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WILDLIFE INVENTORY PLAN
BECHAROF NATIONAL WILDLIFE REFUGE
King Salmon, Alaska

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I. REFUGE OBJECTIVES STATEMENT

Although this recent addition to the National Wildlife Refuge System has no objectives, one can apply the purposes for which the refuge was established. These purposes are outlined in the following excerpt from the refuge's establishing act, the Alaska National Interest Lands Conservation Act of December 2, 1980:

The purposes for which the Becharof National Wildlife Refuge is established and shall be managed include --

(i) to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, brown bears, salmon, migratory birds, the Alaskan Peninsula caribou herd and marine birds and mammals;

(ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

(iii) to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents; and

(iv) to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the refuge.

II. INTRODUCTION

Becharof NWR is 1.2 million acres in size and is readily accessible only by aircraft from King Salmon. Due to prevailing inclement weather, much of the refuge is usually inaccessible even by air, i.e. the Shelikof Strait Coast and many mountain streams. A present staff of three also hinders data gathering and inventory procedures.

This lack of optimum inventory conditions and staff requires the refuge to currently utilize substantial data gathered by the Alaska Department of Fish and Game (ADF&G) in King Salmon, i.e. composition surveys of caribou. Future refuge data gathering will be geared to supplement rather than duplicate data gathered by ADF&G.

Paramount in all surveys will be the safety of the observer and pilot. Surveys will be aborted or postponed whenever weather conditions are marginal. Observers on ground surveys will be armed with a shotgun or high powered rifle wherever in areas of substantial bear use.

III. FACILITIES AND EQUIPMENT

Proper tie-down or hanger facilities for wheel-equipped aircraft and proper docking facilities for float equipped aircraft are required. For winter use, tie-down facilities should include an electrical supply of sufficient power to operate engine heaters.

One furnished cabin and a float plane docking area on Becharof Lake are necessary facilities to accomplish Inventory Procedure 1, Brown Bear Populations, and Composition. The existing ADF&G cabin, under permitted use to the refuge, fulfills this need.

Equipment needs for conducting all Inventory Procedures include: one PA-18 Supercub equipped with wheel/skiis during winter and floats during summer; survival gear including snowshoes and adequate sleeping bags during winter use; appropriate maps; one pair of binoculars; one hand-held tape recorder; appropriate field data forms; pencils; one 35 mm camera with a 50 to 200 mm zoom lens, film and sunglasses.

Refuge: Becharof NWR

Procedure No: 1

Species: Brown Bear

Title: Brown Bear Populations and Composition

I. PURPOSE

The purpose of this inventory is to fulfill the purposes for which the refuge was established. As outlined in the Alaska National Interest Lands Conservation Act (ANILCA), the purposes for establishment of Becharof NWR include: "... to conserve fish and wildlife populations and their habitats in their natural diversity including, but not limited to, brown bear...". In order to carry out this mandate, the U.S. Fish and Wildlife Service must inventory brown bear populations to monitor species status and to collect information for making management decisions. Brown bears are avidly sought by hunters and wildlife photographers, and viewing bears is an experience valued by virtually all refuge visitors. This species is the major predator and one of the key life forms on the refuge. It is, therefore, imperative that the refuge have the best information available on the status and population dynamics of this species.

II. PROCEDURE

General: Aerial brown bear surveys are conducted over two major rivers and thirty-five major streams. Weather permitting, surveys will commence mid-July and run through August until mid-September. During this period

bears are concentrated on streams, feeding on salmon which returned to the refuge to spawn. The objectives of the survey are to determine periods and areas of peak use and population parameters including distribution, composition and size. The data obtained will provide information for use in the development of a brown bear management plan for the refuge and will assist in future management decisions affecting the species. The survey area, consisting of four units, will be flown to determine beginning, peak and end of use. During the peak use period the survey area will be flown to determine population composition and size. Each watershed will be surveyed as a whole before moving to the next. This will decrease the number of "double tabulations". Observed bears will be classified as sows with cubs, sows with yearlings, or individual bears of small, medium, or large size. Data is then recorded on a tape recorder or Field Data Form (FDF, Exhibit 2). Other information to be recorded includes: date, observer, weather, stream, start and finish time, and salmon run composition and size. Tape recorded data will be transferred to a FDF as soon as practical.

Number of Personnel: One pilot and one observer.

Qualifications of Personnel: Pilot must be OAS qualified, and observer must be familiar with judging brown bear sizes from aircraft and with aerial surveying techniques.

Dates of Inventory: Mid-July to mid-August - weekly for four weeks;

Mid-August to end of month - daily for two weeks;

First of September to mid-month - weekly for two weeks;

Time of Day: 0600 - 0900 preferred. If early morning weather conditions are not favorable, then a 1800 - 2100 survey flight may be acceptable. Mid-day surveys are not acceptable unless no other time periods can be flown.

Weather Conditions: Optimal conditions include, clear to partly cloudy skies, no precipitation and calm winds. Minimal conditions must not be less than 1,000 foot ceiling above ground level (AGL), no less than ten mile visibility with light precipitation, and no more than 20 to 25 knot winds. If sustained moderate to severe turbulence is encountered, the survey will be suspended.

Survey Units:

NORTH REFUGE UNIT		
<u>Creek</u>	<u>Length in Miles</u>	<u>Time Required</u>
Big	30	
Gertrude	15	
"B"	12	
<hr/>		
Totals 3	57	1.1 hrs. & headquarters or field camp ferry time = 2.0 hrs.
<hr/>		
<hr/>		

ISLAND ARM UNIT

<u>Creek¹</u>	<u>Length in Miles</u>	<u>Time Required</u>
Featherly	5	
Burlis	5	
Frank's	4	
Ruth River	2	
Otter	5	
Salmon	7	
Bear	10	
Cleo	4	
Becharof	8	
Severson	5	

Totