, maps, stationery, etc.)..	$1,000.00
	$102,964.00
Capital costs	
none.....	0.00
	0.00
Annual total costs.....	$115,564.00
TOTAL PROJECT COSTS**.....	$180,564.00

**(includes costs of field work done in 1990 and planned for 1991, the final year)

Annual Matching Funds	
CWS (NAWMP O&M) [committed].....	$38,864.00
Polar Continental Shelf Project [requested].....	$52,500.00
CWS (AGJV Funds) [requested].....	$52,500.00
Current Shortfall.....	$76,700.00

GREATER SNOW GEESE ON BYLOT ISLAND: FEEDING ECOLOGY AND HABITAT RELATIONSHIPS

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Background: The Greater Snow Goose (Anser caerulescens atlanticus) population has increased remarkably over recent decades to reach a record level of almost 400 000 geese in spring 1990 (Gauvin and Reed 1987, Reed in press, Reed.unpubl.). On staging and wintering areas the increased numbers of geese are placing greater stresses on many of their natural wetland habitats. Intensive grazing and grubbing of tidal marsh vegetation along the US Atlantic coast and in the St. Lawrence estuary has lead to changes in plant composition, to reduced plant biomass, and in some cases to denudation (Smith and Odum 1981, Smith 1983, Giroux and Bedard 1987, Hindman and Ferrigno 1990).

On their high arctic breeding grounds, increased densities of geese have been recorded at the most important colony, Bylot Island, (Reed et al. in prep.) but there and at other dense breeding areas severe damage to vegetation is not yet evident (Giroux et al. 1984, Reed unpubl.). Lesser Snow Geese (A. c. caerulescens) have, however, caused severe damage to their subarctic salt marsh habitats at several locations along the Hudson Bay coast (Kerbes et al. 1990).

Increasing demands on a finite or decreasing food supply could have an important effect on the fitness of the geese themselves. An earlier study suggested that some Greater Snow Geese were leaving the St. Lawrence staging area in spring with insufficient nutrient reserves to breed successfully (Gauthier et al. 1984). Studies on Lesser Snow Geese in Hudson Bay also suggest that goslings are fledging and departing on fall migration in poorer condition than formerly when their habitats were less intensively grazed, and that the fecundity of the population is declining (Cooch et al.1989, Cooke pers. commun.).

Justification: Effective management of goose stocks requires sound knowledge of the ecological interactions betwwen the geese and their habitats. It is important to know how goose numbers affect habitat quality as well as how habitat affects population dynamics. Such knowledge is particularly important for arctic habitats where rigorous conditions limit plant growth and where the critical reproductive period of the geese occurs.

We propose to continue a series of interrelated studies on feeding ecology, habitat use and energetics of Greater Snow Geese

on the southwest plain of Bylot Island over the coming years. The information obtained will enable us to identify problems of habitat degradation caused by the geese and to evaluate whether increasing goose densities are influencing recruitment. It will enhance our capabilities of predicting future population trends and of identifying key arctic habitat types requiring protection.

Objectives: The longterm objective of the study is to evaluate the effects of the large and increasing Greater Snow Goose population on arctic breeding habitats and on goose productivity. Specific objectives include 1) evaluation of the importance of locally-obtained nutrient reserves to the energy budget of breeding pairs, 2) annual documentation of nesting numbers and distribution, phenology, and productivity, 3) assessment of brood movements and habitat use, 4) examination of feeding activity, diet, and food quality for goslings, 5) assessment of grazing on arctic vegetation, 6) evaluation of change in food digestibility in growing goslings, 7) examination of body condition and feeding strategies in incubating females, 8) assessment of size and body condition of goslings at time of fledging.

Experimental design: Techniques employed in 1990 include the following: Body condition of pre-laying and laying geese was assessed by collecting 60 geese; after weighing and measuring the geese, certain tissues were removed and frozen for subsequent fat and protein analyses. Time activity budgets of laying and pre-laying geese were documented through the 24h daylight period by focal sampling. Their diet during this period was determined by examination of the oesophageal content of the collected geese; samples of the ingested food items, along with samples of the same plants collected in the field, were dried, weighed, and brought back to the lab for later analyses (protein, fiber, energy). Nesting success and phenology was determined by monitoring 170 nests from laying through hatch. Twenty adult females were captured on their nests during late incubation and fitted with leg bands, individually coded neck collars, and radio transmitters (backpack type harness); their movements after hatch were recorded daily by triangulation from two receiving stations set up on hillsides overlooking the study area. Radio fixes were recorded in relation to a grid system overlying a habitat map. Body condition of adult females during late incubation was evaluated from weights and measurements (culmen, tarsus) of the 20 individuals caught for marking. Preliminary observations of incubation strategies involved visual focal scanning of 14 nesting females over a 24h period during late incubation. The impact of goose grazing on the preferred brood rearing habitat (Dupontia/Eriophorum) was evaluated at 12 paired plots of 1 x 1m, one of each pair being protected from grazing by a wire exclosure. Plant biomass was measured every two weeks by collecting 20 x 20cm sods from each plot. Food choice and plant digestibility by goslings was evaluated by grazing trials with 16 imprinted goslings obtained from pipping eggs collected from wild nests. Each week grazing trials were conducted in both a

Carex sward and in a Dupontia/Eriophorum sward; plant and dropping samples were analyzed for total and protein digestibility using a natural food marker. Body size and condition of goslings and adults was assessed from weights and measurements of 809 geese captured in mass drives during late August.

Study area: The study area is a glacial valley approximately 12km long and 5km wide situated near the western extremity of the southwest plain of Bylot Island off the northeast tip of Baffin Island. It is characterized by lowlying polygon tundra with many areas of wet meadows dominated by Carex aquatilis stans, Dupontia fisheri, and Eriophorum spp., and dotted with numerous small ponds. The valley is bordered by moderately steep hills rising to about 200m. The southwest plain of Bylot Island represents the largest single concentration of Greater Snow Geese known; it was used by about 26 700 breeding adults in 1988 (Reed et al. in prep.), about 13% of the total breeding population (Reed unpubl.). The logistics of field operations is facilitated by the study area's proximity to Pond Inlet (90km), a settlement served by commercial flights and which serves as a hub for other scientific expeditions.

Timing / anticipated outputs: The study began in 1989 and is planned to continue through 1994. In 1989 and 1990 field work was completed on time budgets, diet, and body condition of adult geese during the pre-laying and laying periods, as well as on brood movements and (macro)habitat use; two Masters theses and several publications are anticipated by the end of 1991. Field work will continue on the other aspects outlined above during 1991 and beyond, with an expected flow of graduate theses and journal publications. The study will also provide direct information for management decisions. Each year in early July the current year's nesting success will be reported back in time to be considered for regulation setting in the Atlantic Flyway. The cumulative knowledge obtained from this study will allow the development of better management and protection strategies for this and other important goose colonies, improved techniques for monitoring breeding goose populations, and an enhanced capability of predicting future population trends.

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<u>Personnel</u>: Principal investigators: Dr. Gilles Gauthier
Dept. de Biologie
universite Laval

Dr. Austin Reed
CWS, Quebec Region

Graduate students (1989-90): Josee Tardif, Line Choiniere, Jack Hughes, Micheline Manseau.

<u>Budget</u>: The following breakdown relates to projected expenditures for 1991. Costs for 1989 and 1990 were somewhat higher. Annual costs for 1992-1994 are expected to remain similar to those for 1991.

Personnel requirements		
Princip. investig.	12mo.	
Grad stud. & assist.	27	$30k
Techn. U. Laval	2	

Operating expenses	32.5	
Air fare, cargo, food	11	
Supplies and equipment	6.5	
Lab analyses	63	
Aircraft charter		
Annual total cost	$143K	
Annual matching funds	12	(confirmed)
FCAR Univ. grant	10	(requested)
CRSNG " "	6	(confirmed)
Technician salary (U.L.)	63	(requested)
PCSP aircraft support	5	(requested)
DINA grant to U. L.	12	(requested)
CWS A-base		
Total matching funds	$108k	
Shortfall (requested from AGJV)	$35k	

28/11/90

GREATER SNOW GEESE IN THE ST. LAWRENCE ESTUARY: POPULATION MONITORING AND HABITAT RELATIONSHIPS

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Background: The Greater Snow Goose (Anser caerulescens atlanticus) population has increased remarkably over recent decades to reach a record level of almost 400 000 geese in spring 1990 (Gauvin and Reed 1987, Reed in press, Reed unpubl.). Analyses of recent demographic data gives no indication of stabilization of numbers, but rather suggests a continued increase through the near future (Reed in press). But predictions from the existing data base must be treated with caution, partially because of increasing difficulties in obtaining accurate data and, perhaps more importantly, because of rapid changes in certain demographic parameters (Reed in press). Efforts to improve management of this important resource in the St. Lawrence valley will require intensified programs to 1) monitoring the population size and other parameters required for population modeling, and 2) gain a better understanding of the ecological requirements of the geese to ensure the availability of an adequate habitat base to support optimal numbers.

On staging areas in the St. Lawrence valley, increased numbers of geese are placing greater stresses on many of their natural wetland habitats, as well as causing damage to agricultural crops on adjacent farmland. Intensive grazing and grubbing of tidal marsh vegetation has lead to changes in plant composition and to reduced plant biomass (Giroux and Bedard 1987, Reed 1990) and, on agricultural land, damage to hay crops is increasing (Bedard et al. 1986, Reed and Cloutier 1990)).

The population increase has also lead to an expansion of the staging area within the St. Lawrence valley. Formerly restricted to the dense Scirpus americanus tidal marshes along a 50 km stretch of the estuary near Quebec City, the geese now occupy various types of marshland and adjacent farmland from Lake Saint-Pierre to Rimouski, a distance of 450 km (Anon 1981, Reed and Dupuis unpubl.). Thus the geese are exerting greater pressures on natural marshes and on farm crops over a much larger area. On the other hand they are providing increased recreational opportunities for hunters and viewers.

To avoid irreparable deterioration of natural marshland, to minimize economic losses to farmers, and to prevent decline in the fitness of the goose population new management programs are called for. Despite the high numbers and overall densities of geese, not all portions of the St. Lawrence valley are used to their apparent potential, suggesting that if the geese were more optimally distributed during both spring and fall the risks of damage to

marshes and crops could be reduced. The present clustered distribution is partially attributable to disturbance from hunting and other human activity. A revised and expanded network of refuges, sanctuaries and wildlife areas could facilitate a more balanced distribution of geese. But our knowledge of the behaviour and ecological requirements of the geese is as yet inadequate to confidently develop such a network: how many protected areas are required, how large should they be, how far apart, what types of habitat should they encompass and in what proportions?

Justification: The St. Lawrence valley serves as the main staging area for virtually the entire population of Greater Snow Geese in both spring and fall. It represents a critical link in their annual cycle by allowing the geese to replenish energy reserves and to lay down nutrients for continued migration and for reproduction (Gauthier et al. 1984, Bedard and Gauthier 1989). The future well-being of present and future goose populations hinges on the creation and maintenance of adequate sanctuary and food in the St. Lawrence. Also at risk are the substantial economic and recreative benefits which the geese provide to a dense human population.

In addition to fulfilling a major ecological requirement of the goose population, the St. Lawrence valley offers the best conditions for monitoring goose numbers; the annual spring photographic survey there has become the "barometer" of that population for managers throughout the flyway (Anon 1981, Hindman and Ferrigno 1990).

Objectives: Provide adequate ecological knowledge to develop management programs that would bring goose numbers and distribution into harmony with the natural food supply and with agricultural and other socio-economical interests. This will require;

- improved capabilities of monitoring and modeling population change.
- documentation of present goose use of the St. Lawrence valley, establishing spatial (geographic), temporal (within- and between-season), and ecological (habitat types) patterns.
- examination of behavioural strategies of geese in this increasingly crowded situation.
- examination of the consequences of crowding and range expansion on the survival and productivity of the geese.
- develop techniques to eliminate or reduce damage to farm crops.

Methods: Conduct expanded aerial (photographic) and ground surveys to monitor population parameters and to establish patterns of distribution and habitat use.

Conduct vegetation sampling to appraise grazing pressures and impacts.

Radio-tracking of geese to determine extent of movements within the staging area.

Monitor body condition of geese in different habitats.

Monitor productivity (age ratio and family counts).

Study area: The St. Lawrence valley, principally between Lake Saint-Pierre and Rimouski.

Timing / anticipated output: The project began in 1989/90 as an expansion of ongoing CWS activities related to monitoring of the goose population and assessment of the effects of grazing on tidal marsh vegetation and on farm crops. The expansion is required to compensate for increased work imposed by the larger area and wider range of habitat types occupied by the geese, and by the need to accelerate output of research results in response to urgent management needs. The enhanced program will continue through 1994.

In 1990 an expanded spring survey was conducted involving three complete aerial photo counts. In the fall, monitoring of goose numbers and body weights (of hunter shot birds) was continued at the Cap Tourmente NWA; age-ratio and family counts were continued throughout the estuary, and radio tracking of geese (marked earlier on Bylot Island) was conducted through the fall staging period. The density and biomass of the vegetation of the Cap Tourmente tidal marsh was assessed at the end of the growing season.

Further analyses of the 1990 spring survey data is expected to allow the development of a more efficient and cost-effective survey for the spring of 1991. During 1991 enhanced monitoring will continue on goose numbers and distribution in spring and on age ratios, body condition, and goose distribution in fall. Further study of movements and habitat use by radiotracking will be conducted. Further examination of use of farmland is also planned.

The enhanced monitoring program will accelerate the availability of more reliable information on spring numbers and fall age ratios for use in management decisions by Atlantic Flyway authorities.

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Smith, T. J. and W. E. Odum. 1981. The effects of grazing by Snow Geese on coastal salt marshes. Ecol. 62:98-106.

Personnel: Principal investigator: Austin Reed, CWS, Ste-Foy
Collaborators: Pierre Dupuis
Nathalie Plante

Field assistants (1990): Mario Labonte
Julien Beaulieu
Jean Landry
Eric Gagnon

Budgetfor 1991:

Personnel requirements

A. Reed	3.5mos
P. Dupuis	0.5
N. Plante	1.0
contracts	7.0
Total	12 person months

Operating expenses

Aircraft rental	$10 000
Contract for photo counts	9 000
film and development	1 500
telemetry equipment	2 000
contract for radiotracking	6 000
travel expenses	5 000
Total annual costs (excluding CWS salaries)	$33 500

Matching funds

CWS A-base (O&M)	$10 000
Shortfall (AGJV request)	$23 500

14/12/90

Quantity and Quality of Habitat Used by Snow Geese Wintering on the Fraser River Delta

A Project Proposal

Problem

The total population of snow geese breeding on Wrangel Island has remained relatively stable in the past 10 years while the number of birds wintering on the Fraser River delta has increased 10 fold in that time. It is not known whether this increase is a redistribution northward of those geese normally wintering in California, or a selection for the more northerly wintering birds. In any event if the stated population goal of 120 000 birds is reached many more geese can be expected to winter in British Columbia. In order to manage the goose population and its habitat appropriatley data on carrying capacity of both foreshore marsh and upland habitat are urgently requied.

Proposed Course of Action

Habitat use will be measured by population monitoring schemes proposed in the Population Data Acquisition proposal. What is proposed here is to (1) continue and expand current studies on the impact of geese on their traditional estuarine winter foods; and (2) initiate parallel studies on uplands. The ultimate goals will be to determine how many geese can be supported on the foreshore, and to determine how much upland habitat needs to be provided, to meet projected population growth.

Foreshore Studies

This part of the study will continue the current program, and will require the cooperation of the Washington Dept. of Wildlife. It will consist of:

1) monthly samples of below ground biomass on the foreshore;

2) calculation of amount of food removed by over wintering geese and the subsequent regrowth the next year;

3) calculation of carrying capacity of the delta marshes;

4) behavioural observations of riverine marsh use in spring to quantify importance of those marshes in spring;

5) calculation of amount of food removed by spring staging geese;

6) determination of body condition during and after spring staging.

Upland Studies

This part of the project will parallel the above studies on the upland part of the birds winter habitat. It will:

1) monthly samples of biomass avalilable to geese in winter on the Alaknan National Wildlife Area;

2) proximate analysis of those samples and estimation of nutrient value of foods removed;

3) behavioural observations of upland habitat use;

4) determination of habitat carrying capacity and formulation of management plan for provision of upland habitat.

Costs

90-91	91-92	92-93	93-94
18K	35K	32K	23

GOOSE STUDIES IN JAMES BAY, QUEBEC

Austin Reed
Canadian Wildlife Service
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Ste-Foy, Qc. G1V 4H5

Background: Coastal wetlands of James Bay serve as a major staging area for migrating Atlantic Brant (Branta bernicla hrota), Atlantic Flyway Canada Geese (B. canadensis interior), and Lesser Snow Geese (Anser caerulescens caerulescens)(Curtis and Allen 1976, Julien and Laperle 1986). Many Canada Geese also use freshwater wetlands inland from the east coasts of James Bay and Hudson Bay for nesting and brood rearing (Addy and Heyland 1968, Lamothe 1982). The area is especially important to Atlantic Brant which rely heavily on a coastal plant, eelgrass (Zostera marina), as a food supply during both migrations; although at their northern limit of distribution in James Bay, the eelgrass beds are dense and extensive (Lalumiere 1988) and represent an oasis of nutrient supply for the Brant along a lengthy migration route. Canada Geese also make extensive use of coastal habitats before moving inland or northward to breed (Curtis and Allen 1976, Prevett et al. 1985, Reed et al. 1990). A smaller but important number of Lesser Snow Geese use the east coast of James Bay for staging; of special importance to them are the bulrush (Scirpus americanus) marshes of Rupert Bay (Courcelles et Bedard 1977).

Justification: All three species of geese are important to Cree and Inuit hunters of northern Quebec (Native Harvesting Research Committee 1982, Reed 1984). Sport hunters of the Atlantic Flyway have a special interest in the Canada Geese and Brant; a high proportion of both stocks which are harvested in that flyway pass through James Bay on migration.

Both coastal and inland wetlands of the James Bay region are within a vast area presently, or destined to be, under hydro-electric development (Savard 1988, Gorrie 1990). Damming of rivers and the creation of huge reservoirs are causing major changes to the hydrology of the region, but the overall impacts of these changes on the wetlands and the geese are poorly understood.

Objectives: This proposal is aimed at gaining an adequate understanding of the ecological requirements of the geese during their staging and breeding periods in the James Bay region. Such an understanding is necessary to assess and predict impacts from development activities and to formulate recommendations to minimize losses.

More specifically, the project will 1) establish the habitat and food requirements of all three species of geese during

migration and of Canada Geese during nesting and brood-rearing, 2) document accumulation of nutrient reserves by Brant during staging, 3) monitor breeding success of Canada Geese, 4) assess the fate of Canada Geese whose breeding territories are affected by development, 5) evaluate the overall impact of development on the goose stocks, 6) describe and map key habitat types.

Methods: Habitat use of coastal wetlands will be established by ground surveys (time activity budgets in relation to habitat types). Diet will be determined from stomach content analyses from geese shot by subsistence hunters. Habitat use during breeding will be evaluated from helicopter surveys in 10 x 10km plots; more detailed information on nest site and brood rearing habitat features will be obtained by ground truthing. Nutrient reserve dynamics of staging Brant will be documented by -field and laboratory analyses of geese shot by subsistence hunters. A sample of Canada Goose nests will be followed through the season to establish average clutch size and hatching success; a number of nesting females will be caught prior to hatch and fitted with transmitters in order to follow brood movements and gosling survival using helicopters to aid in radio-tracking. Telemetry will also be used to asses the fate of displaced breeding pairs. Vegetation studies will be conducted in key wetlands and mapping conducted from aerial photographs and satelite imagery.

Study area: The study area will cover the coastal area extending from the Quebec-Ontario border in the south northward along the east coast of James and Hudson Bays to the mouth of the Nastapoka River in the north, with an intensive study area along the Northeast coast of James Bay. The inland area will cover mainly the region of Lake Bienville.

Timing / anticipated output: The project will continue through 1994. In 1991 emphasis will be placed on evaluation of habitat/food requirements of Canada Geese and Brant, on documenting nutrient reserve accumulation by Brant, and on monitoring breeding success of Canada Geese.

Five reports are anticipated in 1991: a report for the Atlantic Flyway Council during July describing the current year's nesting effort and success of Canada Geese in the Lake Bienville area, a published description and map of the waterfowl habitats of the northeast coast of James Bay, a detailed report on the spring diet of Canada Geese staging on the northeast coast of James Bay, a report on habitat use by Canada Geese and Brant of the northeast coast during late spring, summer, and fall, and a report on nest site caracteristics of Canada Geese in the Lake Bienville area.

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Personnel(1991):

Princip. investig.: Austin Reed, (Res. Sci.) CWS, Que.

Project supervisor: Rejean Benoit,(Bio.) Groupe Env. Shooner

Field assistants: Gaetan Morisette (Techn.) " "
Yves Aubry, (Techn.) CWS, Que.
Josee Tardif (Bio.) " "
Julien Beaulieu " " "

Monique Salathe (Techn.) " "
Noah Potts (guide)
Henry Potts (guide)

Technical collab.: Daniel Bordage (Bio.) CWS, Que.
Nathalie Plante (Stat.) CWS, Que.
Norman Dignard (Bot.) Que. Herbarium
Gilles Gauthier (Prof.) Univ. Laval

Supervisory collab.: Michel Julien, James Bay Energy Corp.
Richard Lalumiere, Groupe Env. Shooner
George Lameboy, Eeyou Corp.
Richard Perrault, Hydro-Que.

Budget: The following budget relates to 1991 operations. It is anticipated that annual costs will increase in 1992/93 when telemetry will be used.

Personnel requirements:		
A. Reed (CWS)	5 mos	
Other CWS staff	3 mos	
Project leaders	12 mos	(2 x 6 mos)
Field assistants	12 mos	(3 x 4 mos)
Guides	5 mos	(2 x 2.5 mos)

Operating expenses:	
Commercial air fare, lodging, food	$11 500
Hiring local guides, canoe	8 000
Aircraft rental	60 000
Laboratory analyses	8 000
Salaries and contract help (non-CWS)	14 000
Material and equipment	7 000
Total	$108 500
Annual matching funds	
CWS A-base and other reg, C&P	20 000
Hydro-Que. and JBEC	52 000
Total	$72 000
Shortfall (AGJV request)	$36 500

14/12/90

Population Turnover Rates and Locations of Critical Habitats for Brant Migrating Along the British Columbia Coast

A Project Proposal

R. McKelvey and N. Dawe
CWS Delta

PROBLEM

Brant once wintered in British Columbia in substantiol numbers but are now seen almost exclusively as sprint migrants. Remnant wintering populations include perhaps 50 birds in the Boundary Bay/Roberts Bank area near Vancouver, and up to 200 birds in the Sandspit/Skidegate area of the Queen Charolotte Islands. In spring migration three major areas are known to be important: (1) the Strait of Georgia; (2) the west coast of Vancouver Island; and (3) the east coast of Graham Island. Recent estimates indicate that up to 25000 birds may be present at one time in the Strait of Georgia, 400 on the west coast of Vancouver Island and up to 2000 on Graham Island.

It is probable however that, with turnover, a much larger proportion of the Pacific flyway population may acutally use these habitats. In 1988, a pilot survey of brant was carried out with the Arrowsmith Naturalists in the Parksville-Qualicum Beach area and in 1989 the survey was expanded to the Comox area with the help of the Comox-Strathcona Naturalists. The main objective was to read the coded leg bands of brant that had been banded in the low arctc and on the Yukon-Kuskokwim Delta in Alaska. Initial findings indicated that some marked birds spent at least 10 days in a particular area and some individuals remained up to 45 days. A number of the birds observed in the Parksville-Qualicum Beach area in 1988 returned to the same site in 1989. At least three separate breeding populations depended on habitat within the Strait of Georgia. Birds from the Yukon-Kuskokwim Delta, from Teshekpuk Lake and from the Canadian low arctic were observed in the Parksville-Qualicum Beach area in 1989.

Population surveys combined with banding and subsequent observations of marked birds will fill three important data needs for brant in British Columbia: (1) it will identify how many brant pass through British Columbia in spring migration, which in turn may allow a third point of flyway population assessment; (2) it will identify the most critical habitats for migrant brant in British Columbia, with a view to eventual protection of those habitats; and (3) it will assess the importance of spring stopover areas in British Columbia to the energy requirements and eventual reproductive success of brant.

Proposed Course of Action

A project involving a number of components is proposed, in three major geographic areas.

Strait of Georgia

To continue building on the past two years of effort the following will be undertaken:

1) Weekly aerial surveys of the Strait of Georgia to determine fluctuations in numbers of Brant and levels of use of major staging areas within the Strait during the spring migration.

2) Band readings, with the assistance of naturalists clubs who have expressed interest in continuing those surveys, will be used to determine turnover rates of the birds and to estimate the numbers of Brant dependent on the Strait of Georgia during the spring movement.

3) Behaviourial observations to determine time budgets and food habits (there is some evidence that Ulva plays a more important role than does Zostera as a major food source for the Brant in the Parksville-Qualicum Beach area).

4) A habitat assessment of the major staging areas and an inspection of potential wintering areas for the possible reintroduction of wintering birds.

5) Capture, weighing and marking of brant on the east coast of Vancouver Island.

6) Compilation of all relavant data on brant use of this area.

West Coast of Vancouver Island

Recent data indicate that some areas of the west coast receive much less use now than 10 years ago. More extensive surveys will be required initially to determine exactly how important this area still is.

1) Conduct bi-weekly aerial surveys between Tofino and Port Hardy.

2) Compile all available data for brant use of this area.

Queen Charolotte Islands

What is planned in the Queen Charlotte Islands is similar to that planned in the Strait of Georgia. Although local naturalists have not yet been involved in brant work there is strong local support for such work.

1) Conduct bi-weekly aerial surveys between Sandspit and Massett to determine fluctuations in numbers of brant and levels of use of major staging areas during the spring migration.

2) Read bands, with the assistance of naturalists clubs, to determine turnover rates of the birds and to estimate the numbers of brant dependent on the area during the spring movement.

3) Conduct behaviourial observations to determine time budgets and food habits.

4) Assess habitat of the major staging areas.

5) Capture, weigh and mark brant on the east coast of Graham Island.

6) Compile all relavant data on brant use of this area.

THE EFFECT OF HABITAT DEGRADATION ON GROWTH AND SURVIVAL OF ROSS' AND LESSER SNOW GOOSE GOSLINGS AT KARRAK LAKE, QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY, N.W.T.

PRINCIPAL INVESTIGATOR: *Ray T. Alisauskas*, Research Scientist, Prairie and Northern Wildlife Centre, Canadian Wildlife Service, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4. (306) 975-4556, FAX (306) 975-4089. *Stuart M. Slattery*, MSc Student, University of Saskatchewan, same address, (306) 975-4791.

BACKGROUND: Habitat degradation caused by over-grazing plays a relatively unknown role in regulating Arctic goose productivity. The critical period for gosling growth and survival appears to be the first two weeks post-hatch (Eberhardt et. al. 1989, Sedinger 1986). Poor foraging opportunities can restrict gosling development and offspring unable to meet nutritional demands of maintenance and growth may suffer high pre-fledging mortality (Sedinger 1986) or experience low pre-fledging growth rates (Lieff 1973). Compensatory growth during migration may not occur (Cooch et. al. in press) and low fledging weight can result in reduced overwinter survival (Haramis et. al. 1986, Sedinger and Raveling 1984), lower adult body mass (Cooch et.al. in press) and poor reproductive success (Cooch et. al. in press, Rockwell et. al. 1987, Cooke et. al. 1984).

An exponential population growth rate calculated using Queen Maud Gulf Migratory Bird Sanctuary (QMG MBS) white goose inventories paralleled Lesser Snow Goose population growth (data from Kerbes (unpubl.) and Kerbes et.al. (1983)). A lower Ross' Goose population growth rate despite equivalent mean clutch size and nesting success (McLandress, 1983) suggest that Ross' Goose gosling survival rates and reproductive success may be substantially lower than those for Lesser Snow Goose goslings. Habitat degradation could be responsible. As quality forage becomes overgrazed near the colony, families must radiate farther and fasting goslings must survive longer on residual yolk nutrients (Ankney 1980, Sedinger 1986). Ross' Goose eggs are smaller (Ryder 1971), thus Ross' goslings may have less residual yolk nutrients and a more limited ability to travel. As a nesting colony grows and the denuded margin expands, Ross' Geese may be the first species forced to feed on poor quality habitat.

JUSTIFICATION: Habitat destruction by geese has been identified as a priority problem in the Arctic Goose Joint Venture Prospectus. Overgrazing will continue as the extremely large QMG MBS Lesser Snow Goose population grows, possibly decreasing long-term productivity in much smaller nesting populations of Ross', White-fronted, and Canada Geese. Locating brood-rearing areas will facilitate future long-term brood/habitat monitoring projects and will focus white goose marking efforts in high density areas.In addition, productivity and gosling body condition indices calculated from this study could be used to predict fall flight from the Central Canadian Arctic. This project will determine if Lesser Snow Goose productivity exceeds that of Ross' Geese as a result of overgrazing.

OBJECTIVES: The hypotheses tested by this study are 1) pre-fledge gosling growth and survival are equal between Ross' and Lesser Snow Geese, 2) brood dispersal distance does not differ between species, and 3) intraspecific gosling growth and survival are independent of the distance reared from the colony. Documented brood movements will produce a brood-rearing area map around Karrak Lake for use in future research. Satellite imagery will be assessed for suitability as a habitat map to monitor habitat conditions and explain brood movements. Estimates of nesting, hatching, and fledging success will provide productivity indices for Ross' and Lesser Snow Geese. Condition indices will be calculated from growth measurements.

EXPERIMENTAL DESIGN: This study will employ radio telemetry to track and recapture Ross' and Snow Goose broods. During late incubation, 50 females will be nest trapped for leg banding, collaring, and radio marking (1:1, Ross': Lesser Snow). An additional 75-100 females will be captured and marked with alphanumerically-coded neck collars and leg bands or leg bands only as radio package controls. Goslings in each marked bird nest will be web-tagged in the star-pipped stage for brood/parental identification. The effective sample size for gosling growth and survival is 480-600 web-tagged goslings. Broods will be located from three radio towers or a helicopter every day during the first two weeks and every 3-5 days thereafter. When possible, habitat will be recorded with locations. Broods will be recaptured during August banding efforts and web-tag gosling recoveries will be weighed and five morphometric measurements taken. A captive flock of 30 goslings (1:1) will be fed ad libitum and measured to produce a standard growth curve for comparing wild gosling growth. Preliminary Landsat thematic maps will be checked for accuracy between tracking sessions.

Habitat use and brood movement data will be divided into two categories- initial dispersal and subsequent movements. Habitat use and home range size and distance from the colony will be assessed on a weekly basis. If the Landsat imagery proves suitable, habitat use versus availability will be determined and the home range site will be mapped and indiced according to location and habitat condition for comparisons of growth and survival data. Egg weights, morphometric measurements and survival estimates will be corrected for age and used to calculate condition and productivity indices. The hypotheses will be tested using condition indices, survival estimates, and movement data in a multivariate Analysis Of Variance (ANOVA).

STUDY AREA: The QMG MBS white goose population has increased exponentially since 1965 and nearly 50% (approximately 200,000 geese) nest at Karrak Lake (Kerbes unpubl., Kerbes et. al. 1983). This colony has been occupied for a minimum of 26 years (Kerbes et. al. 1983) and geese have grazed much of the site down to exposed mud and sparse vegetation (Alisauskas pers. comm.). Thus the current white goose population growth rate in the QMG MBS,

the relative importance of the Karrak Lake site to these geese, and the unknown potential of habitat destruction on all goose species make this area a priority site to initiate a long-term study of gosling growth and survival.

TIMING/ANTICIPATED OUTPUT: This study will be undertaken as a MSc project through the University of Saskatchewan in cooperation with the Canadian Wildlife Service (CWS). Fieldwork will begin in June 1991 and the project will be completed by May 1993. Output will be in the form of an MSc thesis, publishable journal papers within one year after completion, and progress reports to the University of Saskatchewan and CWS.

LITERATURE CITED:

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--------- and D.G. Raveling. 1984. Dietary selectivity in relation to availability and quality of food for goslings of Cackling Geese. Auk 101: 295-306.

PERSONNEL: The student investigator will coordinate field activities, analyze the data, and report the results. His qualifications are 1) assisted with a Canada Goose nesting study in Churchill, Manitoba, 2) radio tracked Pacific White-fronted Geese in California, 3) radio tracked Mallards at the Delta Waterfowl and Wetlands Research Station, and 4) graduated from Cornell University. Two well qualified volunteers will finance their flight to and from Cambridge Bay to work during the nesting phase. One technician will work throughout the summer. Helicopter

support will be contracted through CWS.

BUDGET:**Costs presented are those for an independent project. However, logistics and costs integrate completely with the project POPULATION BIOLOGY OF CENTRAL ARCTIC GEESE, and complete funding of that project would reduce costs of this project substantially to an estimated shortfall of $30,000.00.

Personnel Requirements	
Graduate student @ $150/day x 90 days	$13,500.00
Field assistant @ $150/day x 90 days	$13,500.00
	$27,000.00
Operating Expenses	
1) Commercial flights- two round trip, Saskatoon<->Cambridge Bay, N.W.T.	
$1350.00 per person	$2,700.00
2) Shipping	$1,700.00
3) Twin Otter charter- Cambridge Bay<->QMG MBS one trip	$2,500.00
4) Helicopter charter- 25 hrs	$17,500.00
5) Fuel, Jet-B (includes positioning with Twin Otter) 12 drums @$1000.00/drum	$10,000.00
6) Transmitters- 50 @ $350 each, (single purchase)	$17,500.00
7) Miscellaneous (includes web-tags, neck collars, banding equipment, bow net traps, tower materials, etc.)	$2,600.00
8) Fuel, gasoline and propane	$500.00
	$55,000.00
Capital costs	
Telemetry system	$8,000.00
	$8,000.00
Annual total costs	$90,000.00
Annual matching funds	
CWS (year-end funds) [spent]	$500.00
CWS (AGJV Capital) [spent]	$8,000.00
CWS (NAWMP O&M) [committed]	$29,200.00
Private volunteer assistant [committed]	$13,500.00
NFWF [requested]	$40,000.00
Private organizations [requested]	$37,000.00
AGJV [requested]	$39,000.00
First-year shortfall	$39,000.00

EFFECT OF NECKBANDS ON SURVIVAL OF WHITE-FRONTED GEESE FROM QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY, NWT.

PRINCIPAL INVESTIGATOR: *Ray T. Alisauskas*, Research Scientist, Prairie and Northern Wildlife Centre, Canadian Wildlife Service, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4. (306) 975-4556, FAX (306) 975-4089.

BACKGROUND: Use of alphanumerically-coded neckbands is a valuable tool for determining distribution and movements of geese. However, their use is known to, or suspected to, be associated with significant mortality in some species (e.g., Ankney 1975, Craven 1979, but see Raveling 1976). The effect of neckbands on survival and recovery rates of Canada Geese were examined a posteriori by Samuel *et al.* (1990) who found significantly higher recovery rates (4 of 7 years) and survival rates (2 of 7 years) for juveniles. Because of small banded samples of geese, the authors were unable to statistically detect a significant difference in overall survival rate between neckbanded ($\hat{S}$=0.586), and non-neckbanded juvenile geese ($\hat{f}$=0.685). Neckbanded adults showed significantly higher overall recovery rates ($\hat{S}$=0.045) than did adults without neckbands ($\hat{S}$=0.026). Samuel *et al.* (1990) cautioned that these results were not completely conclusive for Canada Geese banded at Horicon, Wisconsin, and that they should not be applied to other populations of geese.

JUSTIFICATION: The Arctic Goose Joint Venture Prospectus has specified that updating distributions of various goose populations is a high-priority need. Also, CWS (1990) identified that research on the effect of neckcollars on survival of geese is high-priority. Neckband use has increased substantially especially in the last 4 years as part of coordinated banding and monitoring networks designed to update annual distribution of Lesser Snow and Ross' Geese, and since 1990, of White-fronted and Canada Geese. Neckbands are very useful for updating distributions of geese throughout the year. Also, they may be used to estimate survival and population size if some assumptions are made. The important assumption that there is no interaction between either natural or hunting mortality, and the presence of neckbands must be verified before survival or population size is estimated using collar sightings. This study is designed to assess what, if any, difference in survival of White-fronted geese is effected by the presence of plastic neckbands.

OBJECTIVES: The primary objective is to test the hypotheses that there are no differences in survival or recovery rates of White-fronted Geese that carry neckbands and USFWS metal leg-bands compared to those carrying only leg-bands and no neckbands. This work will increase the sample size of neckbanded White-fronted geese for the coordinated marking effort; it will add substantially to knowledge regarding the winter and migration distribution of birds marked in the Queen Maud Gulf Migratory Bird Sanctuary, and important area containing an estimated 43,000 visible birds during nesting (Alisauskas 1990).

EXPERIMENTAL DESIGN: Non-breeding or failed breeding White-fronted geese will be captured during the flightless period between 10-31 July of each year of field work. Geese will be captured with portable nets after being corralled by a Bell 206b helicopter. USFWS metal leg bands will be applied to all geese; alphanumerically coded plastic neckbands will be applied to every other bird that is leg-banded, thereby balancing any site-specific capture effects on the treatment (i.e., neckbanded) and control (non-neckbanded) groups of geese. Survival and recovery rates will be estimated using models in Brownie *et al.*. (1985) relying on the reporting of bands recovered from hunter-killed birds, or birds found dead. Specific band recovery models will be chosen when assumptions about them are either verified or rejected.

The average number of geese that need to be banded depends on several variables some of which are known, some assumed, and some that depend on the objectives of the study. The comparison between the experimental and control groups of geese is equivalent to testing survival rates over years of areas (Brownie *et al.*. 1985:180-182) in that any of those approaches can be tested with the z test statistic. Because the prediction is that survival in the experimental group is less than that of the control, the appropriate test is one sided and the critical value of z=1.645 at α=0.05.

To determine the average number of geese that must be banded per year, I calculated z-values for a variety of realistic $CV(S_i)$ ranging from 4% to 12%, k (number of years of banding) ranging from 2 to 6 years, and D (the specified average difference in S between the experimental group and the control) ranging from 0.04 to 0.12 (Table 1).

The following assumptions were made when calculating the required sample sizes: (1) Because they were unknown, covariances between S_i and S_{i+1} were assumed to be null; because these covariances are invariably negative (Brownie *et al.* 1985), and because they are in the denominator in the calculation of z, assumption that they are 0 will in all likelihood result in a higher value of z than if covariances were in fact 0; (2) S=0.65 for control geese; (3) both $CV(S_i)$ and S_i are constant between years and between experimental and control groups; (4) f_i, the recovery rate, equals 0.07 and is constant among years.

For each k, $CV(\overline{S})$ was calculated using $SE(\overline{S})/\overline{S}$ (Brownie *et al.* 1985:186) after calculating $SE(\overline{S})$ following Brownie *et al.* (1985:19), again assuming no covariance between S_i and S_{i+1}. For a given $CV(S_i)$, $CV(\overline{S})$ declines with increasing k. It is $CV(\overline{S})$ that is of immediate interest although it is influenced by $CV(S_i)$ which the investigator has less command over than he does over k.

Using anticipated values of S=0.65 and f_i=0.07, and variable values of $CV(S_i)$ and k, sample sizes were determined according to Wilson *et al.* (1989).

It is expected that 2000 to 3000 White-fronted Geese could be banded in the Queen Maud Gulf Migratory Bird Sanctuary in each year by a single banding crew; half of these geese would have neckbands put on. The average sample sizes per annum, n, shown in Table 1 are for each experimental group. Thus, for example,

with a CV(S_i)=0.10, a desired D=0.08, the resulting CV(S) would be 0.071 after 3 years of banding, resulting in z=1.309 which would not detect a difference in survival of 0.08 between groups. However, D=0.10 would be a significant difference after only 3 years of banding with average annual sample sizes per group of 1670 (because z>1.645).

Assuming a realistic maximum expectation of 1500 per experimental group for n, the null hypothesis of no difference in survival between experimental and control groups could be rejected after 3 years of banding if $D \geq 0.12$, 4 years if $D \geq 0.10$, 5 years if $D \geq 0.06$ (Table 1). It is unlikely that differences in survival of <0.06 could be statistically detected if k<7.

STUDY AREA: The dual objectives of this study are (A) foremost to text the hypothesis that these is no difference in survival between White-fronted Geese with and without neckbands, and (B) update the migration and winter areas of these geese from a breeding ground perspective, as stated in the AGJV Prospectus. The Queen Maud Gulf Migratory Bird Sanctuary contains high densities of White-fronted Geese, but this species has only been banded there one year previously (1990). Systematic helicopter surveys of the sanctuary during nesting in June, 1990 (Alisauskas 1990) indicated medium (>1/km²) densities along most of the entire coastal portion of the sanctuary and very high (>5/km²) densities of observed White-fronted Geese between the Perry River and the Ellice River. An estimated 42,649 (95% CI: 34,264 - 51,034) adult White-fronted geese could be visible in the survey area (Alisauskas 1990; note that visibility bias is unknown). Subsequent banding confirmed that high densities of both non-breeding/failed breeding flocks and family groups were in this area. Such high densities are necessary if expected sample sizes of between 2000 and 3000 banded White-fronted Geese are to be attained.

TIMING/ANTICIPATED OUTPUT: Initiate systematic banding with alternation of collar application in 1991, and continue in 1992 and 1993. Evaluate attained sample sizes and statistical power of rejecting null hypothesis in 1993/94. Thereafter, an annual review is suggested to determine how long study should last up to a maximum of 6 years of banding. Outputs include annual progress reports, improved and updated information on migration and winter movements of Central Arctic/Eastern Midcontinent/Western Midcontinent White-fronted Geese, final report on implications of neckbands on survival and recovery of White-fronted Geese.

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Wilson, K. R., J. D. Nichols, and J. E. Hines. 1989. A computer program for sample size computations for banding studies. U.S. Fish Wildl. Serv., Fish Wildl. Tech. Rep. 23. 19 pp.

PERSONNEL: Principal investigator, CWS technician, casual help (northern resident from Cambridge Bay), helicopter pilot, helicopter engineer.

BUDGET:

Personnel Requirements	
casual help 21 days @$150.00/day	$3,150.00
	$3,150.00
Operating expenses	
1) Travel (Saskatoon<->Cambridge Bay) 2 people @$1,350.00/person	$2,700.00
2) Travel (Cambridge Bay<->Perry River) Twin Otter 2 trips @$2,000.00/trip	$4,000.00
3) Helicopter Fuel 20 drums @$171.62/drum	$3,432.40
4) Fuel caching with Twin Otter 20 drums @$800.00/drum	$16,000.00
5) Helicopter Charter 30 hrs @$750.00/hr	$22,500.00
6) Accommodation during travel (10 person-nights @$75.00/person-night)	$750.00
7) Neckbands (1500 @ $3.00/neckband)	$4,500.00
8) Miscellaneous banding supplies	$1,000.00
	$54,882.40
Capital costs	
none	0.00
	0.00
Annual Total Costs	$58,032.40
Annual Matching Funds	
CWS (NAWMP O&M) [committed]	$19,432.00
Polar Continental Shelf Project [requested]	$22,500.00
CWS (AGJV Funds) [requested]	$38,600.40
First-year Shortfall	$38,600.40

Table 1. Sample sizes necessary to detect variable differences in survival (D) between groups of White-fronted Geese with, and without neckbands. Assumptions are outlined in text.

$CV(S_i)$			k=(number of years of banding) 2	3	4	5	6
12.0	D	$CV(S)$ --->	12	8.5	6.9	6.0	5.4
		n --->	-[a]	1165	775	576	459
	.12	z	1.192	*1.686*[b]	*2.065*	*2.385*	*2.666*
	.10	z	0.979	1.384	*1.695*	*1.957*	*2.188*
	.08	z	0.771	1.091	1.336	1.542	*1.724*
10.0	D	$CV(S)$ --->	10	7.1	5.8	5.0	4.5
		n --->	-	1670	1097	829	660
	.10	z	1.174	*1.661*	*2.034*	*2.349*	*2.626*
	.08	z	0.925	1.309	1.603	*1.851*	*2.069*
	.06	z	0.683	0.967	1.184	1.367	1.528
8.0		$CV(S)$ --->	8.0	5.7	4.6	4.0	3.6
		n --->	-	2591	1744	1295	1032
	.10	z	1.468	*2.076*	*2.543*	*2.936*	*3.283*
	.08	z	1.157	1.636	*2.003*	*2.313*	*2.586*
	.06	z	0.854	1.208	1.480	*1.709*	*1.910*
	.04	z	0.561	0.793	0.972	1.122	1.254
6.0		$CV(S)$ --->	6.0	4.2	3.5	3.0	2.7
		n --->	-	4773	3012	2303	1834
	.08	z	1.542	*2.181*	*2.671*	*3.085*	*3.449*
	.06	z	1.139	1.611	*1.973*	*2.278*	*2.457*
	.04	z	0.748	1.058	1.295	1.469	*1.672*
4.0		$CV(S)$ --->	4.0	2.8	2.3	2.0	1.8
		n --->	-	10739	6976	5182	4127
	.08	z	1.542	*2.181*	*2.671*	*3.085*	*3.449*
	.06	z	1.139	1.611	*1.973*	*2.278*	*2.457*
	.04	z	0.748	1.058	1.295	1.469	*1.672*

[a]not calculated because significant z-value not present.
[b]italicized z-values are significant at P=0.05 for detecting specified difference in survival between collared and non-collared groups for specified $CV(Si)$.

HABITAT MAPPING OF THE QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY

PRINCIPAL INVESTIGATORS: *Robert S. Ferguson*, Habitat Biologist, Canadian Wildlife Service, P.O. Box 637, Yellowknife, Northwest Territories, X1A 2N5, (403) 920-8532 FAX (403) 873-8185; *Ray T. Alisauskas*, Research Scientist, Prairie and Northern Wildlife Centre, Canadian Wildlife Service, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4, (306) 975-4556, FAX (306) 975-4089; *Gordon Stenhouse*, NWT Manager, Ducks Unlimited (Canada), P.O. Box 2641, Yellowknife, Northwest Territories, X1A 2P9, (403) 873-6744 FAX (403) 873-6387.

BACKGROUND: The Queen Maud Gulf MBS, encompassing about 62,900 km² is the largest in the NWT. The coastal and riparian habitats of this area comprise important nesting areas for White-fronted, Canada, Ross' and Lesser Snow Geese. Recommendations in response to the Northern Mineral Policy proposed a reduction in size to about 54,000 km², subject to a thorough field assessment of the Sanctuary's migratory bird resources. Ongoing projects include the assessment of the distribution and abundance of all geese in the sanctuary, as well as Tundra Swans, Common Eiders, King, Eiders, Oldsquaw, Pintail, Sandhill Cranes, Loons, and Ptarmigan. An understanding of the spatial distributions of habitat types within the Sanctuary is needed.

JUSTIFICATION: The Arctic Goose Joint Venture Prospectus identifies population regulation and breeding distribution as being the greatest research needs for North American Arctic Goose populations. Little is known about the factors that influence the breeding distribution of many species of Arctic Geese, but the most likely influence is the distribution of suitable habitat. Habitat inventory data are needed to document the relationships between waterfowl nesting distributions and habitat features. An understanding of these relationships would assist in identifying areas of particular importance to waterfowl within this vast Sanctuary. The distribution of these key habitats will be a major factor in delineating a revised boundary for the Sanctuary. This information is also a prerequisite to conducting detailed research on the nesting ecology of waterfowl. Most importantly, the results may be used to predict the suitability of other areas in the Central Arctic for nesting waterfowl on the basis of the presence or absence of particular habitat features.

OBJECTIVES: The objective of this 2-year study is to verify imagery of arctic habitats (rock outcrop, various classes of wet and dry tundra based on hummockiness and thus suitability for White-fronted Goose nesting habitat, coastal Puccinnellia habitats, and inland aquatic habitats). This will provide a database to examine association between distribution/abundance of arctic geese and arctic habitat.

METHODS: The primary source of information for mapping the spatial distribution of habitat types will be Landsat Thematic Mapper (TM) data, supported by ground data to verify visual

interpretations of the satellite imagery. Particular emphasis will be given to delineating those habitat types of functional importance to waterfowl (e.g., wetlands, lowland feeding areas, nesting areas, brood rearing areas). Landsat TM data (2 full scenes, recorded 14 and 16 July 1989) were acquired in 1990 and preliminary enhancements of the data were performed at the NWT Centre for Remote Sensing and examined during 1990 fieldwork in the arctic. Verification of the visual interpretation of the images requires that ground data be collected from all parts of the sanctuary. It is important to sample sites covering the full range of spectral values from the entire area because of spectral variability between scenes and within cover types. Collection of ground data in such a large area requires that sampling be done over two field seasons.

Field work will be conducted in the summers of 1991 and 1992, and will require about 100 hr of helicopter support. Ground data (including descriptions of landform, topography, substrate, vegetation and surface moisture) will be collected and analyzed in relation to goose distributions in order to identify cover types of greatest importance to waterfowl. The spatial distribution of these cover types, in conjunction with data on goose distribution and abundance, will be used as the basis for modifying the Sanctuary boundaries.

STUDY AREA: Based on the excellent spectral variability of the essentially cloud-free imagery, and on preliminary ground verification of the image, a broad cover-type map of the Sanctuary may be produced by visual interpretation of enhanced imagery, thereby eliminating the need for automated classifications (which would be extremely time consuming for such a large area). Also, the Sanctuary has areas with highly spatially variable densities of breeding White-fronted, Small Canada, Ross' and Lesser Snow Geese as well as Sandhill Cranes, King Eiders, Northern Pintail and Tundra Swan. The highly variable habitat, the excellent imagery, and highly variable spatial abundance of geese makes this an excellent area to examine arctic goose-arctic habitat associations.

TIMING/ANTICIPATED OUTPUT: Preliminary field work was done in 1990 assessing quality of imagery. Ground verification will commence in 1991 and continue until 1992. Progress will be reviews in each year. Color maps showing the distribution of key habitats for nesting and moulting waterfowl in the QMG MBS; A revised boundary for the QMG MBS, based on waterfowl habitat and population data; Greater understanding of the relationships between nesting arctic geese and their summer habitats; Habitat Inventory data which may be used as input to a Geographic Information System for future studies of the nesting ecology of arctic geese.

PERSONNEL: Principal investigators, helicopter pilot, helicopter engineer.

BUDGET:

Personnel requirements

none	0.00
	0.00

Operating expenses

1)	Travel (Saskatoon, Yellowknife<-> Cambridge Bay) 2 people @ $1000.00/person	$2,000.00
2)	Travel (Cambridge Bay<->Perry River) Twin Otter (2 trips @ $2,000.00/trip)	$4,000.00
3)	Food (5 person-days @ $50.00/person-day)	$3,500.00
4)	Helicopter Fuel (30 drums @ $171.62/drum)	$5,148.60
5)	Fuel Caching (30 drums @ $800.00/drum)	$24,000.00
6)	Helicopter Charter (50 hr @ $700.00/hr)	$35,000.00
7)	Miscellaneous (stationery, topographic maps, processing and printing of remote sensing products)	$1,500.00
		$75,148.60

Capital Costs

1)	Satellite Imagery (first year only)	$9,000.00
		$9,000.00

Total Annual Cost	$84,148.60
Total Project Cost (2 years)	$159,297.20

Annual Matching Funds

CWS (purchase Satellite Imagery - first year only) [spent]	$9,000.00
CWS (NAWMP O&M) [spent]	$38,864.00
DU (Canada) [requested]	$35,000.00
Polar Continental Shelf Project [requested]	$35,000.00
First-year Shortfall	$36,320.00

SPRING NUTRITIONAL ECOLOGY OF WHITE-FRONTED AND SMALL CANADA GEESE NESTING IN QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY

PRINCIPAL INVESTIGATORS: *Ray T. Alisauskas*, Research Scientist, Canadian Wildlife Service, Prairie and Northern Wildlife Centre, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4, tel (306) 975-4556, FAX (306) 975-4089; *C. Davison Ankney*, Professor, Department of Zoology, University of Western Ontario, London, Ontario, N6A 5B7, tel (519) 661-3148 FAX (519) 661-2014; *Graduate Student*, MSc candidate to be named, Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan.

BACKGROUND: Only for Lesser Snow Geese migrating through the eastern portions of the great plains of North America has the timing of spring nutrient reserve storage been completely documented (Alisauskas 1988). Timing of storage varies for different nutrient reserves; protein reserves are stored in two episodes by migrating female snow geese from this population - early in spring migration at latitudes south of the Missouri River Valley, and late in spring migration when geese stage on the Hudson Bay lowlands; fat reserves are stored mostly on the northern plains in the Dakotas and southern Manitoba. Fragmentary information on Atlantic Brant (Van Gilder *et al.* 1986) shows that these birds, unlike Lesser Snow Geese, store considerable fat on wintering areas before departure for spring migration. This and other research on, e.g., Greater Snow Geese (Gauthier et al 1984a,b), Canada Geese (Hanson 1962, Raveling 1979), indicates that timing of nutrient storage by geese in spring varies by species.

Significant studies of body composition have been done relating size of nutrient reserves of some species of arctic-nesting geese including Ross' Geese (Ryder 1970), Lesser Snow Geese (Ankney and MacInnes 1978), Brant (Ankney 1984), and Cackling Geese (Raveling 1979), to how many eggs can be laid by individual females. A common finding of studies to date are that virtually all nutrient reserves (fat, protein and mineral) are acquired before members of each of these species arrive on arctic nesting grounds. Thus, events that influence acquisition of nutrient reserves during spring migration have an important bearing on subsequent productivity and fall population size.

JUSTIFICATION: The CWS ad hoc/National Goose Working Group has determined that little is known about population regulation, distribution, population size, and general ecology of Midcontinent population of White-fronted Geese and Short-grass prairie population of Canada Geese. No information is available on the timing of fat, protein and mineral storage by White-fronted or Small Canada Geese nesting in the Queen Maud Gulf MBS, where large numbers of both species occur. Research that documents the timing and extent of nutrient reserve acquisition during spring for different species of arctic-nesting geese is a required first step toward understanding where nutrition of geese may influence productivity and survival. Concerns about provision of suitable habitat important to geese during spring

migration can be addressed only if the location and extent of nutrient storage is known. Also unknown are the diets consumed by each species after arrival on arctic nesting areas. Such information may add insight into factors affecting the nesting distributions of both of these species of arctic geese.

OBJECTIVES:

-Determine importance of northern plains for spring nutrient storage by White-fronted and small Canada Geese (SGP).
-Assess if prenesting period in the arctic is a period of nutrient gain, equilibrium, or less for White-fronted and small Canada Geese arriving in the Queen Maud Gulf Migratory Bird Sanctuary.
-If the prenesting period in the arctic is a period of nutrient gain or maintenance, determine which plant foods and associated habitats are important spring feeding areas in the arctic for Midcontinent White-fronted, and Shortgrass Prairie Canada Geese.

METHODS: Over two years, each species of goose will be sampled in Sasktachewan/Alberta twice during spring migration (the first sample shortly after arrival on the prairies, and the second sample about two weeks after the first), again after arrival onto arctic nesting areas in QMG MBS, and finally at initiation of egg laying. Each sample requires 10-15 adult geese per sex to acquire acceptable confidence limits for means of nutrient reserves. Esophageal contents will be sorted and individual food items will be sorted by plant species and organ; these will then be analyzed for nutrient content. Dissection and chemical analysis of geese will follow Alisauskas (1988), and fat, protein and mineral reserves will be measured for each.

STUDY AREA: During spring, both species occur in large numbers in eastern Alberta and Western Saskatchewan. Large numbers also occur along the coastal portion of the Queen Maud Gulf Migratory Bird Sanctuary. This will facilitate collections, and will allow the study to share logistics with other research on arctic geese in the Sanctuary.

TIMING/ANTICIPATED OUTPUT: Field work to begin in April, 1991 and end in June, 1992. Several papers in scientific journals, management recommendations, MSc. thesis, identification of important spring feeding habitats in the Central arctic.

LITERATURE CITED:

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VanGilder, L. D., L. M. Smith, and R. K. Lawrence. 1986. Nutrient reserves of premigratory Brant during spring. Auk 103:237-241.

PERSONNEL: 2 Principal investigators.

BUDGET:

Personnel requrements	
Graduate student salary	$12,500.00
	$12,500.00
Operating expenses	
1) Travel (Saskatoon<->Cambridge Bay) 2 people @$1350.00/person	$2,700.00
2) Travel (Cambridge Bay<->Perry River) Twin Otter 2 trips @$2,000.00/trip	$4,000.00
3) Fuel	$1,000.00
4) Freight and Storage	$3,000.00
5) Food	$3,000.00
6) Analyses of Geese	$20,000.00
	$33,700.00
Capital costs	
none	0.00
	0.00
Annual Total Costs	$46,200.00
Total Project Costs	$92,400.00
Annual Matching Funds	
CWS (AGJV Funds) [requested]	$46,200.00
Current Annual Shortfall	$46,200.00

NECK-BANDING OF WHITE-FRONTED GEESE AT INGLIS RIVER, NWT.

PRINCIPAL INVESTIGATORS: *Dick Kerbes*, Biologist, Canadian Wildlife Service, Prairie and Northern Wildlife Centre, 115 Perimeter Rd., Saskatoon, Saskatchewan, S7N 0X4, (306) 975-4111 FAX (306) 975-4089; *Gordon Stenhouse*, NWT Manager, Ducks Unlimited (Canada), P.O. Box 2641, Yellowknife, Northwest Territories, X1A 2P9, (403) 873-6744 FAX (403) 873-6387.

BACKGROUND: Initial surveys have indicated about 15% of the Eastern Mid-continent Population of White-fronted Geese nest and moult in the Inglis River area, Northwest Territories (Bromley and Stenhouse, unpubl. data). This location is on what is thought to be the extreme northeastern edge of the species breeding range. To date, there has not been any marking or banding of geese in this area, partly because of the remoteness and consequently the high cost of operating there. In recent years, the winter distribution of breeding populations appears to have shifted to the point where current understanding of population delineation is cloudy. The geographic affinities of these eastern birds is unknown.

Starting in 1990, a cooperative and co-ordinated marking program for Mid-Continent White-fronted geese was initiated from Alaska to Queen Maud Gulf in the central arctic, when over 3,000 were collared. Despite this success, it is important to mark geese in the Inglis River area, beginning in 1991, to take advantage of programs currently in place for monitoring observations during migration and during winter.

JUSTIFICATION: Updating winter and migration distributions of goose populations based on samples banded in the arctic is identified by the Arctic Goose Joint Venture Prospectus as an area in need of attention.

OBJECTIVES: Provide a marked sample of White-fronted Geese on what is thought to be the extreme northeast portion of their breeding range to better delineate the fall and winter range of the western mid-continent population.

METHODS: Standard helicopter banding.

TIMING/ANTICIPATED OUTPUT: Initiate banding in 1991. Possibly continue in 1992, 1993 depending on numbers banded in 1991. New information on the distribution of Western Midcontinent Population of White-fronted Geese will result.

PERSONNEL: 2 Principle investigators, casual help, helicopter pilot, helicopter engineer.

BUDGET:

Personnel requirements	
Casual help.....	$1,000.00
Operating expenses	

1)	10 hours helicopter ferry	$6,000.00
2)	10 hours banding	$6,000.00
3)	5 hours fixed wing support	$1,750.00
4)	Food, gear, collars	$2,500.00
5)	Travel (2 people from Yellowknife to Gjoa Haven)	$2,000.00
6)	Fuel caching	$1,500.00
7)	Accommodations	$2,500.00
		$22,250.00

Capital costs
none.....0.00

Annual Total Costs.....$23,250.00

Annual Matching Funds
none.....0.00

First-year shortfall.....$23,250.00

A PROPOSAL

BROOD ECOLOGY OF CANADA AND WHITE-FRONTED GEESE ON THE KENT PENINSULA, NWT

Submitted to:

Arctic Goose Joint Venture
North American Waterfowl Management Plan

Submitted by:

Thomas C. Tacha
Caesar Kleberg Wildlife Research Institute
Texas A&I University
Campus Box 218
Kingsville, TX 78363
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and

Robert G. Bromley
Department of Renewable Resources
Government of NWT
Box 1320
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Phone (403) 873-0293

September, 1990

TITLE: Brood Ecology of Canada and White-fronted Geese on the Kent Peninsula, NWT

GOAL: To better understand brood ecology of small Canada (Branta canadensis hutchinsii/parvipes) and white-fronted (Anser albifrons) geese in arctic Canada.

BACKGROUND:

The Department of Renewable Resources (DRR) of the Government of the Northwest Territories of Canada has been conducting studies of the nesting biology of sympatric small Canada and mid-continent white-fronted geese since 1987 in a circa 15km^2 study area located 160km southwest of Cambridge Bay on the Kent Peninsula. Habitat composition and availability on the study area has been delineated using satellite imagery. Nesting of both species is common (75-100 nests each) in the study area. Nest-trapping efforts for both Canadas and white-fronts have been successful. A cabin has been erected on the study site with adequate equipment to support up to 12 people. Logistics and air support options are adequate.

OBJECTIVES:

1. To estimate survival of Canada and white-fronted goslings from hatching to fledging.
2. To monitor movements and mixing of broods for each species.
3. To quantify and compare brood habitat use and selection for each species.

JUSTIFICATION:

The breeding biology of small Canada and white-fronted geese nesting in arctic Canada is poorly understood. Productivity of these geese has recently been monitored to the hatching stage, but not to fledging. Understanding brood survival is essential for predicting fall flights upon which annual harvest regulations should be based. The proposed brood ecology study, when combined with ongoing DRR nesting studies, will complete a basic understanding of natality and breeding habitat requirements of these species. Such information is fundamental to conservation of arctic goose habitats and responsible management of arctic goose populations.

METHODS:

A total of 15 adult females of each species will be trapped each year (1991 and 1992) during the last week of incubation (usually early-mid July), and marked with an aluminum leg band, individually coded neck collar, and a radio transmitter. All goslings (n = 50/species) hatched from these nests will be marked at the nest with web tags and miniature radio transmitters within 18 hours. Additional adult females and goslings will be marked with neck collars or web tags at other nests. Movements, habitat use, affiliations with other geese, and mortality of radio-marked parent females and goslings will be monitored by ground and/or aerial searches daily until fledging (usually late August-early September). Additional information will be obtained through recapture of marked adult females and goslings during banding in July and August.

Movements and habitat use data will be summarized by week following hatch; habitat use will be compared to habitat availability to delineate habitat selection by broods of each species. Daily and seasonal survival rates will be calculated for goslings and compared between years and species.

SCHEDULE OF ACTIVITIES:

Project Duration: 1 January 1991 - 31 May 1993

Field work: 15 June - 1 September 1991-92

Analysis and reporting: September 1991 - June 1992, September 1992 - May 1993

REPORTING:

An annual progress report will be provided by 1 January 1992.

A final project report will be provided by 1 June 1993.

PERSONNEL:

Thomas C. Tacha - Principal Investigator

Robert G. Bromley - Co-principal Investigator

M.S. Student - to be named

Research technician - to be named

COLLABORATING AGENCIES:

Caesar Kleberg Wildlife Research Institute (TAIU)

Department of Renewable Resources (NWT)

Ducks Unlimited (Canada)

BUDGET: ($ U.S.)

Item	1991	1992	1993
Personnel			
Research Technician (@ $1,000/mo)	$ 3,000	$ 3,000	$ 0
Fringe Benefits (@ 17.1%)	513	513	0
M.S.Fellowship @$700-800/mo	$ 8,400	$ 8,400	$ 4,000
Travel			
Commercial Air	$ 4,000	$ 4,000	$ 0
Per diem and Lodging	587	487	500
Contractual Services			
Air Charter	$ 6,000	$ 6,500	$ 0
Supplies			
Transmitters	$18,000	$20,000	$ 0
Camp Supplies	2,000	2,000	0
Telemetry supplies	500	100	0
Equipment			
Telemetry receivers	$ 5,000	$ 0	$ 0
Total Request-AGJV (75%)	$48,000	$45,000	$ 4,500
CKWRI Contribution (25%) Principal Investigator Salary, fringe benefits, and computer time.	$16,000	$15,000	$ 1,500

ARCTIC GOOSE JOINT VENTURE PROPOSAL: HABITATS AND POPULATIONS OF PACIFIC BRANT IN THE CANADIAN WESTERN ARCTIC

January 1991

Ducks Unlimited Canada
Canadian Wildlife Service
Yellowknife, Northwest Territories

HABITATS AND POPULATIONS OF PACIFIC BRANT IN THE CANADIAN WESTERN ARCTIC

Background and Rationale

Pacific or Black Brant (Branta bernicla nigricans) breed in coastal areas of the Western and High Arctic regions of Canada, Alaska, and Siberia. This small maritime goose migrates in spring and fall along the Pacific coast. Most or all of the population uses the Izembek Lagoon (in southwestern Alaska) as a staging site during both migrations. Brant winter on the Pacific coast, with about 90% of the population moving southward to the Baja California region of Mexico, the other 10% remaining in Canada and the United States (Figure 1). At least two different breeding stocks of brant occur in the Pacific Flyway: the Black Brant (Branta bernicla nigricans) of the Low Arctic, and the "gray" brant, possibly also a distinct subspecies, of the High Arctic (Boyd and Maltby 1979, Boyd et al. 1988, Reed et al. 1989a, Shields 1990). The stocks appear to be fairly discrete, remaining segregated on breeding, staging, and wintering areas (Reed et al. 1989a,b).

Numbers of Pacific Brant are low compared to populations of many other arctic-nesting geese (North American Waterfowl Management Plan 1986) and any error in our management of brant populations or habitat could prove to be costly. As indicated in Table 1, the risk of catastrophic mortality or reproductive failure caused by pollution, disease, adverse weather, or disturbance could be critical because of these low population levels, the maritime and colonial nature of brant, and the potentially limited abundance of suitable habitat. For these reasons, brant have been designated as a priority species under the Arctic Goose Joint Venture (Bromley et al. 1986, Canadian Wildlife Service National Goose Working Group 1989).

The proposed study concerns three major deficiencies in our knowledge of the brant of the Canadian Western Arctic: (1) population distribution, abundance, and trend; (2) habitat use and availability; and (3) population delineation on breeding, migration, and wintering ranges. The geographic focus of the study will be Banks Island as this

area likely represents the most important breeding area for brant in the Canadian Western Arctic (Manning et al. 1956, Pacific Flyway Technical Committee 1981). The cooperative investigation, involving Ducks Unlimited Canada and the Canadian Wildlife Service, will be carried out over a four-year period from 1991-92 to 1994-95.

Objectives

(1) Determine the status, distribution, and abundance of Pacific Brant on Banks Island.

(2) Identify important habitats for breeding and moulting brant on Banks Island and the characteristics of these habitats.

(3) Delineate the different stocks of brant that exist on Banks Island and their wintering grounds.

Methods

Population status, distribution, and abundance

Brant present special problems for population inventories because they can nest either colonially (at densities sometimes exceeding several hundred pairs per km^2) or in a highly dispersed manner (population densities less than one pair km^2). The distribution and abundance of brant on Banks Island will have to be determined through a combination of helicopter surveys for widely dispersed nesters and moulting flocks, and intensive searches of colonies by boat and on foot. Aerial surveys will follow methods described by Hines et al. (1990). A Bell 206B Helicopter will be flown along straight transect lines 45 m above ground at a ground speed of about 80 km/hr. All brant observed within 200 m of the transect will be used for calculations of population densities but observations made outside transects will provide additional information on distribution of moulting birds and (possibly) location of colonies. Surveys will be stratified according to methods described by Caughley (1977) and Gasoway et al. (1986) if preliminary results suggest that is feasible. Ground counts of all nests will be carried out at small colonies, and sample plots (Sedinger 1989) or line-transects (Anderson et al. 1979, Burnham et al. 1980) will be used to count breeding pairs at large colonies.

Habitat

Habitat studies will combine the information gathered during aerial surveys with descriptions of "available" and "used" macro-habitats (i.e., landscape or vegetation units that can be mapped at a scale of 1:50 000). Preliminary assessment of cover types used by nesting and moulting brant will be carried out in 1991, and study sites for more intensive investigations will be determined at this time. The major cover types present in at least two areas used by brant will be determined in 1991 through interpretation of Landsat images and black-and-white air photos. Habitat features that are readily recognized from remote-sensing imagery and known to be important to geese and other waterfowl (e.g., vegetation type, the presence of hydrophytic sedges and grasses, pond size, depth and turbidity of water) will be used in delineating cover types (Pakulak et al. 1974, Ritter et al. 1989). Whenever possible, vegetation cover types will be interpreted in terms of existing information on soils, surficial geology, and climate so that the relationships among physical environment, plant communities, and goose distribution are better understood. Major habitat types will be mapped at a scale of 1:50 000.

Population Delineation

Flightless geese will be captured by helicopter "drives" (Timm and Bromley 1976, Maltby 1977). Each captured bird will be equipped with an aluminum United States Fish and Wildlife Service band on one leg and a numbered plastic band on the other leg. Systematic observations carried out on staging and wintering sites as part of other AGJV programs will provide useful information on migration and wintering affinities of the colour-marked brant. Flightless adults will be banded during mid-summer, and young birds will be banded later in the summer. A minimum of 500 adult geese, and as many young of the year as possible, will be the banding goal for each year of study. Potential banding sites will be identified during population surveys and habitat studies.

Coordination with Other AGJV Projects and Cooperation with the Inuvialuit

The investigation of brant populations will be closely integrated with other studies of waterfowl in the Inuvialuit Settlement Region being carried out by the Canadian Wildlife Service, and other AGJV projects conducted on migration routes and wintering

grounds (Table 2). Logistics will be simplified, costs significantly reduced, and the overall quality of the results greatly enhanced by coordinating all projects. Two CWS programs will be especially important in this regard: the proposed population inventories of eiders on Banks and Victoria islands, and ongoing population inventory and banding studies of geese and swans on the adjacent mainland region. These studies will produce useful information on brant for geographic regions other than Banks Island, and effectively will expand the geographic base of the proposed study at no additional cost.

Successful wildlife management programs cannot be implemented in the Western Arctic without the close cooperation, involvement, and support of the Inuvialuit. The people from Sachs Harbour will assist in fuel caching and field work, and as part of other CWS studies of the waterfowl of the Inuvialuit Settlement Region, the traditional knowledge of brant distribution and abundance will be determined.

Outputs

(1) Annual progress reports on the distribution, abundance, habitat, and survival/mortality of Pacific Brant (15 December 1992, 1993, 1994, 1995);
(2) Final publication of results in scientific journals or technical reports (manuscripts produced by 31 December 1995).

References

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Time Table and Budget

The project can be divided into two discrete components - "subproject 1" dealing with the distribution, abundance, and habitat, and "subproject 2" addressing population delineation, migration routes, and wintering sites of the brant from Banks Island. The annual cost, including salary and benefits for the project biologist ($45 K per annum), is $248.4 K. Detailed breakdowns of the costs of the two subprojects are indicated in Tables 3 and 4, and a time table for completion of work during 1991-92 is presented in Table 5. It is anticipated that the time-table will be similar in future years.

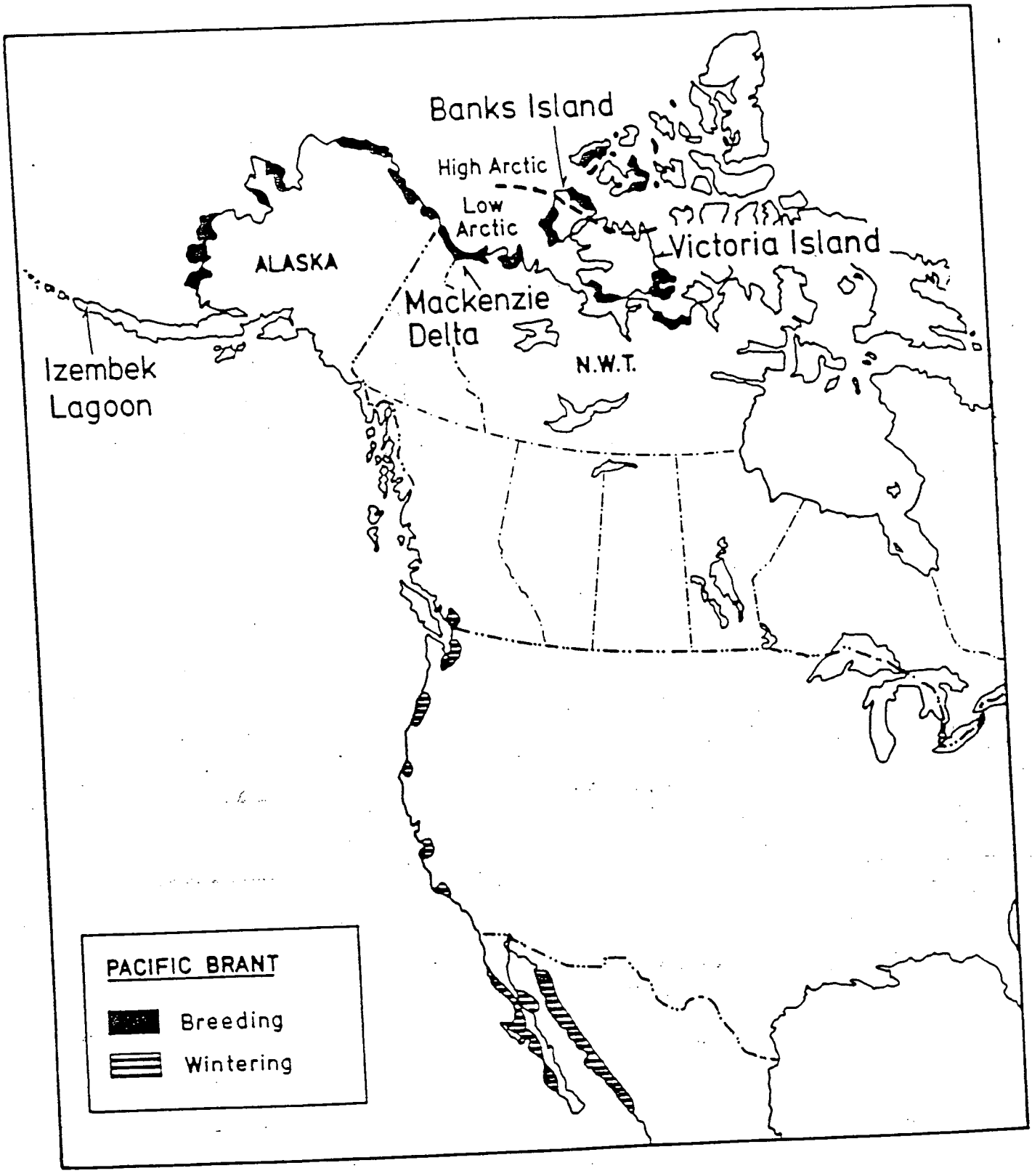

Figure 1. The distribution of Pacific Brant.

Table 1. Concerns about breeding populations of Pacific Brant in the Canadian Arctic.[a]

(1)	Population levels of brant are relatively low, and there is little room for error in management of these populations. Risks due to catastrophic mortality are great because of the small population size.
(2)	The population status of Pacific Brant in Canada is unknown (are populations decreasing, stable, or increasing?) and there is a lack of information on distribution and abundance.
(3)	Brant are the most maritime North American goose roosting, nesting, feeding, and rearing their young on or near the sea. Like other seabirds, they are vulnerable to oil spills and other forms of marine pollution.
(4)	Many brant nest colonially and the birds from a specific breeding site are associated on staging and wintering grounds also. Localized impacts such as industrial development, hunting, pollution, disease, or food shortage could have a substantial, perhaps disastrous, effect on a particular breeding stock of birds.
(5)	Stocks of brant may be genetically distinct and should be managed as discrete subspecies.
(6)	Brant are specialized in their use of habitats both on breeding and wintering grounds. The habitats on which brant are dependent are likely limited.
(7)	Brant numbers have declined precipitously in some parts of their breeding and wintering range.
(8)	There is a significant subsistence harvest of Pacific brant in the Canadian Western Arctic. Brant stocks will need to be maintained at healthy levels so that this harvest can be continued.

[a] References:

Boyd (1979), Boyd and Maltby (1979), Boyd et al. (1988), Bromley et al. (1986), Canadian Wildlife Service National Goose Working Group (1989), Lensink (1987), McLandress (1984), Pacific Flyway Technical Committee (1981), Reed et al. (1989a,b), Shields (1990)

Table 2. Projects with which the study of Pacific Brant on Banks Island will be closely coordinated.[a]

(1)	Population surveys and banding studies of geese and swans on the mainland of the Inuvialuit Settlement Region (Canadian Wildlife Service).[a]
(2)	Population surveys of King and Common Eiders on Banks and Victoria island (Canadian Wildlife Service).
(3)	Inventory of migratory birds and their habitat in and near Kendall Island Bird Sanctuary (NOGAP study by Canadian Wildlife Service).
(4)	Study of inter-colony dispersal of brant (University of Alaska).
(5)	Radio-telemetry study on brant use of staging and wintering sites (United States Fish and Wildlife Service).
(6)	Annual monitoring of brood sizes, age ratios, and productivity of brant on the staging area at Izembeck Lagoon, Alaska (United States Fish and Wildlife Service).
(7)	Investigation of migrating brant and their habitat in the Strait of Georgia, British Columbia (Canadian Wildlife Service).
(8)	Distribution of High Arctic brant on staging areas and wintering grounds (Canadian Wildlife Service).

[a] The agency assuming the lead role in the project is indicated in parentheses.

Table 3. Annual budget for subproject 1: distribution, abundance, and critical habitats for breeding and moulting Pacific Brant on Banks Island.

Output or Steps	Person Days	O&M (K)
Preparation/literature review	25	0.5
Purchase of maps	1	1.2[a]
Purchase of air photos	2	1.5[b]
Purchase of Landsat (TM) transparencies	2	1.8[c]
Fuel purchase	0	15.0[d]
Fuel caching	0	13.5[e]
Travel	6	4.5[f]
Helicopter surveys	30	44.1[g]
Helicopter ground-truthing of habitat maps	20	15.8[h]
Air photo interpretation	20	0.3
Data input and analysis	20	0.3
Report writing	25	0.0
Drafting and printing	5	1.0
Field equipment and expenses	3	10.0[i]
Field assistants (Sachs Harbour)	0	3.8[j]
TOTAL	159	113.3

[a] 150 topographic maps @ $8.00 each

[b] 300 air photos @ $5.00 each

[c] 6 Landsat Thematic Mapper transparencies @ $300 each

[d] 50 drums turbo fuel @ $300/drum

[e] by skidoo (local hire) and Twin Otter

[f] 3 people - Yellowknife - Sachs Harbour return

[g] 70 hrs Bell 206B @ $630/hr

[h] 25 hrs Bell 206B @ $630/hr

[i] field and camping equipment, food, hotel, etc.

[j] 30 person days @ $125/day

Table 4. Annual budget for subproject 2: population delineation, staging areas, and wintering sites of Black Brant from Banks Island.

Output or Steps	Person Days	O&M (K)
Preparation	15	0.5
Travel	6	6.0[a]
Fuel purchase	0	12.0[b]
Fuel caching	0	10.8[c]
Banding drives (helicopter)	40	47.3[d]
Data input and analysis	20	0.5
Report writing	20	0.0
Data analysis	30	0.3
Drafting and printing	5	0.7
Field equipment and expenses	1	8.2[e]
Field assistants (Sachs Harbour)	0	3.8[f]
TOTAL	137	90.1

[a] 2 trips - Yellowknife - Sachs Harbour return

[b] 40 drums turbo fuel @ $300/drum

[c] by skidoo (local hire) and Twin Otter

[d] 75 hrs Bell 206B @ $630/hr

[e] nets and poles for drive-trapping geese, food, hotel, etc.

[f] 30 person days @ $125/day

REQUIRE

8 weeks
$8,400 Exp.
$6,000 TRAVEL
TO MONITOR NECK

Table 5. Time table for completion of 1991-92 program concerning Pacific Brant habitat and populations on Banks Island.

1 February 1991	hire project biologist
1 May 1991	literature review
15 May 1991	acquire field equipment, photos, maps, Landsat imagery
1 June 1991	complete planning of field work and community consultation
15 July	field work on breeding populations
15 August	field work concerning habitat and banding
15 October 1991	computer input of data
15 November 1991	preliminary data analysis
31 December 1991	progress report
1 March 1992	air photo interpretation, further data analysis
1 April 1992	draft habitat map of intensive study areas

PROPOSAL

AERIAL SURVEYS FOR GEESE AND SWANS AND BANDING OF GREATER WHITE-FRONTED GEESE ON OLD CROW FLATS, YUKON, 1991-1993

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Revised 7 December 1990

1. BACKGROUND AND JUSTIFICATION

The Old Crow Flats, located in the northern Yukon Territory, is recognized as a wetland area of international importance as waterfowl habitat (IUCN 1987). Each year it supports on the order of 500,000 waterfowl which come there to breed and undergo their annual feather moult. The most common species of waterfowl are Scaup, Scoters (primarily white-winged Scoters), Northern Pintail, Oldsquaw, and American Wigeon (e.g. Conant and Dau 1990).

In recent years, concern has been raised about the status of White-fronted Goose populations in North America. In contrast to the situation for many other North American goose species which are subjected to heavy hunting pressure, the population status, distribution, and population dynamics of White-fronted Geese are very poorly documented, especially for those birds which migrate in the Central and Mississippi Flyways. The Western Midcontinent Population of White-fronted geese is the only population of geese included in the Arctic Goose Joint Venture Prospectus (Anonymous 1990) which is currently thought to be declining. The Old Crow Flats lies within the breeding range of the Western Midcontinent Population, but there have never been studies to determine the number of geese nesting or moulting on the Flats. Annual waterfowl surveys conducted in June by the U. S. Fish and Wildlife Service for at least 20 years on the Old Crow Flats suggest a population averaging about 5,000 whitefronts, but the USFWS surveys are directed primarily towards ducks and are not considered accurate for White-fronted and Canada geese which are cryptically coloured and frequently found on land rather than in the water. This number (5,000) seems a reasonable guess at the summer population of whitefronts on the Flats according to D. Mossop (pers. comm.) of the Yukon Department of Renewable Resources, who conducted studies there during the mid-seventies.

For three years (1988-1990), the Canadian Wildlife Service has been conducting special surveys for White-fronted Geese, Canada Geese, and Tundra Swans in the Inuvialuit Settlement Region, which includes the Yukon north slope, Mackenzie Delta, Tuktoyaktuk Peninsula, and areas eastward to the Mason River in N.W.T (Hines et al. 1990). Other surveys have been conducted in the breeding range of the Eastern Mid-continent population (Queen Maud Gulf, Kent Peninsula, Victoria Island).

It is proposed to complement this work by using the survey technique of Hines et al. (1990) or a comparable one to estimate the White-fronted Goose, as well

as Canada Goose and Tundra Swan populations of the Old Crow Flats.

Midcontinent White-fronted Geese have also been banded and colour marked throughout much of their range during the past 5 years and this effort continues. Banding of the Western Midcontinent population in its Canadian breeding range began in earnest only in summer 1989, but some banding efforts have been taking place in the Alaskan breeding range over a number of years. A small number of White-fronted Geese were banded in the Old Crow Flats during the 60s, resulting in a total of 20 recoveries, but no banding has taken place since that time. In order to understand the current movements, winter range, and mortality of the Old Crow Flats birds, a three year banding program is proposed with a goal of banding about 5% of the population each year.

2. OBJECTIVES

1. Estimate the total breeding population and distribution of Greater White-fronted Geese, other geese, and Tundra Swans on the Old Crow Flats.
2. Determine the migration routes, wintering grounds, and mortality rates of Greater White-fronted Geese summering on the Old Crow Flats.

3. METHODS

3.1 Breeding Population Surveys

3.1.1. Transect Method

At present it is planned to use the techniques of Hines et al. (1990). This involves flying a Bell 206B helicopter equipped with bubble windows at approximately 80 km per hour at 45 m above the ground. The machine will be flown along straight lines following the UTM north-south gridlines (10 km apart) on standard 1:250,000 topographic maps. Observers will count birds within 200 m on either side of the helicopter. Each transect will be divided into 2-km segments as the basis for recording data.

The main portion of the Old Crow Flats contains 9 transect lines totalling 445 km. An additional area of wetlands south of the Porcupine River contains 3 transects totalling 60 km. The transects total 505 km and 400 m wide corresponding to an area of 202 km^2. The total amount of flying time to survey this area at 80 km per hour is (445 km + 60 km)/80 km per h = 6.3 h. Shuttles to Old Crow for fuel at 2 h intervals will add an additional 150 km at 160 km/h = approx. 1 h. An additional 700 km or 4.4 h will be required to ferry the helicopter from the base at Tuktoyaktuk to Old Crow. Thus the total amount of helicopter flying is approximately 11.8 h. Adding 10% to this for "breathing room" brings the total to 13 h. This should be accomplished in 2 days of flying provided the weather cooperates.

3.1.2 Plot Method

Another option which will be considered over the course of the winter is using a plot rather than transect as the basis for the survey. Plots have a number of advantages over transects and have been used with good success for

surveying breeding waterfowl in northern Ontario (Ross 1985, 1987)

Using the same 6.3 h of flying time from Old Crow as the basis, approx. 30 2x2 km plots (120 km²) could be searched completely for all waterfowl species at the rate of 12 minutes per plot (5 plots or 20 km² per hour); this rate is derived from previous work with plots of this size. If more resources were available, it would be desirable to increase the sample of plots to approximately 50 to improve the precision of population estimates. Fifty plots would require an additional 4-5 hours of flying time to survey, thus a total of 17-18 hours including ferry time. Plots could be chosen on a random, systematic, or stratified random basis. The same number of observers (three) would be required as for transects. Aerial photos or satellite imagery at a scale of 1:50,000 or larger would be useful to aid navigation and for marking the locations of birds where feasible. Bird observations would be recorded on a plot basis and where possible by waterbody within each plot.

3.1.3 Discussion

As can be seen above, the plot technique would likely cover about 60% of the area covered by the transects with the same amount of resources. The advantages of the plot technique may outweigh this shortcoming, however. In particular:

1. Plots would be searched completely for all waterfowl species without unknown and possibly significant undercounting of some species.
2. The method is more easily repeatable than are transect surveys; the UTM grid system provides a ready framework for the survey design and data base.
3. The capabilities of the helicopter are used to full advantage; it can be flown at whatever speed is optimal, from 0 to over 160 km per hour.
4. Observers do not need to be as highly trained as those for fixed-wing surveys owing to the options of extremely low and slow flight and repeated passes to identify birds.
5. Only the wetland area (or whatever is considered potential habitat) is searched in each plot, eliminating unnecessary time, vigilance and observer fatigue which are associated with transect surveys, especially in areas where the potential habitat is fairly dispersed.

Fuel for the helicopter will have to be purchased in Old Crow. Accommodation can be provided at the CWS trailer. Three observers will be required in addition to the pilot. These persons should probably plan to meet the helicopter in Old Crow, in which case travel for at least two of them will be required to and from Old Crow.

3.2 Banding

Banding efforts will take place during mid-July. A helicopter will be used to herd flocks of flightless geese into portable pens. Geese will be marked with standard metal bands and additional markers (probably neck collars) according

to a North American protocol. It is hoped that at least 250 (5% of 5,000) white-fronted geese can be marked in this fashion each year.

It is assumed that sightings of marked geese would be provided via existing network(s) of observers established during the past years of banding of the Western and Eastern Midcontinent populations.

4. DURATION AND PRODUCTS

A three year duration for the project is proposed in order to encompass some of the natural year to year variation in populations, and to band sufficient numbers of birds in different cohorts for mortality estimates.

Annual reports will be prepared summarizing the results of the surveys and banding. These reports will be completed by 1 December of the current year, i.e. Dec 1991, 1992, 1993.

5. PERSONNEL

The Principal Investigator will be J. Hawkings, who will be the field party leader for both the surveys and banding. Other personnel for surveys and banding will be recruited from existing CWS, Yukon Government, and Ducks Unlimited Personnel, as well as volunteers. At least one person from Old Crow will be hired for the banding, and if possible, for the surveys.

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6. BUDGET

Breeding Population Surveys

Item	(per year FY 91/92 to FY 93/94) (O & M)	Staff (A-base)
Helicopter		
Charter 25 h @ $650 (dry)	16,250*	
Fuel 25 hr x 100 litre/hr x $2.25/litre(Old Crow)	5,625*	
Travel		
3 persons Whse-Old Crow return @$ 700	2,100	
Accommodation and Expenses in Old Crow (3 days)	300	
Materials		
Maps 1:50,000 20 sheets @$ 8.00	160	
Landsat Imagery 1:50,000	200	
Aerial photos from NAPL 1:50,000 100 photos @ $4	400	
Film	100	
Personnel		
CWS J. Hawkings 2 months @ 3,800		7,600
(Other) 0.5 months @ 3,800		1,900
Yukon Gov't, Ducks Unlimited, volunteers (to be arranged)		
Local resident 3 days @100	300	
Report Printing	400	
TOTAL	$ 25,835	$9,500
*TOTAL (excluding 13 h Heli Charter and 1,300 litres fuel)	14,460	

* Logistic support from Polar Continental Shelf may cover up to 13 h ($8,450) of helicopter charter and $2,925 of fuel costs.

NOTE: The amount requested from The Arctic Goose Joint Venture for surveys will be as much as $25,835 per year if no PCSP support is forthcoming, or as little as $14,460 if the entire amount requested from PCSP is received.

BUDGET (continued)

Banding

Item	(per year FY 91/92 to FY 93/94) O & M	Staff (A-base)
Helicopter		
Charter 30 h (incl. 4.4 h ferry from Tuktoyaktuk to Old Crow and return) @ 650 dry	$18,500*	
Fuel 30 hr x 100 litres per hr x $2.25 per litre	6,750*	
Travel		
3 persons Whse-Old Crow return @ $700	2,100	
accommodation and expenses in Old Crow 5 days	500	
Personnel		
CWS J. Hawkings 1 month @ 3,800		3,800
Other 0.5 month @ 3,800		1,900
Yukon Gov't, Ducks Unlimited, volunteers (to be arranged)		
Local resident 4 days @ $100	400	
Materials		
Neck Collars 500 @ $3	1,500	
Miscellaneous (glue, poles, etc.)	200	
Freight for nets, poles, etc.	500	
TOTAL	$ 30,250	5,700
* TOTAL (excluding 10 charter and 1,000 litres fuel)	21,700	

* Logistic support from Polar Continental Shelf Project may cover up to 10 h ($6,500) helicopter charter and 1,000 litres fuel ($2,250).

NOTE: The amount requested from The Arctic Goose Joint Venture for banding will be as much as $30,250 per year if no PCSP support is forthcoming, or as little as $21,700 if the entire amount requested from PCSP is received.

MOVEMENTS OF GREATER SNOW GEESE IN SPRING

A research proposal submitted to

the Arctic Goose Joint Venture by

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15 December 1990

BACKGROUND

Greater snow geese have expanded their spring staging area along the St.Lawrence River as a result of a large increase in numbers. With the first expansion in the 70's, snow geese have invaded the Kamouraska and Isle-Verte areas downstream from their traditional haunts near Cap Tourmente and Montmagny (Gauthier et al. 1984). The extensive use of agricultural lands specially of hayfield in this area have brought important depredation problems and a lots of complaints from farmers (Bédard et al. 1986). Moreover, the carrying capacity of some Scirpus marshes, the main feeding habitat, has been reduced (Giroux and Bédard 1987).

With the additional increase in numbers in the mid 80's, geese have started to use the Lac St-Pierre area located about 250 km upstream from the other areas. In 1990, more than 2 millions goose-days have been recorded there compared to 1 million during the preceding spring (J.-F. Giroux, unpubl. data). No depredation problems have been yet observed in the Lac St-Pierre area because geese are mainly feeding on waste corn. Proper management of geese in this region could reduce the use of the Kamouraska and Montmagny areas thus lessening depredation problems.

The importance of the different staging areas in relation to energy reserves have been studied in 1989 and 1990 as part of a larger study on energetics conducted by G. Gauthier, J. Bédard and J.-F. Giroux. The pattern of migration and the relative use of each area for staging are unknown and this information is essential to interpret some results of the energetic study. Questions such as what proportion of the total population used the Lac St-Pierre area and what is the average length of stay of individual birds at each area are unknown. Movements among the different staging sites in spring are also unknown.

OBJECTIVES

We propose to use radio-telemetry to:

1- determine the pattern of migration of greater snow geese in spring along the St-Lawrence river,

2- determine turn-over rates and length of stay of geese at each major staging area and to

3- determine habitat use and daily movements pattern of geese in the Lac St-Pierre area.

JUSTIFICATION

Management implications

Different management measures will have to be taken in the near future to alleviate some of the current problems caused by the expanding population of greater snow geese. Creation of additional refuges has been suggested to increase hunting and observation opportunities. Revenues generated from these activities could be used to compensate local farmers for losses in hay production resulting from spring grazing. Our results will help to suggest the location of these new refuges.

Our intensive study in the Lac St-Pierre area will allow us to determine which habitat is preferred. Modification of some agricultural practices either from a voluntary participation or through some incentives from governments or private organizations (e. g. Eastern Habitat Joint Venture, Duck Unlimited, Willife Habitat Canada, Fondation de la Faune du Québec, etc.) could retain geese for longer periods in this region thus reducing the use of areas subjected to crop depredation.

Similarly, it has been proposed that changes in agricultural practices in the Kamouraska and Montmagny areas should be implemented. Use of grass species less attractive for geese and/or more resistant to grazing coupled with the presence of attractive lure-crop could solve some of the problems. Our results on distribution and movements of geese in spring could be used as baseline information to evaluate the effects of these different management practices that will be implemented in the coming years. In addition, knowledge obtained in the St.Lawrence valley about the management of greater snow geese will be useful to managers dealing with other expanding goose populations in other parts of the continent.

Population delineation

Knowledge about the existence of several populations of Canada geese has recently oriented the management of this species. It is presently unknown if snow geese staging at Lac St-Pierre constitute a distinct population from those staging at Montmagny or Isle-Verte. Marking geese at different sites on the wintering grounds and tracking them in spring at each area along the St.Lawrence river will allow us to determine if we are still dealing with a single or several populations.

Energy budget

Establishing the importance of the Lac St-Pierre region as a spring staging area will be useful in understanding accumulation of energy reserves. Use of corn in this area could result in geese leaving for the arctic with greater reserves than few years ago when geese were solely dependent of Scirpus marshes and hayfield.

STUDY AREA & METHODS

Marking of geese

Greater snow geese will be captured at several sites on the wintering grounds in late February. Concentrations of birds occur at this time of the year on both side of Delaware Bay in New Jersey and Delaware. Efforts will be made to mark representative samples in each large concentrations. One hundred adult-plumage birds will be fitted with a transmitter attached with a harness.

Tracking of geese

Geese concentrate at night along the St.Lawrence river and on some impoundments. These areas will be visited daily to check the presence of the marked birds. Tracking will be conducted by 3 persons. The first observer will be based near lac St-Pierre and will cover the area west of Québec City. A second person based in Québec City will cover the area around Cap Tourmente as well as the south shore up to L'Islet. Finally, a third person will cover the south shore from L'Islet to further downstream. Remote islands in the Montmagny area will be flown with aircraft every two days.

Intensive tracking will also be conducted in the Lac St Pierre area to determine habitat use and daily pattern of geese in this area. Two persons will be responsible for this aspect that will be part of another project supported by J.-F. Giroux using a grant from the Québec Ministry of Education (FCAR).

TIMING & ANTICIPATED OUTPUT

We proposed to conduct this study during the spring of 1991 in order to use some of the matching funds available until June 1991. The following calendar will be followed:

February 15-28: Marking of geese in the U.S.

March 15 - May 15: Tracking of geese along the St.Lawrence valley.

June 1 - November 15: Compilation and analysis of data.

November 15 - December 31: Writing of report and preparation of a scientific manuscript.

We propose to write a report that will be available to managers who are responsible for greater snow geese and its habitat. We also plan to write a scientific paper presenting data on movements, turn-over rates and use of different staging areas. Some information will also be included in a paper on energetics by Gauthier et al. in order to explain some of the results.

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PERSONNEL

Jean-François Giroux will be responsible for the overall project while Gilles Gauthier will coordinate some aspects of the marking operations. Université Laval has staff with expertise and equipment for catching and banding geese. More than 2500 greater snow geese have been caught and banded in the last ten years. Technicians at UQAM have gained experience with telemetry and tracking while conducting a project on black ducks in collaboration with Jerry Longcore of the USFWS.

BUDGET

(1) Personnel

Banding crew: 5 persons for 2 wks @ $530/wk including social benefits	$ 5 300
Tracking crew: 3 persons for 8 wks @ $530/wk including social benefits	12 730

(2) Operating expenses

Banding operation:	
Rental of 2 vehicles for 2 wks @ $350/wk plus gas ($600)	2 000
Food for 5 persons for 2 wks @ $20/day/person	700
Lodging for 5 persons for 2 wks @ $40/day/person	2 800
Tracking operation:	
Rental of 3 vehicles for 2 months @ $1000/mo plus gas ($3000)	9 000
Food for 3 persons for 2 months @ $ 20/day	3 720
Lodging will be provided by other on-going projects	

(3) Capital Costs

100 radios @ $200/radio from Advanced Telemetric System	20 000
1 receiver Lotek SRX-400 (2 other available at UQAM)	3 500
Aircraft (50 hours @ $170/hour)	8 500
	---
(4) Total Costs	$ 68 250

(5) Matching funds

FCAR Equipe (Gauthier, Bédard & Giroux):	
Operating grant	$ 11 000
Equipment	8 700*
Grant to JFG (Nouveau-Chercheur)	5 000
Salary for 1 senior technician (Univ. Laval)	4 000
Grant from UQAM to JFG	3 000*

TOTAL	$ 31 700

* Available until June 1, 1991

(6) Funds requested to AGJV	$ 36 550

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Ph.D. (Biologie) Université Laval, 1986

Theses: 1979, M.Sc. A study of waterfowl nesting on artificial islands in southeastern Alberta

1986, Ph.D. Utilisation des marais à scirpe de l'estuaire du Saint-Laurent par la grande oie blanche

Scholarships: Société Zoologique de Québec, 1977-78

Bourse d'études supérieures FCAR, 1982-85

NSERC postdoctoral, 1986-88

Experience: 1988- Professeur régulier, Département des sciences biologiques, Université du Québec à Montréal.

1986-1988 Honorary Research Fellow, University of Aberdeen, Ecosse.

1978-1981 Research Biologist, Ducks Unlimited Canada, Winnipeg.

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SUPERVISION OF GRADUATE STUDENTS

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St-Georges, Mario. Reproduction and mortality of white-tailed deer on Anticosti Island. Sept. 1984 - Sept. 1989. Co-supervisor: Robert Joyal.

D'Astous, Natalie. Effects of fire on the food of white-tailed deer on Anticosti Island. Sept. 1986 - May 1990. Co-supervisor: Robert Joyal.

Poulin, Hélène. Population dynamics of white-tailed deee on Anticosti Island. Sept. 1987 - Dec. 1990. Co-supervisor: Robert Joyal.

De Koster, Raymond. Activity of greater snow geese in spring at Lac St-Pierre. Sept. 1989 - August 1991.

Cazelais, Stéphanie. Habitat selection and activity of Canada geese in spring at lac St-Pierre. Jan. 1990 - Dec. 1991.

Dion, Josée. Habitat use of black ducks in fall in the St.Lawrence estuary. Sept. 1990 - May 1992.

Ouellet, Clément. Movements of black ducks in fall in Québec. Jan. 1991 - Dec 1992.

M.Sc. in environmental sciences:

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Dehoux, Pascal. Effect of hunting on activityy of black ducks in fall in the St.Lawrence estuary. Sept. 1989 - Dec. 1991.

10 Dec. 1990

THE LA PEROUSE BAY SNOW GOOSE PROJECT

Project Summary for the Arctic Goose Joint Venture Project

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** City College of New York, New York, 10031 and American Museum of Natural History, New York, 10024, N.Y.,U.S.A.

Background

The La Perouse Bay Snow Goose Project has provided the largest and most detailed investigation of a waterfowl population in the world to date. As such, it provides demographic details valuable for the management of Snow Geese and in addition provides a theoretical framework essential for an understanding of the factors regulating other waterfowl species. The study commenced in 1968 with help from the Canadian Wildlife Service (CWS), and has been in continuous operation since that time with the financial assistance of the Natural Sciences and Engineering Research Council of Canada (NSERC), CWS and the benefiting member states of the Central and Mississippi Flyway Councils.

The study comprises a detailed investigation of more than 2000 nests each year, observations of broods and the annual banding of up to 6000 birds just prior to fledging. In addition we carry out a variety of observations and experiments to test specific features of the life cycle and biology of the geese. Recovery, recapture and resighting data allow us to calculate survival, recovery, immigration and emigration rates. The

data represent a unique documentation of a waterfowl population which can be used as base line data as changes to our environment present waterfowl with new challenges. More than 100 publications have appeared as a result of this work.

Current Work in Progress

The colony has expanded in both in terms of area and numbers of geese, beginning with about 2500 pairs in 1968 to about 8000 to 10000 pairs in the late 1980's. In recent years it has become more difficult to estimate colony size accurately but it seems that numbers of geese may now be declining.

Such a decline would be predicted from our recent findings of decreases in important demographic parameters. Clutch size, gosling body size and first year survival have all declined significantly in recent years. Recent cohorts of adult geese are also smaller than those hatched in earlier years. Such changes suggest that this population is in some difficulties. The reduced clutch size reflects a reduction in the availability of nutrient for egg production. As the global population has increased, this may have resulted in increasing competition for essential resources during the spring migration either in the northern prairies or along the coasts of Hudson and James Bay. The reduction in body size is a reflection of a lower growth rate of goslings during the brood rearing period as the study has proceeded. This reduction is most reasonably attributed to a decline in the availability/quality of food in the brood-rearing areas. Over-grubbing of the salt marsh vegetation during early spring by resident and migrant geese has led to reduction of the acreage of salt marshes of approximately 10% per annum (Jefferies pers.comm.) and the geese have increasingly turned to alternative food plants such as Carex

aquatilis.

The increase of juvenile mortality during the course of our study is not due to increased hunter kill. On the contrary, the recovery rate of both adult and juvenile geese has declined threefold during the 20 years of our study. This is extremely unlikely to be due to a major change in reporting rate and more likely is a result of fewer hunters and an expanding population of geese. Thus we conclude that juvenile mortality has increased due to increase in natural mortality, probably occurring soon after the geese fledge.

The main thrust of our work in the next 5 years will be to discover the reasons for the demographic changes outlined above. Whereas a reduction in the food availability/quality seems to be the main factor contributing to the declines, we must also consider two other possibilities: disease and environmental pollutants. To test the food hypothesis, we are collaborating with Dr. R.L. Jefferies of the University of Toronto on a detailed examination of the major food plants and the growth of goslings under controlled environments. We are currently investigating the disease hypothesis, by comparing frequencies of several disease organisms in the present population with data obtained by Dr. D. Rainnie of the University of Saskatchewan on the LPB population in 1981. To test the environmental contaminants hypothesis, we have been collecting embryos which died at hatch for the past several years and collecting both adult birds and eggs for examination for levels of toxins.

Regardless of the explanation for the decline, it is clear that the La Perouse Bay Snow Goose population is in some difficulties, perhaps similar to those detected at the McConnell River colony some years ago. This suggests that at least in the more southerly breeding colonies there is some sort of boom and bust cycle related to the deterioration of the

AN ASSESSMENT OF HABITAT USE AND MOVEMENTS OF WRANGEL ISLAND LESSER SNOW GEESE

A PROJECT PROPOSAL

Sean Boyd
CWS, Delta, BC

AN ASSESSMENT OF HABITAT USE AND MOVEMENTS OF WRANGEL ISLAND LESSER SNOW GEESE A PROJECT PROPOSAL

1. Problem

A unique population of Lesser Snow Geese (LSG) nests on Wrangel Island in the Soviet Union and winters in central California and on the Fraser/Skagit deltas of North America. The population declined severely in the early to mid 1970's and only one nesting colony remains out of several historical. For those reasons, the LSG is considered endangered in the Soviet Union. Despite the international significance of the Wrangel geese, we know little about their use of staging areas during migration (ie. habitats used, turnover rate, etc.) and the importance of those areas to their overall fitness. We know little about their movements on the winter grounds (eg. timing and rate of mini-migrations between the Fraser and Skagit deltas), habitat use at night on the Fraser Delta, and flock or sub-flock cohesion during migration and in winter. Filling the above information gaps will improve our understanding of the ecology of the Wrangel LSG population outside of their nesting season. It will also help in our ability to manage them. A neck-band study is producing information on migration routes but the data are limited for the above needs, especially in areas that are large and inaccessible. The only way to collect the required information is to mount radio transmitters on geese and track their movements.

2. Proposed Work

The Soviets are planning to band LSG on Wrangel Island in July/August of 1991. During that time, we will mount standard back-pack and neck-band radio transmitters on 20 geese. Coincidentally, the USFWS has proposed a separate study in which 30 standard radios plus 30 satellite radios will be deployed on Wrangel LSG. Those additional radios will expand the scope of our study. The radios will be distributed as evenly as possible to ensure that both wintering populations have suitable sample sizes.

We will track each radio on Wrangel Island until the geese leave by late August. The radios will be monitored on the Fraser and Skagit deltas from September 1991 to May 1992. Radios will be located periodically from an airplane but most of the work will be conducted on the ground using triangulation. Also, radios will be tracked over 24 hour periods to determine patterns of movement and habitat use during day and night.

During the 1992 spring migration, telemetry will be conducted on the Stikine Delta and Cooke Inlet, Alaska, in cooperation with USFWS and USFS biologists working in those areas. Most tracking will have to be done by airplane due to the size and inaccessibility of the areas involved.

Soviet biologists will be able to follow the remaining radio-mounted geese throughout their entire stay on Wrangel Island. Among other aspects of their nesting biology, differences in the timing and pattern of arrival and departure of the two wintering populations could be assessed.

The project is expected to last as long as the life-span of the radios, about 2 years. Roughly the same effort will be required in F/Y 1992/1993 to track the radios on the winter grounds.

3. Costs

	1991/92	1992/93
O & M		
Contract to monitor radios	6K	6K
Plane rental	4K	4K
Travel to Stikine/Cooke Inlet	2K	4K
Total O & M	12K	14K
CAPITAL		
Scanner/receiver + antennae	5K	

Government of Canada / Gouvernement du Canada

MEMORANDUM NOTE DE SERVICE

TO / A

B. Turner, R. McKelvey, J. Mulhern
D. Nieman, R. Bromley, R. Bjorgy
J. Hines, R. Alisauskas, M. Schwitters
A. Didiuk

FROM / DE

R. H. Kerbes
CWS, Saskatoon

SECURITY - CLASSIFICATION - DE SECURITE	
OUR FILE — N / RÉFÉRENCE	
YOUR FILE — V / RÉFÉRENCE	
DATE	4 Jan 1991

SUBJECT / OBJET

Prelim. Notes on Neckbanding of Arctic Geese and Autumn 1990 Monitoring Results

I prepared the above for Dale Caswell's use at the Arctic Goose Joint Venture meeting to be held in Tofino later this month. A copy is enclosed for your info. Best regards,

Dick

GC 177

7540-21-798-8998

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Arctic Goose Joint Venture - Neckbanding of Geese in Arctic Canada and Alaska in July - August, 1990 - Monitoring Results, Autumn 1990.

1. Table 1 shows approximately total birds neckbanded in each area:

   Eastern Arctic = Baffin Island plus West Hudson Bay

   Baffin Island = Great Plain of the Koukdjuak

   West Hudson Bay = Eskimo Point (Arviat) region

   Central Arctic (W) = Kent Peninsula and Victoria Island

   Central Arctic (E) = Queen Maud Gulf MBS

   Western Arctic = Tuk and Anderson R. regions

   Alaska = Kanuti, Innoko, Selawik, and Koyukuk/Nowitna NWR's, plus North Slope

   -Canada Geese were not neckbanded in the Western Arctic due to delay in production and supply of neckbands in July, then to lack of available moulting geese in August.

   -Almost 70% of the target total numbers of White-fronts was neckbanded.

   -In Alaska 400 Snow Geese were neckbanded and in the Eastern Central Arctic 500 Ross' Geese and 500 Snow Geese were neckbanded, 100% of targets.

2. Tables 2 and 3 give detailed summary of banding results.

   -details not yet available for Eastern Arctic and Alaska.

   -February 1990 Progress Report will include all areas in Table 2.

   -use of SY and ASY, rather than AHY, may be questionable, especially for Canada Geese (Table 3).

3. Table 4 summarizes observations of above, plus all previous recent neckbandings, made in Alberta, Saskatchewan and Montana in September, October, and November 1990.

   -observer network included 9 observers who spent 4 or more weeks in the field (5 CWS staff, 4 CWS Contracts, 1 SPRR Staff) and approximately 12 other CWS, SPRR, Alberta and Manitoba staff working in Canada. Volunteer observer M. Schwitters covered the Freeze-out Lake, Montana area.

   -observations of Eastern Arctic Canada Geese (low numbers in Saskatchewan and Manitoba) not included.

   -of Central, Western and Alaska neckbanded samples, approximately 20% of the small Canadas and 25% of the White-fronts were resighted.

   -average number of sightings per code, for White-fronts, Small Canadas and Snow Geese, varied from 1.2 to 1.6 sightings per code, which reflects

the turnover as the geese passed through on migration.

4. Distribution of observations in Alberta, Saskatchewan and Montana in autumn 1990, by number of unique codes seen per degree block is summarized in the draft figures per neckbanded region.

   -did not show any changes in the pattern for Snow and Ross' Geese shown from 1987 to 1989, i.e. the Central Arctic Snow Geese and Ross' Geese migrate over a broad front from eastern Alberta to eastern Saskatchewan, while the Wrangel, Alaska, and Western Arctic Snow Geese moved through eastern Alberta and western Saskatchewan.

   -of the two Canada Goose segments from the Central Arctic, the Western birds were confined to western Saskatchewan, whereas the Eastern segment extended from eastern Alberta to eastern Saskatchewan.

   -White-fronts from the Western and Eastern Central Arctic were found from eastern Alberta to central Saskatchewan, with the Easter birds tending to be farthest east.

   -White-fronts from Alaska and the Western Arctic showed a similar pattern to those of the Central Arctic, except that only the Alaska birds were recorded in the Peace River country of northern Alberta.

5. Four of my slides from the 1990 Queen Maud Gulf banding operation are included. Dan has some of my slides from 1989 and Ray may also have suitable slides if you need more.

Table 1

Arctic Neckbanding of Mid-continent White-fronted and Small Canada Geese, July-August 1990.

Area	Agency	Neckband Colour	Neckband Code*	Approx. No. Neckbanded
Small Canada Geese:				
Baffin Island	CWS	Orange		900
West Hudson Bay	CWS	Orange		500
Central Arctic (W)	NWT	Yellow	L-N,N	300
Central Arctic (E)	CWS	Yellow	L-L,N	845
Subtotal, Small Canada Geese				2,545
White-fronted Geese:				
West Hudson Bay	CWS	Blue	L-L,N	12
Central Arctic (W)	NWT	Blue	L-N,N N-L,N	700
Central Arctic (E)	CWS	Blue	L-L,N	700
Western Arctic	CWS	Red	N-L,L	700
Alaska	USFWS	Red	L-N,L	1,350
Subtotal, White-fronted Geese				3,462

*Code has one vertical character followed by 2 horizontal characters;
L = Letter, N = Number.

R.H. Kerbes
CWS, Saskatoon
Sept 1990

Table 2

Number of geese marked in Central and Western Arctic Canada
July - August 1990

		White-fronted		Small Canada		Snow		Ross'	
		Adult[1]	Local[2]	Adult	Local	Adult	Local	Adult	Local
E.Cent.Arc. QMG	Neckband	679	21	839	3	496	-	475[4]	1
	Lgbd Only	-	446	2	191	580	421	304[4]	266
	Color Lgbd	-	-	-	-	-	327	-	263
W.Cent.Arc.[3]	Neckband	589	75	117	180	-	-	-	-
	Lgbd Only	68	209	592	56	-	-	-	-
Western Arc. Tuk-Anderson	Neckband	692	-	-	-	-	-	-	-
	Lgbd Only	325	17	559	-	-	-	-	-

[1] Adult = Hatched in 1989 or earlier
[2] Local = Hatched in 1990
[3] In addition 21 White-fronts and 9 Canadas of unknown age were neckbanded
[4] In addition 24 Ross'-Snow Hybrids were neckbanded and 7 Ross'-Snow Hybrids were legbanded only

Table 5. Number of geese marked in Central and Western Arctic Canada, July-August 1990.

Species	Age[1]	Central Arctic: Queen Maud Gulf MBS Neckband	Queen Maud Gulf MBS Legband Only	Queen Maud Gulf MBS Color Legband	Kent P & Victoria Is. Neckband	Kent P & Victoria Is. Legband Only	Western Arctic: Tuk & Anderson Neckband	Tuk & Anderson Legband Only
Greater White-fronted Geese	L	21	446	–	75	209	–	17
	AHY	–	–	–	508	59	1	–
	SY	242	–	–	81	9	229	98
	ASY	437	–	–	–	–	462	227
		700	446	–	664[2]	277	692	342
Small Canada Geese	L	3	191	–	180	56	–	–
	AHY	–	–	–	117	592	–	554
	SY	310	2	–	–	–	–	–
	ASY	529	–	–	–	–	–	5
		842	193	–	297[3]	648	–	559
Subtotal White Snow Geese	L	–	355	271	–	–	–	–
	SY	47	70	–	–	–	–	–
	ASY	342	403	–	–	–	–	–
		389	828	271	–	–	–	–
Subtotal Blue Snow Geese	L	–	66	56	–	–	–	–
	SY	12	16	–	–	–	–	–
	ASY	95	91	–	–	–	–	–
		107	173	56	–	–	–	–
Total Snow Geese	L	–	421	327	–	–	–	–
	SY	59	86	–	–	–	–	–
	ASY	437	494	–	–	–	–	–
		496	1001	327	–	–	–	–
Ross' Geese	L	1	266	263	–	–	–	–
	SY	94	94	–	–	–	–	–
	ASY	381	210	–	–	–	–	–
		476	570	263	–	–	–	–
Ross'-Snow Hybrids	SY	5	4	–	–	–	–	–
	ASY	19	3	–	–	–	–	–
		24	7	–	–	–	–	–

[1]By year hatched: L=1990, AHY=1989 or earlier, SY=1989, ASY=1988 or earlier.
[2]Does not include 21 birds of unknown age. [3]Does not include 9 birds of unknown age.

Table . Numbers of Arctic neckbanded geese observed in Alberta, Saskatchewan, and Montana, September-November 1990 (unique, completely read codes).

Species	Region and Year(s) of Neckbanding	Province/State of Observation			
		Alta.	Sask.	Mont.	Total
White-fronted Geese	Alaska 1990	92	226	-	303
	Western Arctic 1990	28	156	-	179
	Central Arctic (W) 87-90	38	215	-	246
	Central Arctic (E) 1990	15	144	-	153
	Subtotal	173	741	-	881
Small Canada Geese	Central Arctic (W)1990	-	60	-	60
	Central Arctic (E)1990	8	165	-	170
	Subtotal	8	225	-	230
Snow Geese	Wrangel Island 1988-89	8	9	3	19
	Alaska 1984-90	42	56	16	110
	Western Arctic 87-89	112	143	45	282
	Central Arctic (E) 89-90	16	82	-	94
	Subtotal	178	290	64	505
Ross' Geese	Central (E) Arctic 89-90	83	147	19	236
	Total	442	1403	83	1852

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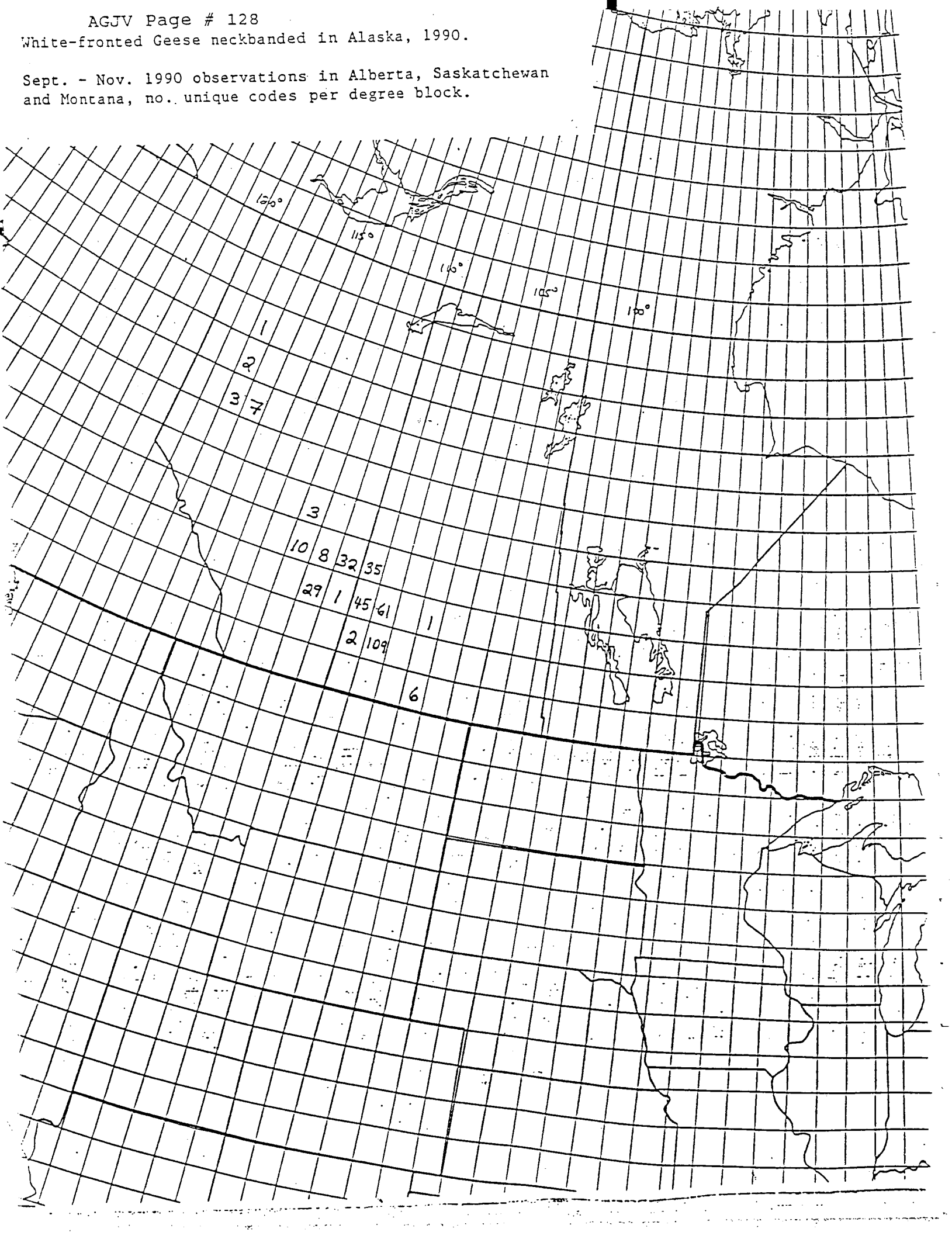
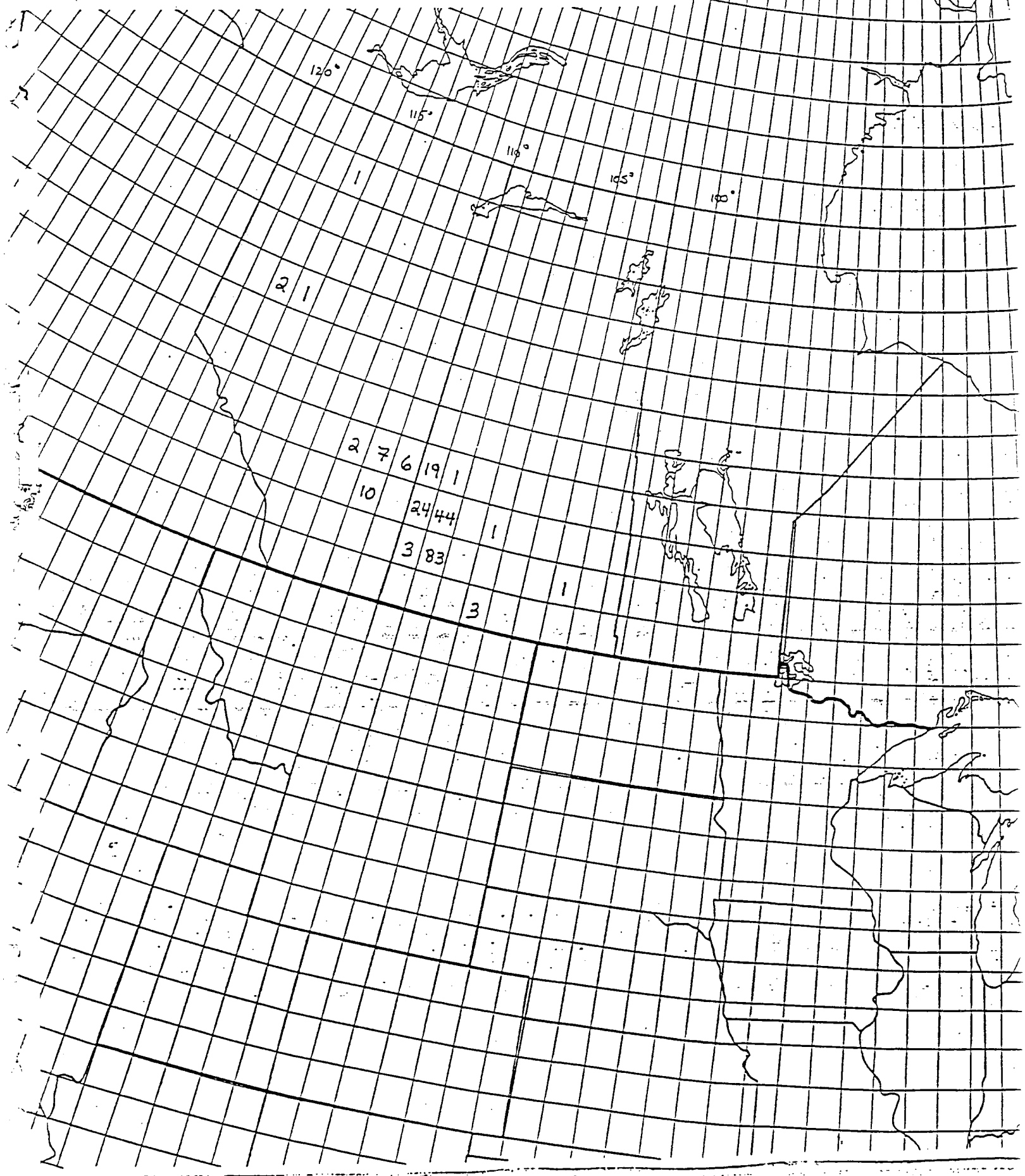
White-fronted Geese neckbanded in Alaska, 1990.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



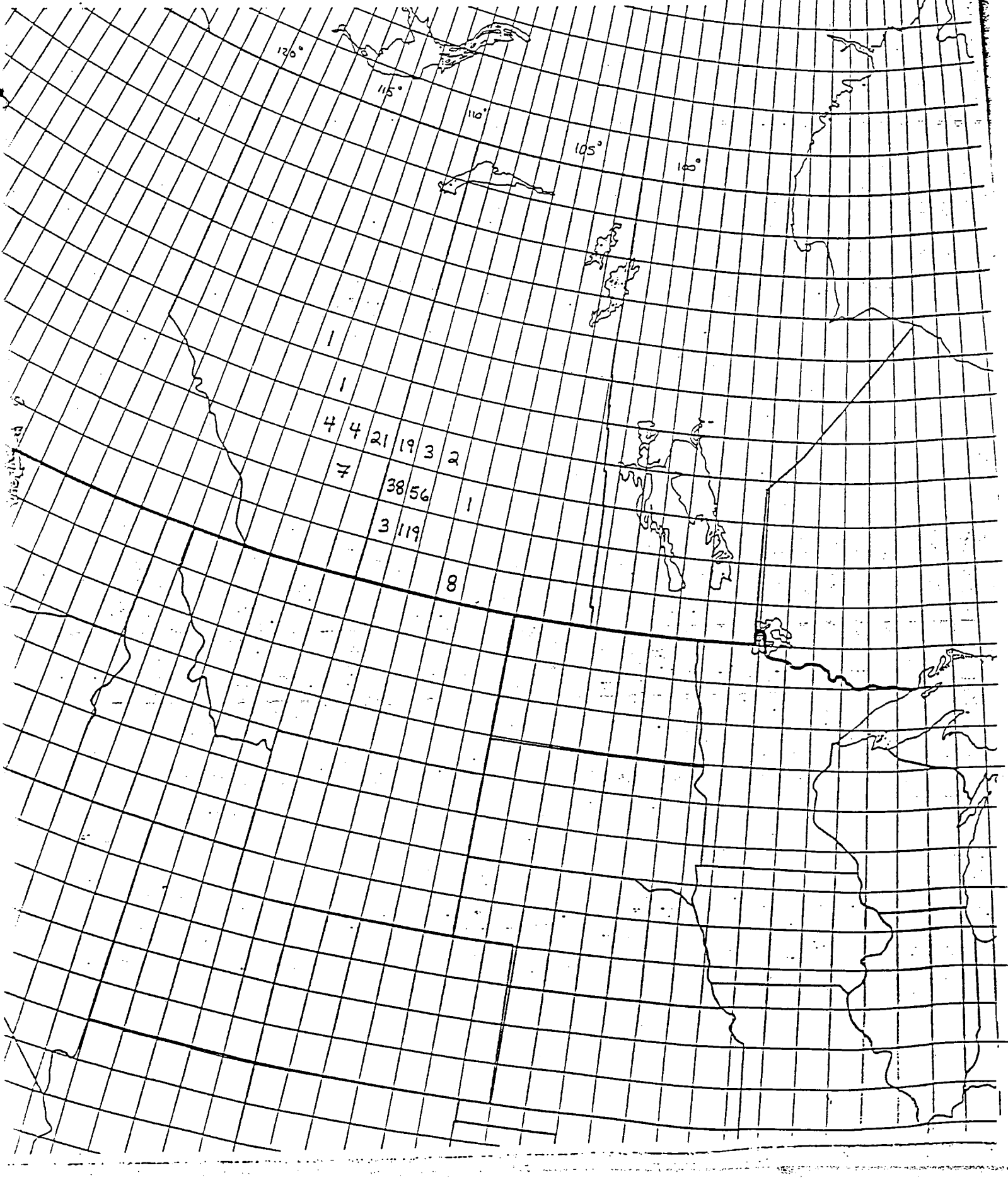
White-fronted Geese neckbanded in Western Arctic, 1990.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



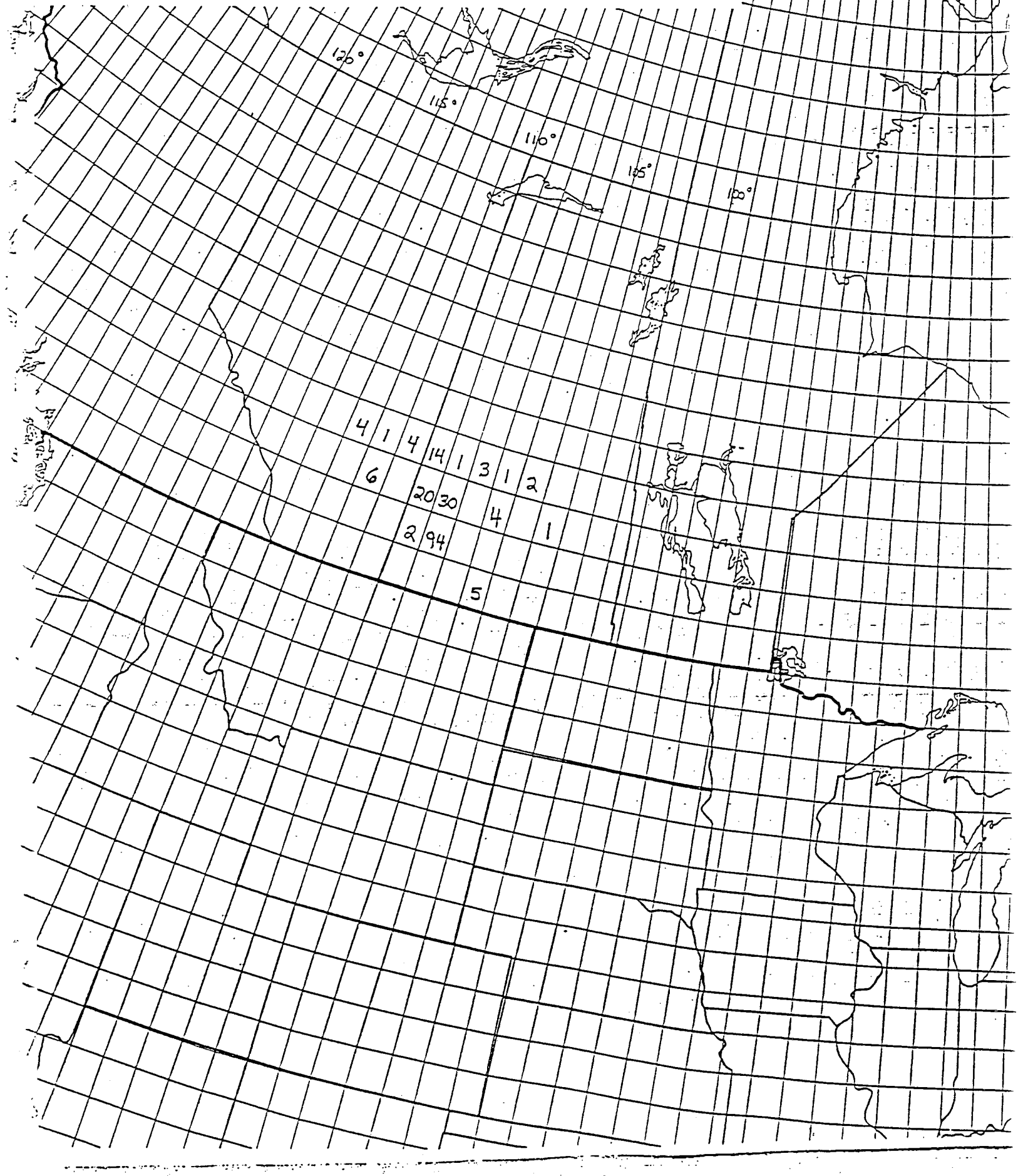
White-fronted Geese neckbanded in Central Arctic (W), 1987-90.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



White-fronted Geese neckbanded in Central Arctic (E), 1990.

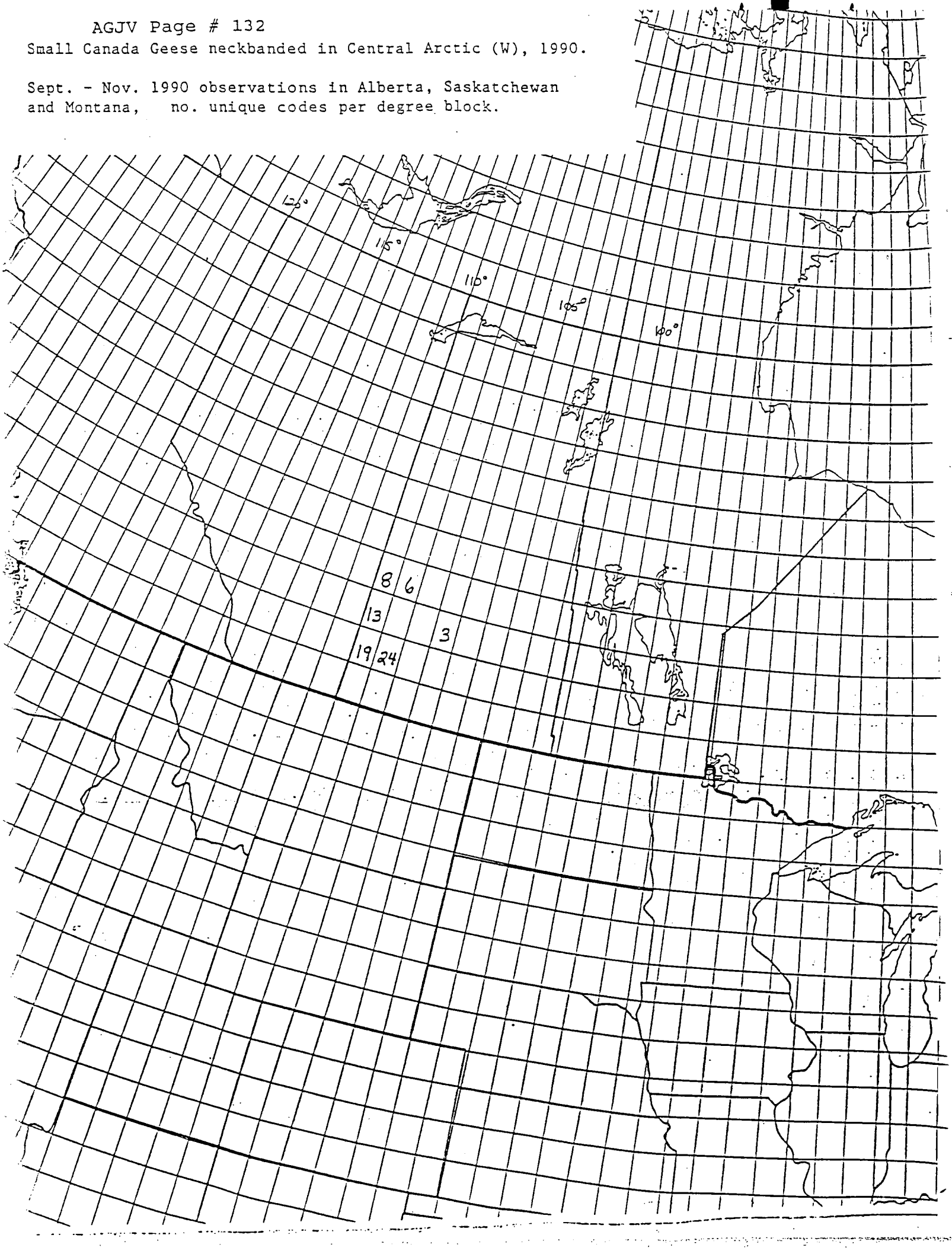
Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



AGJV Page # 132

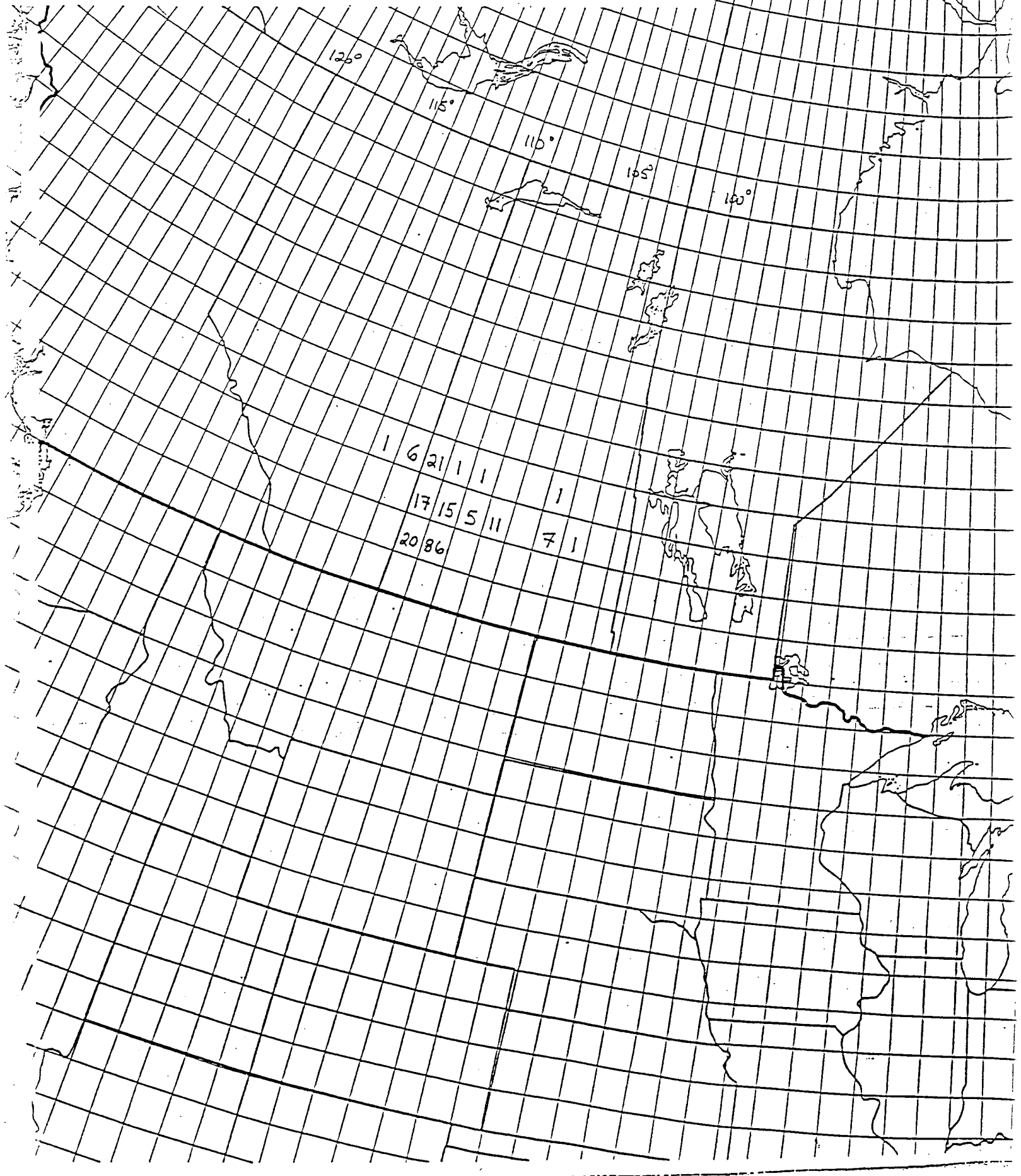
Small Canada Geese neckbanded in Central Arctic (W), 1990.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



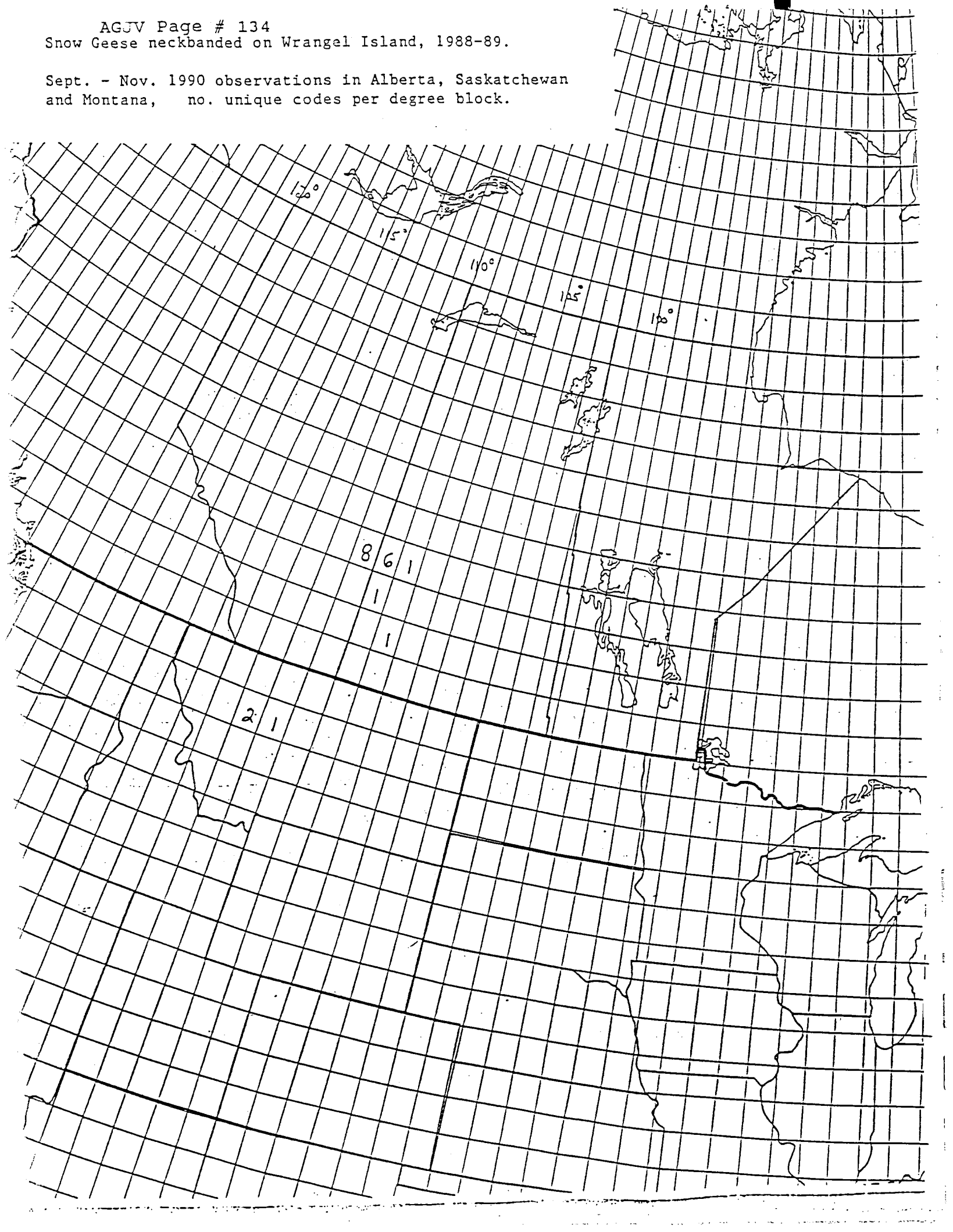
Small Canada Geese neckbanded in Central Arctic (E), 1990.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



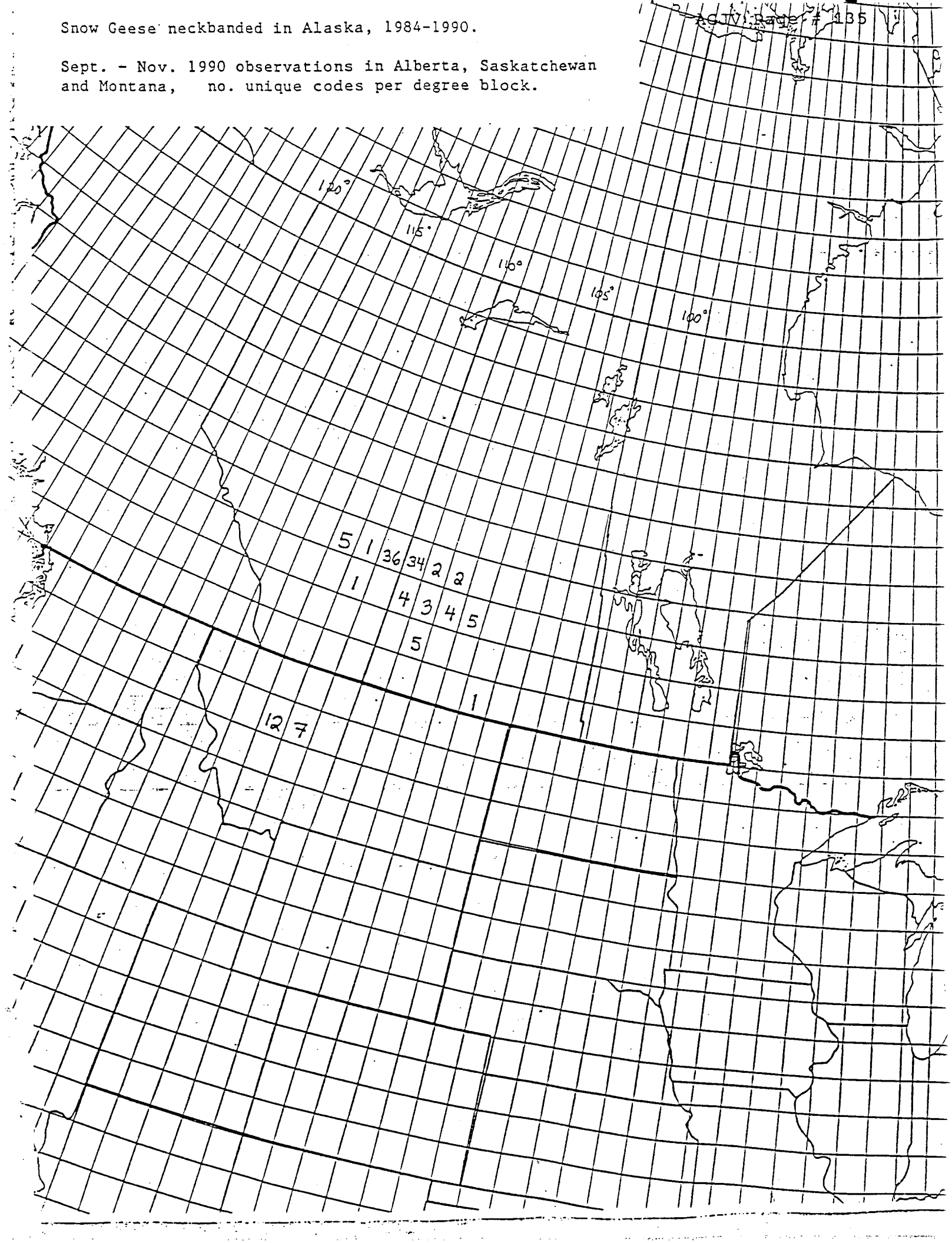
Snow Geese neckbanded on Wrangel Island, 1988-89.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



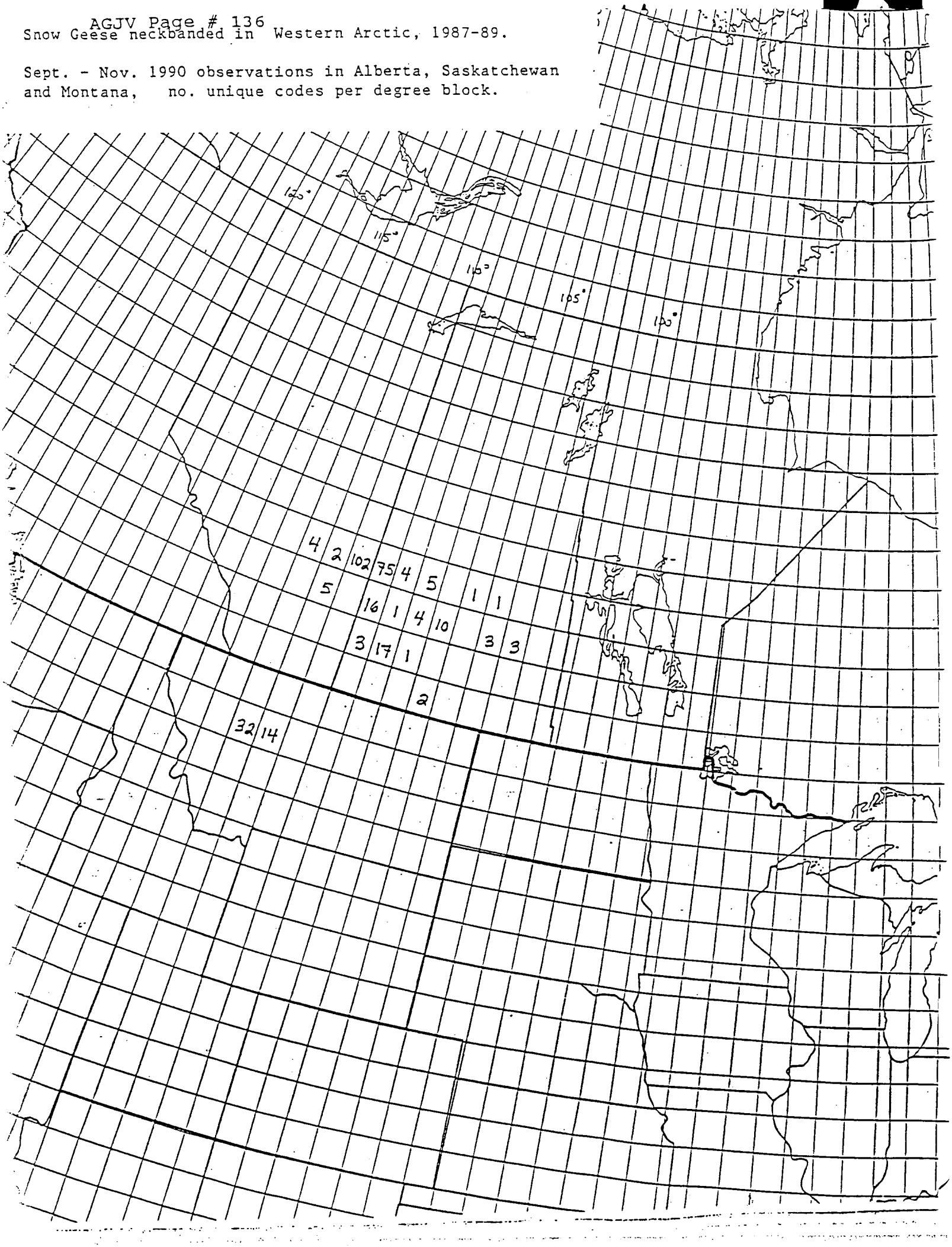
Snow Geese neckbanded in Alaska, 1984-1990.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



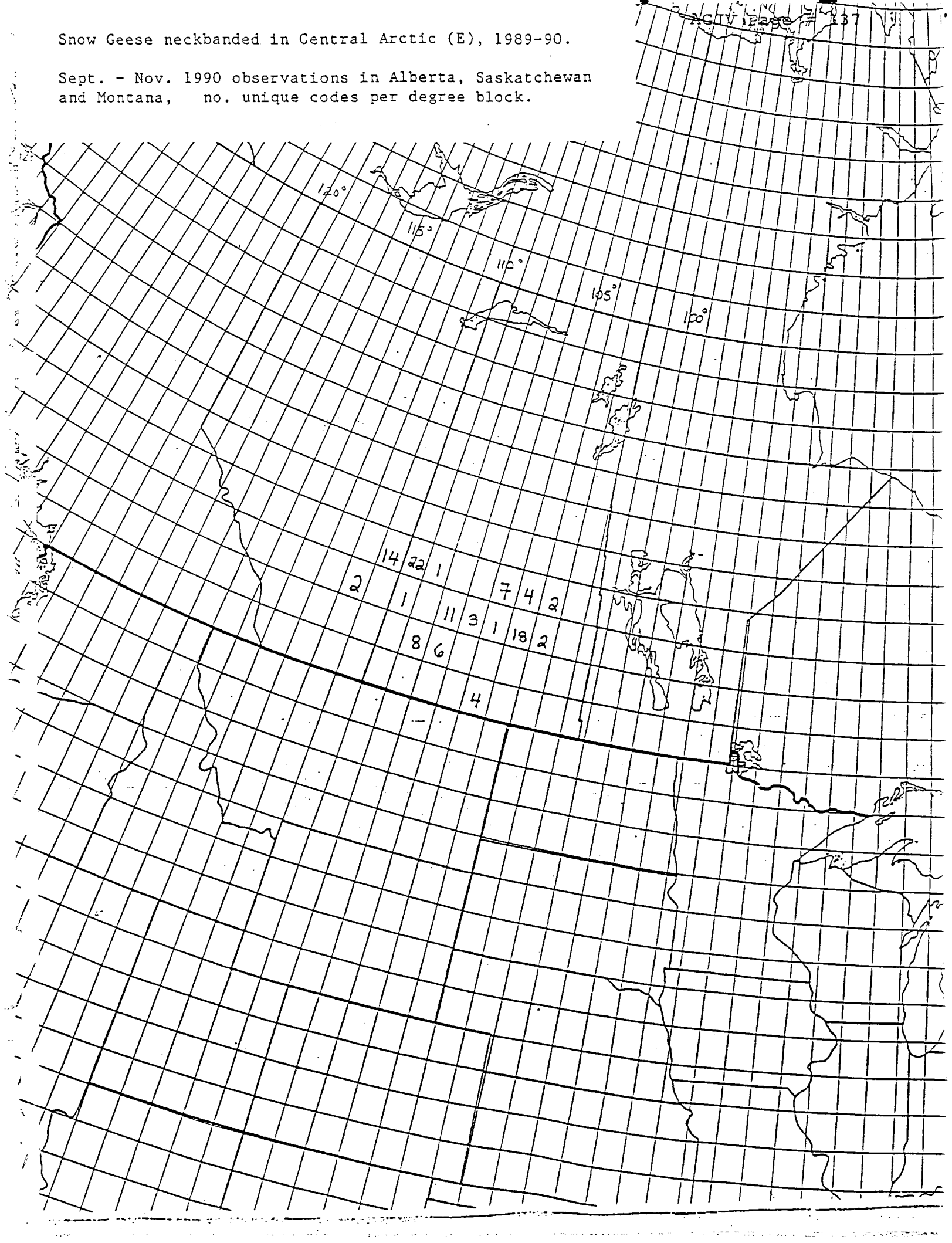
Snow Geese neckbanded in Western Arctic, 1987-89.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



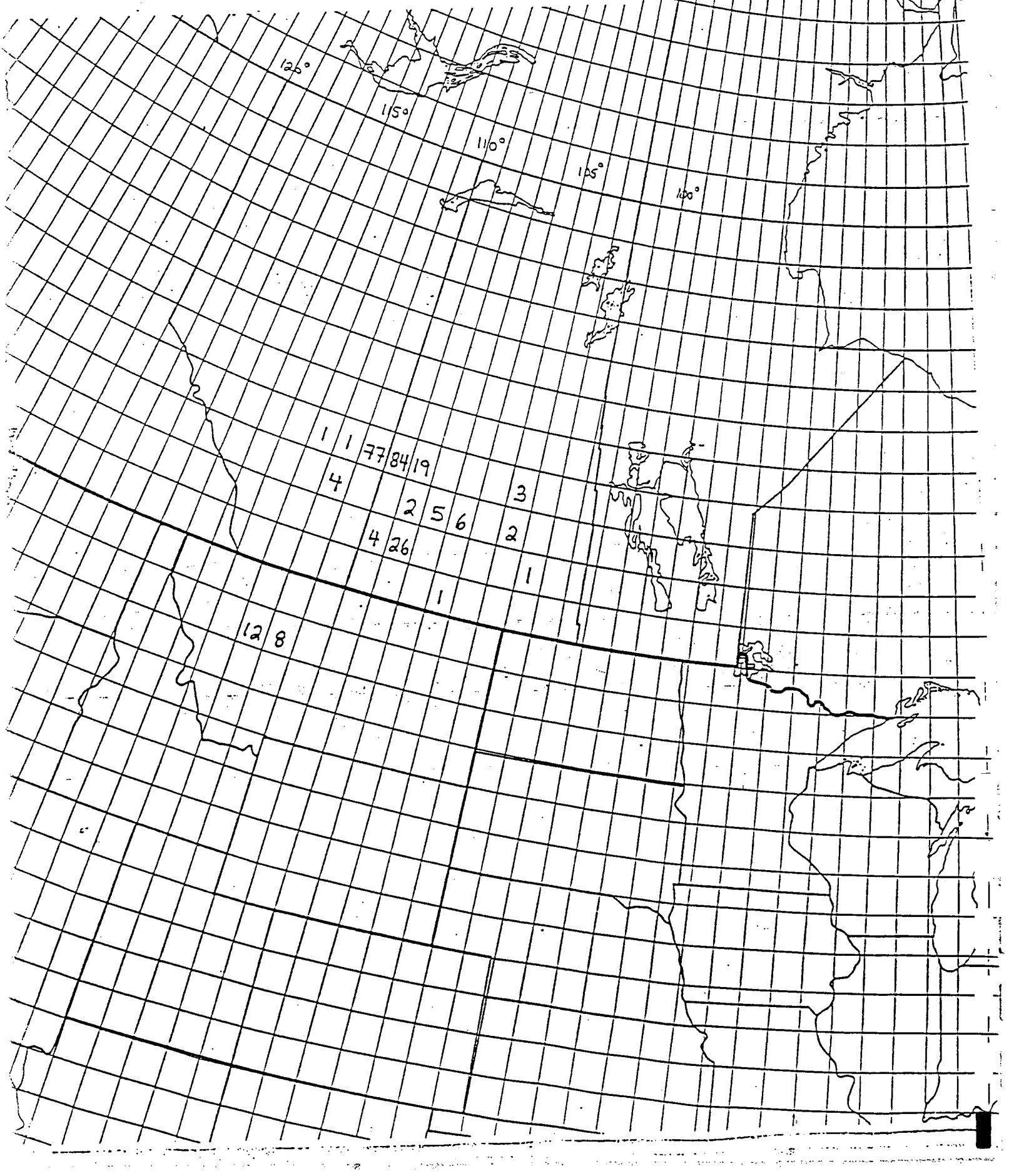
Snow Geese neckbanded in Central Arctic (E), 1989-90.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



Ross' Geese neckbanded in Central Arctic (E), 1989-90.

Sept. - Nov. 1990 observations in Alberta, Saskatchewan and Montana, no. unique codes per degree block.



1990 Project Summary

Dark Goose Marking, West Central Arctic

Objectives

The 1990 objectives for this project were to neck collar 700 and leg band 300 each of White-fronted and small Canada Geese in the West Central Arctic.

Results

689 White-fronts were marked with blue (white lettering) neck collars, and 396 were leg banded only.
296 small Canadas were marked with yellow (black lettering) neck collars, and 631 received leg bands only. Collars did not become available for application until near the end of the capture program.

1991 Objectives

Our objectives for next year will be the same as this year.

PROGRESS REPORTS FOR PROJECTS FUNDED BY THE CANADIAN WILDLIFE SERVICE / ARCTIC GOOSE JOINT VENTURE FUND, AND COORDINATED BY CWS-QUEBEC REGION, 1990.

December 1990

BROOD-REARING ECOLOGY AND INCUBATION BEHAVIOUR OF GREATER SNOW GEESE ON BYLOT ISLAND: A PROGRESS REPORT FOR 1990

Austin Reed
Canadian Wildlife Service
Ste-Foy, Que.

Objectives: The main objective of this study, which began in 1989, is to document home ranges and movements of individual Greater Snow Geese (Anser caerulescens atlanticus) families in relation to habitat types. Movements are determined by telemetry using transmitters placed on adult females caught on their nests during late incubation. Examination of body weights of adult females caught in 1989 prompted us to add a second objective in 1990: examination of body condition of females at time of hatch and time budgets during incubation. A third objective was to mark and weigh large samples of adult and juvenile geese just before fledge in order to 1) augment the number of marked individuals in the population for further studies, 2) examine body weights of geese of both age groups and growth indices (culmen, tarsus, wing) in goslings, and 3) obtain a large sample of banded birds to allow estimation of survival rates.

These objectives are linked with those of Dr. Gilles Gauthier, Université Laval, to provide a more comprehensive study of the reproductive ecology of Greater Snow Geese. The main thrust of the joint study is to examine how the geese exploit this arctic environment and how their activities impact on their habitats.

Field Activities: Work began in late June 1990 with the setting

up of two observation blinds and antennae on hillsides overlooking the study area. From 30 June to 9 July, 21 females were caught with net traps; all were weighed, measured, and marked with neck collars and 20 of them were fitted with transmitters. At the time of hatch several of those nests were revisited to determine initial brood size and to web-tag goslings. From 6 to 8 July the time activity budgets of 14 incubating females were recorded during two sessions covering a full 24-hour cycle. Telemetric observations were conducted daily from 11 July through 16 August; each day tracking was conducted simultaneously from both blinds over a 4-hour session, following which a visual census of all geese in a portion of the study area was conducted. The sessions were staggered over time to cover all times of day. Radio fixes of marked geese and visual observations of all geese were recorded in relation to a grid system overlying a habitat map. From 17 to 20 August flightless geese were rounded up for capture and banding with the help of a helicopter.

Preliminary Results: Mean body weight of 20 adult females was 2186 g, about 100 g less than in 1989. Even with these lighter body weights in 1990, Greater Snow Geese from Bylot Island appear to maintain a higher level of body condition through to late incubation than Lesser Snow Geese (A. c. caerulescens). Our observations on nest attentiveness in 1990, restricted to late incubation, revealed that females fed intensively while away from the nest but such recesses were infrequent and of short duration.

Eighty percent of the 20 radio-marked females produced

broods. Regular daily triangulation fixes were maintained on 16 females for the full 35 days of tracking. The four remaimaining females were followed for shorter periods; they were lost track of when, apparently, they left the study area. Most radio marked broods initially moved considerable distances from the nest before "settling in" to a more confined area which they inhabited through the rest of the brood-rearing period. All types of habitats were used; preferences are not evident from preliminary, cursory examination but may show up under more detailed analyses. Visual surveys in a 10 km^2 intensive study area showed more-or-less continued occupation by 150-250 broods.

Eight banding drives conducted from 17 to 20 August resulted in the capture of 809 geese, including the recapture of 6 adults previously banded in the south, 4 of the radio-marked females, and 9 web-tagged goslings. In all, 390 juveniles and 338 adults were newly banded. Neck collars were placed on 108 adult females. Body weight, culmen length, and tarsus length were recorded for all geese; wing length was recorded for 163 juveniles.

Discussion and Plans for 1991/1992: Over the coming months a full analysis of the 1989 and 1990 data on brood movements and habitat use will be conducted; the results of that analysis will dictate whether any additional field work on this topic is justified in 1991. It is anticipated that the results will allow us to develop a refined survey for 1992 which will provide an accurate indication of both colony size (quantitative surveys were

conducted in 1983 and 1988) and habitat preferences for the entire south plain of Bylot Island.

The main emphasis in 1991 will be on examining the behavioural mechanisms by which nesting females maintain body condition through the incubation period. Patterns of nest attentiveness will be determined throughout the incubation period and the behaviour of the females during nest recesses recorded, paying special attention to habitat types used and food plants selected. A sample of nesting females will be captured late in incubation to determine body weights and other indices of body condition.

Attempts to capture and mark goose families late in the flightless period will be intensified both within the study area and elsewhere on the south plain of Bylot Island. All marked geese will be weighed and measured. These measurement data will help establish the body condition of adults during late brood rearing and growth rates of goslings. Further information on growth and body condition will be obtained from marked individuals examined later in hunters' bags at Cap Tourmente and elsewhere in the St. Lawrence estuary. These and other recoveries of marked birds will allow estimation of survival rates by age category thus enabling refinement of existing population models.

Nov.'90

5

FEEDING ECOLOGY OF BREEDING GREATER SNOW GEESE ON BYLOT ISLAND (NWT) IN 1990: A PROGRESS REPORT

by

Gilles Gauthier
Département de biologie
Université Laval,
Ste-Foy, Qc, G1K 7P4

In 1990, I continued the study initiated 2 years ago on the energetic and feeding ecology of breeding greater snow goose (Chen caerulesens atlantica) on Bylot Island. The emphasis was still on the pre-laying and laying periods as we sought to increase sample sizes obtained in 1989. However, a new aspect of the research program was initiated during the brood-rearing period.

OBJECTIVES

The greater snow goose population has increased steadily over the past 20 years to reach 400,000 birds in spring 1990. In the St. Lawrence estuary staging ground, this increase has led to several problems including conflicts with agriculture and overgrazing of some marshes. Recent studies have also indicated that greater snow geese may not accumulate sufficient energy reserves in spring to meet the energy cost of reproduction.

The long-term objective of my research program is to evaluate the effects of the population increase on nesting habitats and on productivity (nesting success and survival of young). A secondary objective is to evaluate the contribution of nutrient reserves to the energy budget of breeding pairs in this population. Specific goals in 1990 were as follows: (1) measure the productivity of the colony (nest initiation dates, clutch size, nesting success), (2) determine the condition of geese (i.e. fat and protein reserves) from arrival time until the start of incubation, (3) assess the level of feeding activity, diet and food quality during this period, (4) evaluate the

impact of goose grazing on the arctic vegetation, and (5) measure change in food digestibility in growing goslings.

FIELD ACTIVITIES

We established the base camp on May 25 in a glacial valley in southwest Bylot Island (73° 08' N - 80° 00' W). Our field crew was made of 6 people until June 20 (1 graduate student, 2 technicians, 1 biologist, 1 inuit and myself) and 5 people (2 graduate students, 2 summer students and 1 inuit) from June 20 to August 22. The study area is characterized by polygon tundra. Sunken polygons form numerous small and shallow ponds that dominate lowlands. Shallower ponds develop into wet sedge meadows where Carex aquatilis var. stans, Dupontia fisheri and Eriophorum sp. dominate. Polygon rims are raised ($\leq$ 0.5 m) and, being drier, are preferred by geese as nesting site.

A sample of 170 nests was monitored. Nests were found during egg-laying to determine date of initiation. Nests were revisited periodically to determine clutch size and nesting success.

Body condition of geese was assessed by collecting birds. Pairs were shot during the following periods: arriving birds (May 26-29), pre-laying (June 5-9), laying (June 9-13) and beginning of incubation (June 17). A total of 60 geese were shot and autopsied. Some tissues (skin, abdominal fat, gizzard, breast and leg muscles, and gonads) were removed and kept frozen for fat and protein analyses in the laboratory.

We established the time-activity budget of nesting pairs throughout the 24h daylight period. Pairs were randomly selected with spotting scopes and the behavior of males and females was followed simultaneously. The behavior was noted every 10 sec (focal animal sampling) during 15-min observation periods.

Diet of nesting geese was determined from the oesophagal content of shot birds (31 geese had food in their gut). Samples were sorted out, dried and weighed. Samples of plants eaten by geese were also collected. These samples were dried in the field and brought back to the laboratory for chemical analyses (protein, fiber, energy etc.).

We evaluated the impact of goose grazing on the vegetation by setting up 12 1 x 1 m exclosures in mid-June to prevent grazing in the preferred brood-

rearing habitat (Dupontia/Eriophorum). Exclosures were paired with experimental plots of similar size where geese could graze freely. Plant biomass was measured every 2 weeks by collecting 20 x 20 cm sods of vegetation in each exclosure and experimental plots.

Sixteen goslings were collected in nests at hatch (one gosling per nest) and imprinted on humans. Every week, goslings were brought into 2 diferent habitats (Carex and Dupontia/Eriophorum) for grazing trials. Plant and dropping samples were collected and brought back to the lab to assess total and protein digestibility using natural food marker (acid detergent fiber).

PRELIMINARY RESULTS

Snow-melt was relatively late in 1990. On June 5, nesting sites were still 85% snow-covered. Up to 200 snow geese were already present in the valley on May 25. However, major arrivals (several hundreds) occurred on May 27. During the pre-laying period, geese moved around searching for snow-free patches. However, upon initiating egg-laying, they settled on a territory and concentrated most of their activity in the vincinity of the nest. The first nest was initiated on June 5 but peak initiation was June 14 (2 and 6 days later than in 1989 and 1988, respectively). Up to 65% of the nests were initiated within a 4-day period. Peak of hatch was on July 10. Clutch size (3.6 eggs; mean from a subsample of 20 nests) was similar to 1989 (3.9 eggs, N = 65).

Preliminary analyses of shot birds show that female snow geese arrived on Bylot Island with moderate fat reserves. Fat declined between arrival and pre-laying but increased from pre-laying to the beginning of egg-laying. Finally, fat reserves declined again during laying to reach their lowest at the start of incubation.

During the long pre-laying period, male and female time budget were very different. Pre-laying females spent more than 75% of the entire day feeding (i.e. up to 18 h) compared to less than 44% in males. Conversely, pre-laying females spent 6% of their time in alert compared to more than 32% in males. Time of day and date had no influence on time budget. Early in the season, geese used mostly mountain slopes where they fed on roots (carrots) of

Oxytropis maydelliana, bulbs of Polygonum vivipara and overwintered green shoots of Alopecurus alpinus. As snow-melt progressed, geese started to feed on basal stems and rhyzomes of Carex stans and Eriophorum scheuchzeri. Plant quality analyses (protein and fiber) of these species are currently conducted.

At the peak of brood-rearing (early August), plant biomass was lower in the grazed sites and regrowth following grazing appeared to be low. However, plant senescence (and presumably a decrease in plant quality) was earlier in the ungrazed than in the grazed sites. Laboratory analyses (plant biomass and quality) are still underway.

Grazing trials with goslings showed that Carex was a much less preferred habitat for young goslings than Dupontia/Eriophorum. Laboratory analyses to determine difference in food digestibility between these 2 habitats are also underway.

CONCLUSION

Our results show that greater snow geese differ from several other populations of Arctic-nesting geese. They are unusual in having a very long pre-nesting delay (≥ 14 days). Although they deplete some of their fat reserves shortly after arrival on the breeding ground, the intense feeding activity of females enable them to replenish a large part of these reserves. Hence, feeding makes a very significant contribution to the energy budget of nesting females.

Because of their late nest-initiation date, greater snow goose goslings are faced with one of the shortest growing season of all goose species (they grow from 100g to ~2400g [fledging weight] in about 45 days). Preliminary observations suggest that feeding by growing goslings may have a severe impact on food availability. Thus, even slight decreases in growth rate as a result of overgrazing could have a large impact on survival because of the extremely short growing season available at northern breeding colonies such as Bylot Island. As the population is currently expanding, it becomes critical to understand what resources are essential for gosling growth and what are the limiting factors.

PLANS FOR 1991

In the following years, I will pursue the long-term objectives laid out earlier in this progress report. My specific objectivs for the 1991 field season are as follows:

1) Continue to monitor the productivity (date of nest initiation, clutch size and nesting success) of the Bylot Island colony.

2) Continue to monitor the cumulative impact (i.e. over several years) of grazing on both food availability and food quality.

3) Study the foraging behavior of growing goslings. More specifically, I will investigate how previous grazing affect the foraging startegy of families in their prefered Dupontia/Eriophorum habitat.

4) Assess what are the important factors limiting growth rate and final body size of greater snow geese gosling at Bylot Island and evaluate their impact on gosling survival.

10

OBSERVATIONS AND RADIO TRACKING OF SNOW GEESE OVER THE UNGAVA PENINSULA DURING SEPTEMBER 1990

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Objectives: Examine use of the Ungava Peninsula by Snow Geese (Anser caerulescens) during fall migration and attempt to determine the subspecies involved (A. c. caerulescens vs atlanticus). I was especially interested in learning whether there were any specific habitats or particular localities in this vast subarctic area which served as critical staging areas for large numbers of Greater Snow Geese (A. c. atlanticus); any such areas would merit consideration for special protection because of their strategic position along a lengthy migration route linking the arctic breeding grounds and the major staging haunt on the St. Lawrence estuary.

Field Activities: This pilot study sought to take advantage of 1) the availability of a PCSP helicopter based along the west coast of Ungava Bay during mid-September, and 2) the possible passage of 19 radio marked Greater Snow Geese which had been marked for studies on brood movements on Bylot Island earlier in the year. We conducted a series of survey flights in the form of loops radiating out from the coastal settlement of Kangirsuq (Payne Bay) and from a fuel cache about 100 km inland from 11 to 16 September. The helicopter was equiped with two Yagi antennae linked to a scanner receiver. We flew at approximately 100-300

m above ground level looking for goose flocks and listening for radio signals. We set down at several locations to appraise evidence of goose use and to collect botanical material.

Preliminary Results: Approximately 16 000 Snow Geese were seen along roughly 2700 km of survey route. No radio signals were received. The proportion of blue phase individuals in the flocks observed was highly variable with means for individual survey sections varying from 0 to 35% and averaging 16% overall. This is perplexing because Greater Snow Goose flocks rarely contain more than 1% blue phase whereas Lesser Snow Geese from the nearest colony (the Great Plain of the Koukdjuak) show about 80% blue phase. The suggestion is that both subspecies simultaneously use the area during fall migration. Snow Geese were widely dispersed over the area, used a wide array of tundra habitat types, and appeared to feed principally on the basal portion of Carec sp. as well as the berries of Empetrum nigrum and ericaceous shrubs. No important concentrations of geese were found.

Plans for 1991: Given the uncertainties of helicopter support and the availability of radio-marked geese, as well as the high costs of operation and conflicting demands on my time, I do not plan to continue field work in 1991. On completion of the full analyses of the data it might be possible to develop a more effective and ~~cos demanding approach for future years~~, perhaps involving greater implication of local people and agencies, and the use of satelite telemetry.

Nov.'90

GREATER SNOW GOOSE HABITAT RELATIONSHIPS IN THE ST. LAWRENCE ESTUARY: A PROGRESS REPORT FOR 1990

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Objectives: The overall objective is to attain an adequate level of ecological understanding of goose-habitat relationships in order to develop and implement management programs which would bring goose numbers and distribution into harmony with the natural food supply and with agricultural and other socio-econmical interests. In 1990 field work was conducted on three aspects: 1) an intensified spring survey to determine total population size and to document proportional use of different sectors of the St. Lawrence valley; 2) a survey of the above- and belowground biomass of Scirpus americanus and other macrophytes in the tidal marsh at Cap Tourmente during September; and 3) documention of movements and duration of stay of geese at Cap Tourmente and other staging haunts along the south shore of the St. Lawrence during fall migration using telemetry (19 geese, radio marked in July on Bylot Island, were potentially available for tracking).

Field Activities: Between 27 April and 12 May, 3 complete photographic surveys were conducted between Grondines and Mont Joli using a fixed wing, bimotor aircraft. A staging area west of our survey area, Lac Saint-Pierre, was covered by daily ground surveys by a research team from l'université du Québec (UQAM). Visual estimates of all goose flocks were conducted during each survey. Presently, a complete photo count of geese has been

performed only on the middle survey (2/3 May); photo counts for the other surveys will be conducted over the coming months.

During September; stem density of Scirpus americanus, Sagittaria latifolia, and Zizania aquatica was assessed in 375 sample quadrats distributed over three vegetation zones at Cap Tourmente; Scirpus stem length and presence/absence of seed heads was determined from a subsample. In addition 12 complete samples of above- and belowground vegetation were collected for biomass determination. Compilation and laboratory analyses will be completed over the coming months.

From late September through early November radio scanning for marked geese was conducted at all important staging haunts in the St. Lawrence. At the Cap Tourmente NWA and the Montmagny, Saint-Vallier, Cap Saint-Ignace and Rivière Trois Saumons sanctuaries tracking was conducted daily. Staging areas on Ile-aux-Grues/Iles-aux-Oies and at Lac Saint-Pierre were covered twice during the season. Scanning was conducted with handheld antennae; supplementary scanning was done at Cap Tourmente with an automatic absence/presence recorder.

Preliminary Results: The photo count from the 2/3 May survey, to which has been added visual estimates of a few flocks which were outside the survey area, indicated a total population of approximately 370 000 geese. Further analyses of all the survey data will be reported at a later date.

No results are yet available for the vegetation survey at Cap Tourmente.

To date, approximately 13 radiomarked geese (all were adult females) have been detected on staging areas in the St. Lawrence. Several were present for more than 10 days; most of them spent the entire stay at the same staging site but a few changed sites before departing for the south. We have been able to observe several of the radiomarked geese and determine whether they were accompanied by their mate or by goslings. A detailed report will follow.

Discussion and Plans for 1991: The three topics chosen for study in 1990 will contribute to our understanding of the ecological requirements of this rapidly expanding population in a densely inhabited region with finite areas of natural habitat. It is urgent to establish an expanded network of protected areas to ensure the most efficient use of available natural habitat. These and other topics merit continued attention in 1991 and beyond to help us answer such questions as: how many protected areas are needed?, how large should they be?, how far apart should they be?, what types of habitat shoud they encompass and in what proportions? It is anticipated that l'université Laval and UQUAM will present a joint request for AGJV funding for a major study on Greater Snow Goose movements within the St. Lawrence system in 1991. My plans for 1991 are fully complementary to their proposal and include continued intensified surveying in spring and detailed monitoring of habitat use in the fall. My present plans call for a re-survey of the vegetation at Cap Tourmente in the fall of 1992 but some additional marsh assessment may be possible in 1991.

Nov. '90

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GOOSE STUDIES IN JAMES BAY, QUEBEC: A PROGRESS REPORT FOR 1990

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Objectives: Investigate use of wetlands near James Bay by migrating and breeding geese, with emphasis on habitat types that are threatened by development. Three studies were initiated in 1990: 1) Habitat use and diet of migrating Canada Geese (Branta canadensis) in coastal wetlands; 2) Nesting requirements of Canada Geese near Lake Bienville; 3) Habitat use and accumulation of nutriant reserves by Atlantic Brant (Branta bernicla) staging in coastal wetlands.

Field Activities: In May Cree hunters collected 300 digestive tracts of Canada Geese from several coastal hunting camps. Another 20 were collected in fall from one camp. Laboratory analyses of that data will be collected during November. Preliminary observations og habitat use by Canada Geese along the northeast coast were conducted during late May/early June (the tail end of spring migration) and in mid/late September.

Near Lake Bienville during June, the clutch size and nest-site characteristics were documented for 29 Canada Goose nests which were found during a search by helicopter; we returned in July to appraise nest success and to obtain more detailed information on nest-site characteristics.

In late May/early June, and in mid/late September we conducted ground studies on feeding ecology and habitat use by staging Brant along the northeast coast. Cree hunters provided 7 Brant specimens in June and in September for carcass analyses. Body weights and measurements were obtained from several other

hunter-shot Brant.

Preliminary Results: Results are not yet available from the Canada Goose stomach analysis. In both spring and fall, staging Canada Geese made extensive use of salt marsh habitats for feeding and resting and also foraged regularly on islands characterised by ericaceous heath.

Near Lake Bienville Canada Geese nested in low shrub and grass on islets or peninsulas associated with ponds or bogs. Mean clutch size was 4.3 $\pm$ 1.1 (SD) eggs (n = 29 nests).

Brant were observed to feed exclusively over eelgrass (Zostera marina) beds or on dislodged eelgrass blades which they found along shore in windrows, in the water column, or embedded in melting spring sea ice. Further information on diet and nutrient reserves will be obtained from carcass analyses to be conducted later this year. Mean body weights of adults measured just before departure in early June (1630 g for 8 males, 1490 for 7 females) indicated the presence of large quantities of nutrient reserve. Observation of flocks during September suggested a low proportion of juvenile Brant in the fall flight.

Discussion and Plans for 1991: The present field season allowed us to obtain some valuable insights into the staging ecology of Brant and Canada Geese and into the nesting requirements of Canada Geese. More importantly we gained valuable experience in working with collaborating agencies and, especially, with native hunters - experience which should ensure efficient operations in coming years.

In 1991 a full scale study of the staging ecology of Brant

is planned; extensive ground observations and detailed examination of hunter-shot geese will be conducted at 2 or more study sites along the coast in both spring and fall.

Studies of habitat use by staging Canada Geese along the northeast coast will be continued and additional material will be collected to determine the fall diet.

Plans for additional studies on the nesting and brood rearing ecology of Canada Geese in the Lake Bienville area will be forthcoming.

Nov.'90

NESTING DISTRIBUTION AND ABUNDANCE OF GEESE IN THE QUEEN MAUD GULF MIGRATORY BIRD SANCTUARY, 1990

PROGRESS REPORT

R.T. ALISAUSKAS

PRAIRIE AND NORTHERN WILDLIFE CENTRE
CANADIAN WILDLIFE SERVICE
115 PERIMETER ROAD
SASKATOON, SASKATCHEWAN
S7N 0X4

NOVEMBER 1990

DRAFT

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INTRODUCTION

The Arctic Goose Joint Venture Prospectus identifies a lack of knowledge regarding breeding distributions of geese in the arctic. The Prospectus also points out that the AGJV is an opportunity to direct more research toward geese in the arctic than has been done in the past. Surveys of arctic geese on their nesting grounds is in itself a priority product of the AGJV; however, such surveys are also a necessary first step toward focused research on the nesting grounds, and toward understanding the factors that influence the distribution and abundance of arctic geese.

The Queen Maud Gulf Migratory Bird Sanctuary (QMG MBS) is the largest sanctuary in Canada encompassing 62,780 km² of low arctic mainland and marine habitat of Queen Maud Gulf. The sanctuary harbours large and rapidly expanding numbers of nesting Ross' and Snow Geese (Kerbes, pers. comm.), and early reconnaissance surveys during brood rearing (Barry 1962) indicated that it was an important area for Canada Geese and White-fronted Geese. Aside from fairly regular photographic census of Snow and Ross' Goose colonies, no systematic surveys of Arctic Geese or other waterfowl have been conducted (see Lumsden 1964, Kuyt et al. 1971).

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METHODS

Aerial survey of geese (White-fronted Geese, Canada Geese, Brant, non-breeding flocks of Ross'/Snow Geese), ducks (Common Eider, King Eider, Oldsquaw, Pintail), Tundra Swans, and Sandhill Cranes were conducted from June 20 to June 26, 1990. Observations were made from A Bell 206B helicopter flying at 100 kph, 50 meters above the ground.

Navigation was done by the pilot using flight lines predrawn on 1:250,000 NTS maps. An observer in the left front passenger seat recorded sightings on the left and directly ahead, and a second observer in the right rear seat recorded sightings on the right side of the flight line. Frequent verification of sightings between both observers prevented duplication in recording the same sightings. All sightings within 200 m of the helicopter were recorded.

Flight lines were predrawn on easting and northing lines for UTM zones 13W and 14W and were referenced by a transect letter and a segment number. Flight lines were spaced 10 km apart and each was segmented every 2 km. Each segment was 0.8 km² large.

The pilot announced initiation of segments, and observations

were recorded for each segment directly on paper. For each species, observers recorded the number of individuals that were deemed to be associated with one another (i.e., flock size), and if that group was visibly associated with a nest.

Sampling design.-- Because waterfowl other than Ross' or Snow Geese had not been systematically censused in the QMG during nesting, there did not exist preliminary information that could be used to decide on appropriate sampling effort before the field season. Therefore, a two-step approach to finalizing a sampling strategy was used (Figure 1). Priority target species for this work were (A) White-fronted and (B) Canada Geese, so the following decisions were based on the numbers of each of these species. Because of fuel availability and allotted helicopter hrs, an attempt was made to compromise between spatial extent of the survey, and intensity of sampling. First, flight lines 20 km apart with a north or south heading were selected to extend inland from the coast. The length of these transects were determined by the presence of White-fronted Geese; i.e., when the numbers of White-fronted geese were low for at least 20 km, a decision was made to discontinue the heading. As surveys continued, it became obvious that most White-fronted Geese were encountered within 50 km of the coast. Second, once this coarse southern limit to the northern distribution of geese was established, flight lines were selected every 10 km apart with both north-south headings and east-west headings. This method also increased the amount of information obtained per hour of helicopter flight.

Delineation of Study Area.-- A total of 3346 km were flown for data collection (1673 segments), thereby directly surveying 2677 km^2 of the sanctuary. The total size of the sanctuary (including mainland and Queen Maud Gulf with offshore islands) is 62,780 km^2, so that 4.3% of the sanctuary was covered. The mainland portion of the sanctuary is 51,353 km^2, and 1459 segments (2,918 km^2) were flown over the mainland so that 5.1% of the mainland was covered directly.

A study area within which estimates of White-fronted Goose distributions and abundance were valid was spatially delimited as the area south of the coast, within the western and eastern boundaries of the sanctuary, and north of southern limits of all north-south transects (Figure 1). This mainland area comprises 23,421 km^2 and included 2,918 km^2 (12.5%) of the sanctuary mainland that was surveyed directly. This study area constitutes the northern 45.6% of the mainland portion of QMG MBS.

Spatial distribution of geese.-- Variation in the spatial distribution of geese was summarized using the POTMAP routine of SPANS. Input data were geo-referenced centroids of each 2 km

segment with total number of White-fronted Geese observed per segment. POTMAP produces a smoothed surface from point data based on averages of the number of neighbours, n, that are specified. A sampling circle is divided into an inner radius, α, within which all points are weighted equally, and the total radius minus α, or γ, which is the portion of the sampling circle radius in which points are not weighted equally. Within γ, the decay function of the weighting factor, β, can be between 0 and 1, with β=0.5 describing a linear decay, and β=0.1 describing an exponential decay function, for example.

Because segment centroids were 2 km apart, I specified that α=2.5 km to weight adjacent centroids equally. Some centroids were up to 20 km apart, and it was desirable to estimate White-fronted Goose abundance between these segments, so γ=20 km was selected. This added continuity to the description of spatial abundance in these more widely spaced segments. However, to preclude undue influence on average numbers of birds for any segment by numbers at very distant segments, β=0.05 was chosen; this resulted in including segments that were 20 km apart in the averaging procedure, only if they were one of the first n=40 nearest segments to the segment at the center of the sampling circle. Thus, any segments more than 2.5 km away from the center of the sampling circle had a very small weighting.

Estimates of Geese within Study Area.-- To date, only total numbers of observed White-fronted Geese within the study area have been analyzed. Estimates of total numbers of White-fronted Geese were derived in two ways. The first method was to take the average number of geese observed/km² for all north south transects (Figure 2) using

$$D=\sum_{i=1}^{t}\frac{n_i}{l_1(0.4)}$$

where D = density (km²), t = number of transects (35), n_i = number observed on transect i, l_i=length of transect i, and 0.4 is the transect width. Total numbers of birds, N, of each species were determined using

$$N=DxA$$

where A = size (23,421 km²) of study area. Ninety-five % confidence limits (cl) of total numbers were calculated using

$$cl(N)=cl(D)\,xA$$

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These transects were composed only of those segments that were centered over the mainland portion of the sanctuary.

The second method for estimating total White-fronted geese that would be visible within the study area involved using the density contours as produced above. The area of these density contours, or strata, were weighted by the number of geese representing that density stratum.

RESULTS & DISCUSSION

Over 7 days, 51 hours of helicopter time were logged. About 9 hours were used to ferry between Cambridge Bay and the CWS cabin at Perry River. Therefore, about 42 hours were used to collect the data and depart from flight lines to refuel.

Spatial distribution of geese.-- Based on potential mapping, the distribution of White-fronted geese was non-random (Figure 3). Immediately coastal areas generally had less than 1 bird observed/km^2; the density of observed birds increased to greater than 1/km^2 in a more or less continuous east-west band farther inland. This band was of varying width and the southern boundary extended inland along major river corridors. Several areas averaged greater than 5 geese observed/km^2 and again were associated with rivers.

From west to east, the most important rivers were the Tingmeak, an un-named river flowing into QMG to the west of Atkinson Point, an un-named river flowing into QMG to the east of Atkinson Point which drains a large round unnamed lake, the Perry River, the mouth of the Ogden Bay River, and the McNaughton River. The single most important regions were drained by the two major Rivers with their mouths on either side of Atkinson Point.

South of this band of high density, numbers observed within the study area were generally less than 1 White-fronted Goose/km^2, but there were several pockets averaging between 1 and 5 White-fronted Geese observed/km^2. In one area about 50 km directly inland along the Ellice River, densities of observed White-fronted Geese exceeded 5/km^2, suggesting that there are high density pockets of this species occurring outside the 1990 study area.

Estimates of Geese within Study Area.-- Using north-south transects as the basis for determining overall density of White-fronted Geese within the mainland study area yields 1.82±0.358 (95% confidence limit)/km^2. Thus, the estimate of the number of White-fronted Geese that would have been observed in the study area is 42,649 (95% confidence interval: 34,264 - 51,034). This is in all likelihood an underestimate of the population that is resident on the study area for 2 reasons: first, both members of a nesting pair are highly cryptic (behaviorally and morphologically) and visibility bias is unknown; second, there is

a bias associated with those pairs in which only one member was observed. The relation between what is visible and what is present needs to be established before a population estimate can be derived.

Using the second method for estimating total number of White-fronted Geese that would be observed in the study area (Table 2) provides a value of 45,456.

RECOMMENDATIONS

To establish that goose distributions are consistent from year to year, a second year of field work is recommended to provide segment by segment correlations between years for each species of waterfowl observed.

Because of some evidence that there may be substantial concentrations of White-fronted Geese farther inland than was flown in 1990, an additional 25 hrs of helicopter time is needed to cover the area extending to the southern boundary of the Sanctuary.

A subset of transects need to be flown twice to examine repeatability of counts in the same year.

Most importantly, a ground verification effort is necessary for two reasons: (A) to provide a correction factor to apply to the aerial survey especially as it pertains to nesting White-fronted Geese, and (B) to examine features of nesting habitat selection by White fronted geese. This would be an important piece of research toward understanding habitat influences on nesting White-fronts.

Helicopter surveys such as this are not as apt to be affected by poor weather. Queen Maud Gulf remains icebound until July, and so there is virtually no chance of heavy fog until then. The timing of the flights (late June) relative to average ice melt in the gulf (July) make helicopter surveys in this area a feasible procedure for annually monitoring geese in this area.

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Table 1. Summary of White-fronted Geese observed on individual North-South Transects in the Queen Maud Gulf Migratory Bird Sanctuary, June 1990.

UTMZONE	TRANSECT	NUMBER OF SEGMENTS	TRANSECT LENGTH (km)	SURVEYED AREA (km^2)	NUMBER OF GEESE OBSERVED	GEESE /km^2
13	A	39	78	31.2	54	1.73
13	B	15	30	12.0	24	2.00
13	C	30	60	24.0	42	1.75
13	D	15	30	12.0	39	3.25
13	E	29	58	23.2	69	2.97
13	G	27	54	21.6	28	1.30
13	H	13	26	10.4	35	3.37
13	I	45	90	36.0	59	1.64
13	J	13	26	10.4	24	2.31
13	K	37	74	29.6	81	2.74
13	L	14	28	11.2	23	2.05
13	M	55	110	44.0	60	1.36
13	N	15	30	12.0	16	1.33
13	O	54	108	43.2	34	0.79
14	A	18	36	14.4	48	3.33
14	B	35	70	28.0	59	2.11
14	C	18	36	14.4	5	0.35
14	D	40	80	32.0	24	0.75
14	E	14	28	11.2	52	4.64
14	F	39	78	31.2	65	2.08
14	G	18	36	14.4	4	0.28
14	H	38	76	30.4	21	0.69
14	I	16	32	12.8	50	3.91
14	J	30	60	24.0	28	1.17
14	K	25	50	20.0	11	0.55
14	L	7	14	5.6	8	1.43
14	M	26	52	20.8	55	2.64
14	N	7	14	5.6	18	3.21
14	O	39	78	31.2	53	1.70
14	P	10	20	8.0	7	0.88
14	Q	39	78	31.2	38	1.22
14	R	15	30	12.0	24	2.00
14	S	20	40	16.0	4	0.25
14	T	9	18	7.2	6	0.83
14	U	20	40	16.0	18	1.13
	SUM	884.00	1186.00	707.20	1186.00	63.73
	MEAN	25.26	33.89	20.21	33.89	1.821
	STD	13.06	20.95	10.45	20.95	1.08

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Table 2. Estimated number of geese observed in study area, Queen Maud Gulf Migratory Bird Sanctuary

CLASS	NO. GEESE PER CLASS	AREA SQ. KM.	ESTIMATED NO. GEESE OBSERVABLE PER CLASS
1	0	511.30	0.00
2	1	13346.20	13346.20
3	2	3972.30	7944.60
4	3	2470.00	7410.00
5	4	1374.70	5498.80
6	5	772.90	3864.50
7	6	507.90	3047.40
8	7	196.30	1374.10
9	8	84.70	677.60
10	9	76.80	691.20
11	10	43.20	432.00
12	18	65.30	1170.18
	TOTAL	23421.60	45456.58

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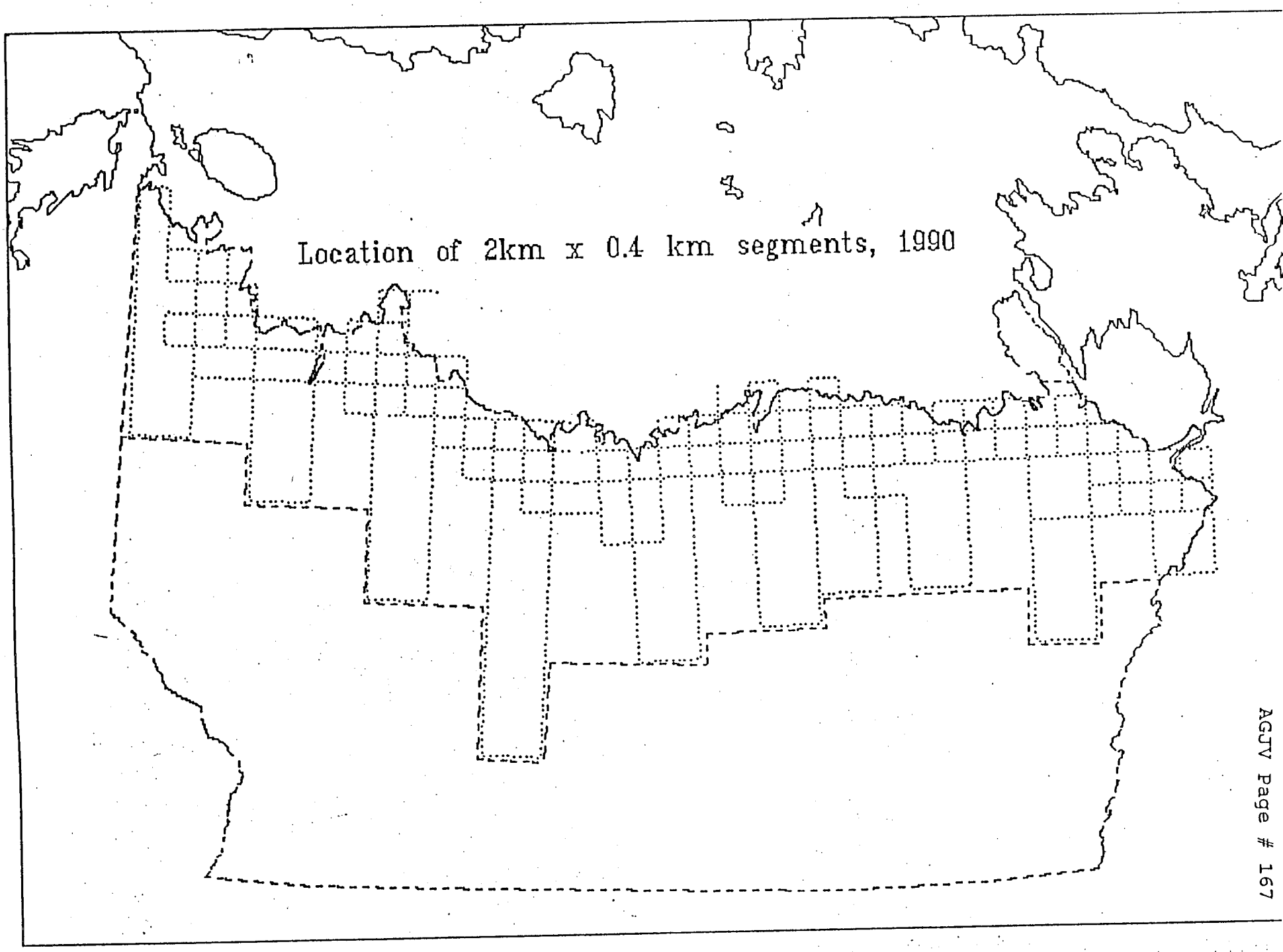
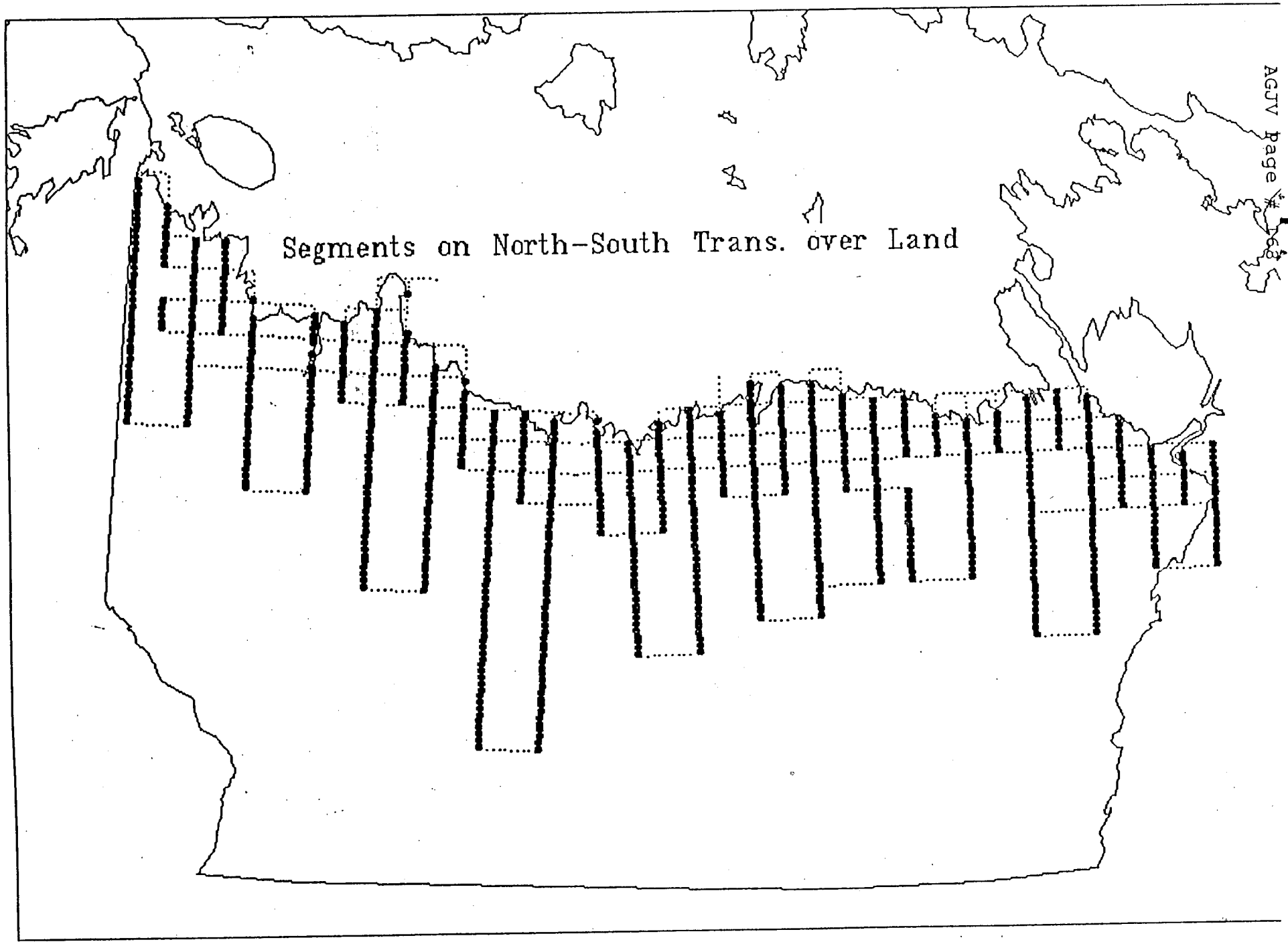
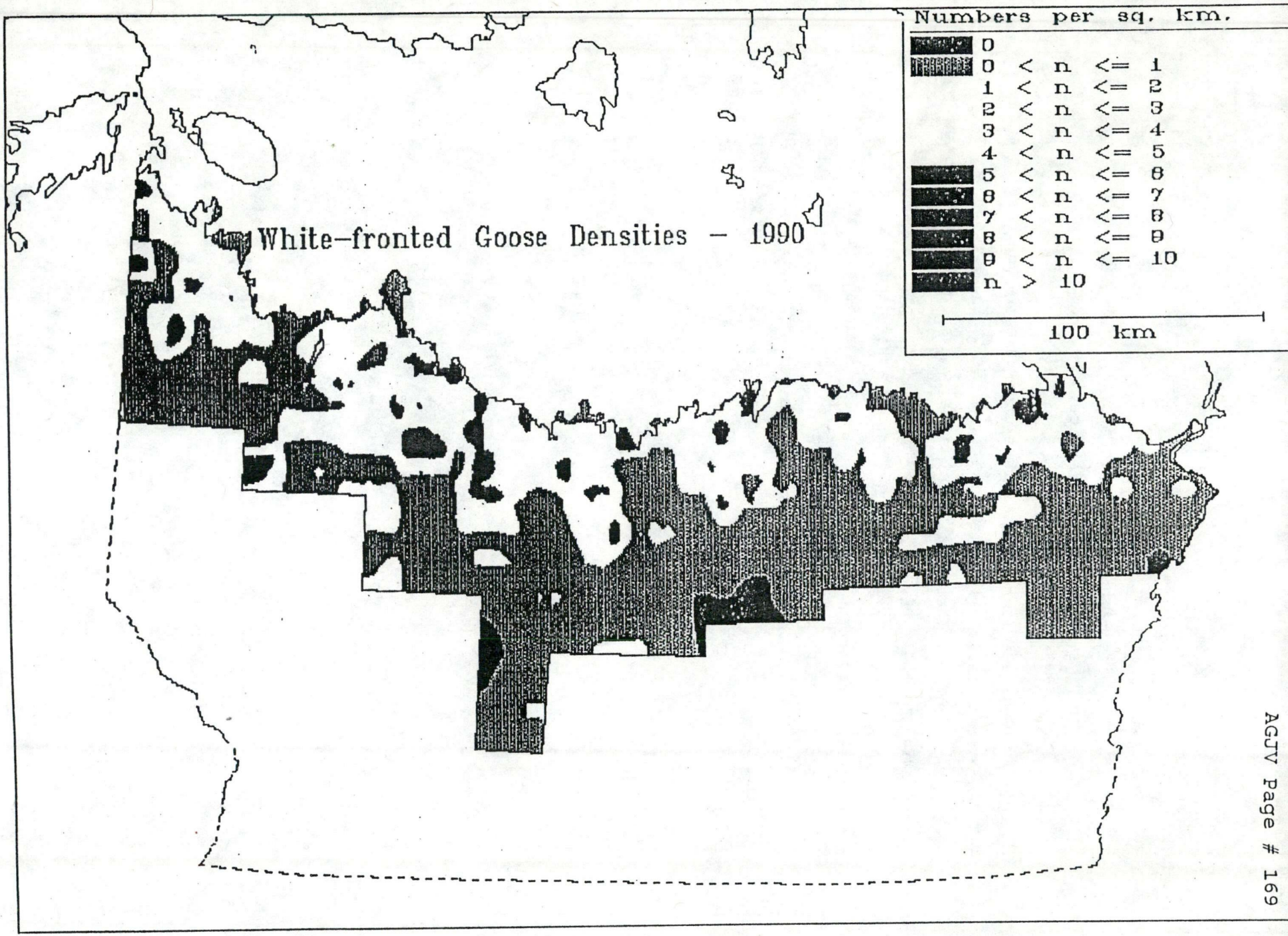
FIGURE 1. Spatial distribution of centroids of 2 km by 0.4 km segments flown in the Queen Maud Gulf Migratory Bird Sanctuary in June, 1990.

FIGURE 2. North-south transects that were flown in June, 1990. These are the transects upon which estimates of geese observable from the air were made for the study area.

FIGURE 3. Spatial distribution White-fronted Geese measured as an estimate of the number observable from the air.


Location of 2km x 0.4 km segments, 1990


Segments on North-South Trans. over Land
AGJV Page #


White-fronted Goose Densities – 1990
Numbers per sq. km.
0
0 < n <= 1
1 < n <= 2
2 < n <= 3
3 < n <= 4
4 < n <= 5
5 < n <= 6
6 < n <= 7
7 < n <= 8
8 < n <= 9
9 < n <= 10
n > 10
100 km

A Brief Synopsis of Progress to December 1990
on Arctic Goose Joint Venture Projects
in the Pacific and Yukon Region,
Canadian Wildlife Service.

In fiscal year 1990-1991 four projects were undertaken in the Pacific and Yukon Region of the Canadian Wildlife Service, under the auspices of the Arctic Goose Joint Venture. These included: (1) an investigation of brant staging and migrating through the Strait of Georgia; (2) population studies of Wrangel Island snow geese on Wrangel Island and on the northern wintering grounds on the Fraser River/Skagit River deltas; (3) an assessment of the rate of use of upland fields by snow geese wintering on the Alaksen National Wildlife Area in Vancouver; and (4) an intensive assessment of harvest of snow geese by hunters on the Fraser River delta. Progress to date on each project is briefly reported here.

Brant Migration and Staging in the Strait of Georgia.

Introduction

Brant once wintered in British Columbia in substantial numbers but are now seen only in spring migration. Recent estimates indicate that up to 25,000 birds may be present at one time in the Strait of Georgia, 400 on the west coast of Vancouver Island, and 2,000 on Graham Island on the Queen Charlottes. It is probable, however, that with turnover, a much larger proportion of the Pacific flyway population may actually use these habitats. In 1988, a pilot survey of brant was carried out with the Arrowsmith Naturalists in the Parksville-Qualicum Beach area and in 1989 the survey was expanded to the Comox area with the help of the Comox-Strathcona Naturalists. The main objective was to read the coded leg bands of brant that had been banded in the low arctic and on the Yukon-Kuskokwim Delta in Alaska.

Initial findings indicated that some marked birds spent at least 10 days in a particular area and some individuals remained up to 45 days. A number of the birds observed in the Parksville-Qualicum Beach area in 1988 returned to the same site in 1989. At least three separate breeding populations depended on habitat within the Strait of Georgia. Birds from the Yukon-Kuskokwim Delta, from Teshekpuk Lake and from the Canadian low arctic were observed in the Parksville-Qualicum Beach area in 1989.

A more intensive effort in the Strait of Georgia was undertaken during the spring migration of 1990, under the auspices of the Arctic Goose Joint Venture. The objectives of that study were: to conduct weekly aerial surveys of brant in the southern Strait of Georgia; read leg bands and use those sightings to calculate turnover rates of staging brant, and estimate total populations passing through the Strait of Georgia; analysis food habits through faecal analysis; and determine use of important habitats by recording daily activity budgets.

Methods

Standard procedures were used for all aspects of the project. Aerial surveys were conducted once per week, generally on low tides when the brant were at the shore line and thus easier to see. Most of the southern Strait of

Georgia was covered, from Campbell River to Victoria in the west, from Boundary Bay to Powell River in the east, and most of the small islands near the Gulf Islands known to have been used by brant in the past. Band readings were made regularly at major staging locations, and opportunistically at any location brant were concentrating.

The derivation of a relationship between mean length of stay as derived from band reading data, and the probability of an individual bird staying one more day, was used to determine turnover rates of brant migrating through the Strait of Georgia. The probability of a bird staying one more day was calculated by using the mathematically derived formula p=L/L+1, where L=the mean length of stay. The difference between the count on day d and on day d+i was multiplied by the probability of a bird remainin another day, to calculate the possible number of new birds arriving since day d. The total number of birds seen during the study was then obtained by adding each calculated number of new birds arriving.

Activity budgets were recorded in the Parksville-Qualicum area using scan sampling techniques. Faecal analysis was accomplished by collecting samples from three major staging sites through the duration of their use by brant. Portions from pooled samples were examined under a dissecting microscope, the contents identified and the relative proportions determined.

Results and Discussion

Progress was made on all objectives in 1990. Brant were first observed on the third aerial survey (14 March), with peak numbers being recorded 17 April (Table 1). A peak of 8,295 birds was seen, well below the peak of 25,000 recorded earlier (Blood and Smith 1988). Between 27 February and 25 May 1,038 band readings of 305 different bands were record. Most were yellow bands (301) from the Yukon-Kuskokwim delta, Alaska, with others from Wrangel Island, USSR, (3) and Victoria Island, NWT (1). In addition 25 records of 5 different forms of nasal disk markers were seen from birds banded at Teshekpuk Lake, nothern Alaska. The mean length of stay was calculated to be 6.9 days, with a range of from 1 to 49 days.

Several calculations can be used to determine what the total population of brant passing through the Strait of Georgia might be, based on turnover rates. The frequency distribution of lengths of stay of banded brant are shown in Figure 1. A conservative estimate of the number of birds passing through

the Duncan area was obtained by using the mean length of stay of banded birds, which resulted in an estimate of 19,588. However, using the geometric mean for the average length of stay (2.9 days) resulted in an estimate of 28,276 birds. Using the median length of stay (1 day) resulted in an estimate of 70,273, a number which begins, biologically, to be much closer to what would be expected if the Strait of Georia did in fact host a large part of the brant popualtion in spring. Expanding this calculation to the whole Strait, assuming no interchange of banded birds between one location and any other between surveys, results in an esimate of 84,971 for the Strait of Georgia.

Table 1. Total numbers of brant seen in the Strait of Georgia during aerial surveys, spring 1990.

Date	Survey Day	Total	Estimated Old Population	Estimated New Population
14/3/90	1	564	0	-
24/3/90	10	1482	128	1354
27/3/90	13	2960	949	2011
03/4/90	20	4255	1047	3208
10/4/90	27	7218	1505	5713
17/4/90	34	8295	2553	5742
24/4/90	41	8020	2933	5087
01/5/90	48	2566	2836	-
			Etimated Total	26,679

Snow Goose Population Studies

Introduction

Basic population information for snow geese nesting on Wrangel Island is fragmented. Data have been collected on Wrangel Island by Soviet biologists for approximately 20 years (see Bousfield and Syroechkovskiy 1988). These data have included estimates of the number of spring arriving geese, accurate calculations of nesting effort and nest success, and estimates of the number of young leaving the island (V. Baraniuk, pers. comm.). Until 1990, total counts of geese on the island have not been possible, for various bureaucratic and logistic reasons.

Data on the northern wintering grounds have been collected more or less systematically since 1973 (draft management plan, Pacific Flyway Study Committee). These have included total population counts and estimates of the proportion of juveniles in the flocks. Data on the California wintering component of the flock have not been collected. Geese going to California mix with birds coming from the western Canadian arctic and cannot be studied or monitored separately.

The purpose of the study reported here was to determine the size of the population on Wrangel Island using airphoto techniques, and to continue the collection of data on the northern wintering grounds. The pricipal objectives were: (1) to assist Soviet biologists in conducting and analyzing a photo inventory of snow geese nesting on Wrangel Island; (2) to conduct photo inventories of geese wintering on the northern wintering area; and (3) to read neck collars of geese banded on Wrangel Island and the Fraser River delta on the Fraser River wintering area.

Methods

Air photographs of geese on Wrangel Island were obtained in 1990 by V. Baraniuk, using a hand held 35mm camera, from a helicopter. The survey coincided with the period when almost all birds were on the molting area on the north side of the island. The camera was supplied by the Canadian Wildlife Service, the helicopter by the Russian management agency Glavanota, and the film and processing were supplied by CWS through the AGJV. The data collected

were analyzed in Vancouver by Baraniuk in November, while he was visiting Canada under the auspices of the Canada/USSR agreement to exchange information on northern science. Film and processing were supplied by the Arctic Goose Joint Venture.

Population counts of geese wintering in the Fraser River/Skagit River deltas were made by similar photographic techniques. Film, processing and some of the aircharter time in the Fraser River area were provided by the AGJV. Aircharter time for surveys in both the Fraser River and Skagit River was provided by the Washington Dept. of Wildlife..

Results and Discussion

Progress has been made on all three of the original goals of this project. Data on the size of the population of snow geese wintering in Fraser/Skagit area is still being collected. However, peak populations generally occur in mid to late November, so counts to date are probably indicative of the northern wintering population for this year. In November an average of three counts showed 33,500 birds present.

The estimated total population on Wrangel is about 60,000 birds, the lowest count since 1978 (Table 2). Although the number of successful nests was high, the proportion of young in the winter flock indicates that survival to fall flight was low. Poor weather and above average predation by foxes has been cited (V. Baraniuk, pers. comm.) as the reasons for such poor recruitment. Comparing the number of birds on the wintering area with this population estimate infers that about 56% of the Wrangel Island nesting birds winter in the north and 44% in California. That is nearly a reversal of the proportions thought have existed for the two flocks about 10 years ago (see older versions of the Pacific Flyway management plan for Wrangel Island snow geese).

Collar reading is also still in progress, so little new information can be reported at this time. However, the number of brown collars seen (placed on geese wintering on the Fraser River delta in 1986 and 1987) is very low, in keeping with high loses suspected earlier (McKelvey et al. 1989).

Table 2. Recent trends in the population [illegible] nesting on Wrangel Island, USSR.

year	estimated spring population (x 1000)	number of nests	% successful nests	% juveniles in winter	northern wintering population
1978	65.4	21	78	40	16075
1979	84.5	30	90	36.4	26891
1980	90.7	10	70	11	39700
1981	89.0	39	95	49.5	40500
1982	100	14	65	17	43090
1983	95	1.7	6	-	44626
1984	90	25	73	16.3	31600
1985	90	27	81.5	32	40200
1986	100	29	90	29	46238
1987	100	23.5	80	43	39640
1988	90	7.5	7.5	7.8	55350
1989	80	30	60	0	43760
1990	60[1]	26.5	49.2	13	33500

1. First photo inventory of complete population.

Snow Goose Harvest

Introduction

Harvest of migratory birds in Canada is measured annually by the National Harvest Survey and Species Composition Survey. In British Columbia, snow geese are only hunted in the Fraser River delta area, and by a relatively small number of hunters. The National Harvest Survey does not have the resolution to measure the harvest of snow geese in such a relatively small area, with much accuracy. Because there few prescriptions available to managers of this goose flock, except regulation of harvest, it is important to have good harvest information. Such data will also meet the requirements of the Pacific Flyway management plan for this population, and for any management agreements being developed in cooperation with the Soviet Union. The study reported on here was designed to acquire harvest information over a two year period, with a view to developing a long term operational survey. Another objective was to make bhg checks of hunter killed birds, while at the same time taking a preliminary estimate of harvest to compare with the results of the questionnaire.

Methods

Harvest information data are being collected by mail questionnaire in the Greater Vancouver area of British Columbia. Because of the large human population in the lower Fraser Valley, the province of British Columbia requires every person hunting there to acquire a Fraser Valley Special Area Permit. The main purpose of that permit is verify that each person hunting in the Fraser valley has some form of personal liability insurance. Purchase of the permit has created a sampling universe of about 4300 hunters. On purchase, the hunter is asked if he hunted snow geese in the preceding year. Permit sales in 1989 indicated that 760 hunters reported hunting snow geese the previous year. Those that so indicated were chosen as the sample for the 1990 survey.

Results and Discussion

Progress has been made on some of the original objectives of this study.

The questionnaire has been designed and mailed out. Data are being analyzed as they are received but to date there is nothing to report. However, the snow goose population was much reduced in 1990 in the Fraser River delta area, as a result of poor nesting success on Wrangel Island, and harvest appears to have been reduced as a result. In addition, the area in which snow goose hunting is allowed was zoned as steel shot only in 1990, which may have resulted in fewer hunters pursuing snow geese. Virtually no progress could be made on checking hunter bags for geese, as a result of the poor harvest.

Peak counts of snow geese wintering in the Fraser River delta area, harvest as estimated by the National harvest Survey and more precise estimates from past local harvest surveys are shown in Table 3. From the results of the rather small sample of local harvest questionnaires, it appears the National Harvest Survey over estimates the kill.

Table 3. Recent snow goose populations and harvest on the Fraser River delta.

year	peak count	National Harvest Survey estimate	local harvest survey estimate
1978	-	600	
1979	-	1800	
1980	-	1600	
1981	-	3300	
1982	22779	2800	1590
1983	23268	nd	802
1984	-	2500	
1985	-	3900	
1986	24072	2500	
1987	37173	2000	
1988	26920	2500	
1989	22940	1200	
1990			

Snow Goose Habitat Use Study

Introduction

Between 1980 and 1989 the estimated total population of snow geese nesting on Wrangel Island has remained relatively stable, while the peak number seen on the Fraser River delta has increased nearly 10-fold in that time. It appears the increase in the Fraser River delta area is a result of higher survival of northern wintering birds. If a higher rate of survival is maintained and the total population grows to the management plan objective of 120,000, considerably higher numbers might be expected in Fraser delta area eventually.

In 1981 snow geese began extensive fall and winter use of upland fields on the Alaksen National Wildlife Area, a phenomenon until then seen only in the spring. If such upland use was a result of the large population on the Fraser delta that winter, even more use of uplands can be expected as the population grows. The purpose of this project is to assess the impact of snow goose use of uplands on the Alaksen National Wildlife Area, with a view to modifying management of the National Wildlife Area to accommodate more geese.

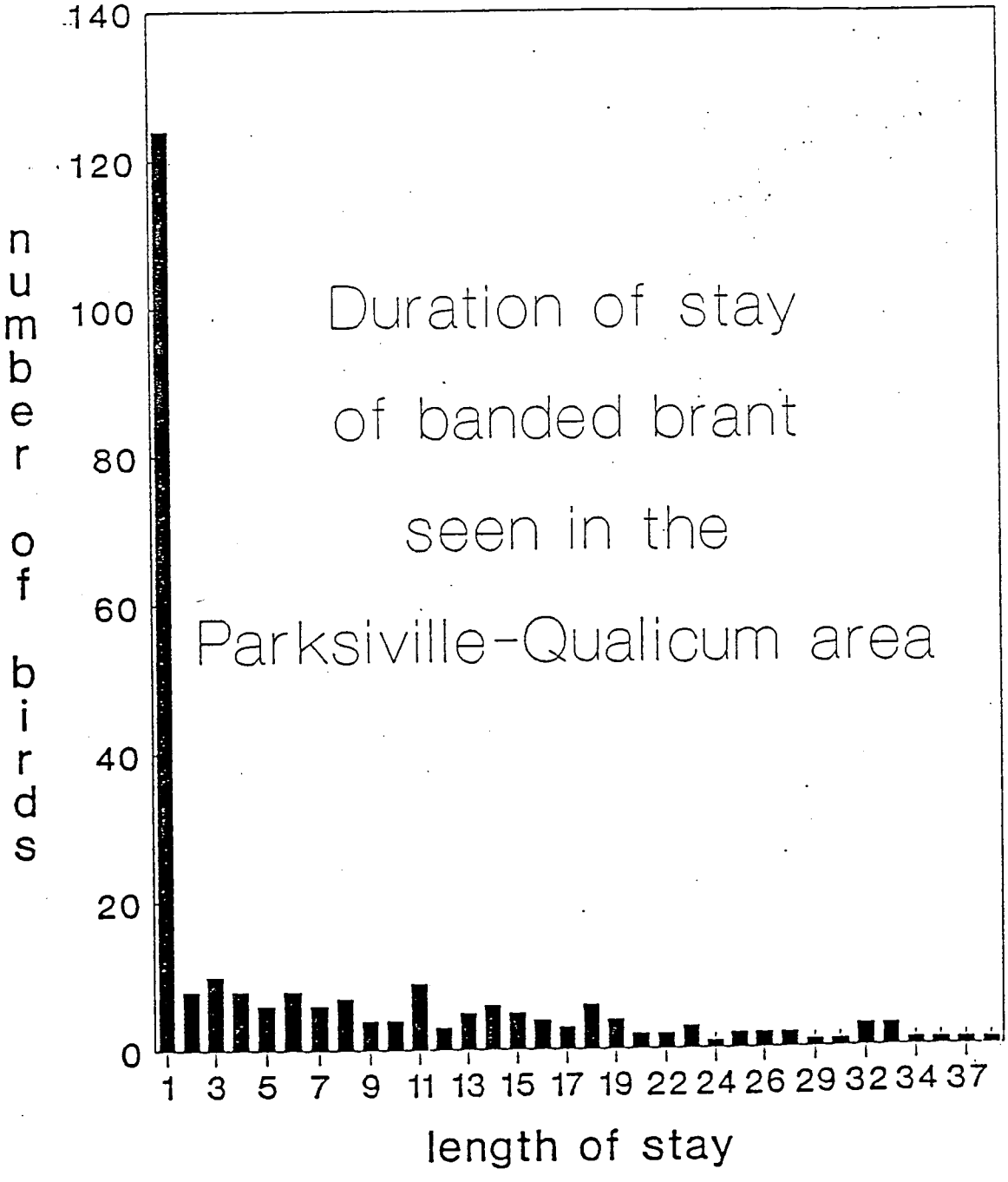
Methods

Biomass of pasture grass and winter cover crops potentially available to wintering snow geese was measured on the Alaksen National Wildlife Area using exclosures. Rates of use of the Wildlife Area fields were assessed by regular counts of geese present, using air photographs.

Results and Discussion

Some progress has been made towards reaching the goals of this study, but the anticipated use of the fields by snow geese has not materialized. Exclosures were set out on all fields potentially available to geese, and biomass collections made prior to the arrival of snow geese onto the Fraser River delta. These are being processed now but as yet no estimates are available. Use of the fields by snow geese has been recorded using air photographs.

Although it appears unlikely much information pertinent to snow goose management will result from this study this year, field use should be anticipated for at least one more winter. If the goose population enjoys good production next year, it is probable that field use will result. As well, the management of the Wildlife Area fields may be modified in an attempt to attract the geese again. Field use is inevitable when the population begins to recover.


Duration of stay
of banded brant
seen in the
Parksiville-Qualicum area
number of birds
0
20
40
60
80
100
120
140
1 3 5 7 9 11 13 15 17 19 22 24 26 29 32 34 37
length of stay

COORDINATING OFFICE UPDATE

January 28, 1991

The Canadian Wildlife Service, Western and Northern Region, established an Arctic Goose Joint Venture Coordinating Office at the Prairie and Northern Wildlife Centre in Saskatoon. This office is directed by A. Diamond, a member of the Arctic Goose Joint Venture Technical Committee, plus there are five permanent federal employees located in Saskatoon who are directly involved in Joint Venture activities.

The primary functions of the Coordinating Office are to:

1. Facilitate the conception, planning, discussion and review of Arctic Goose Joint Venture projects.

2. Provide for storage, analysis, retrieval and interpretation of data collected by Arctic Goose Joint Venture projects, and

3. Facilitate the generation of interim and final reports on Arctic Goose Joint Venture activities.

The budget of the Coordinating Office is $32K. These monies are required for related travel, publication of reports and for office support. To date, electronic data processing equipment have been acquired and are being utilized to analyze information collected during the 1990 field season.

Revisions have been made to the Arctic Goose Joint Venture Prospectives and a published document will emerge by March 31. Much of the development of the Prospectus and the cost of producing it will be borne by the Coordinating Office.

An Arctic Goose Joint Venture Contact List, or directory bearing the mailing address, telephone and fax numbers of persons associated with the Arctic Goose Joint Venture has been prepared by the Coordinating Office. A draft is presented for your review, and possible input. Although directories are

constantly changing and are out-of-date as soon as produced, an updated version of the present effort will be distributed by the Coordinating Office by March 31. This directory will facilitate exchange between Americans and Canadians associated with the Arctic Goose Joint Venture.

A compendium of approved Arctic Goose Joint Venture projects was developed last autumn. In addition, a document summarizing the results of Arctic Goose Joint Venture 1990 field projects conducted last summer has been compiled plus it is distributed for your information. Additionally, a document contains projects outlined for future activities that the Arctic Goose Joint Venture might consider. These proposals have been received from a variety of sources.

The Coordinating Office organizes annual meetings held to plan future Arctic Goose research. Results from ongoing investigations are accessed and modifications are made to study designs. An Arctic Goose Joint Venture project review and planning session was held in Saskatoon on November 1 and 2, 1990.

In addition to facilitating, planning and discussing research projects associated with the Arctic Goose Joint Venture, the Coordinating Office fulfills an information outlet role. The Coordinating Office provides information on Arctic Goose Joint Venture projects to national, local and regional information outlets.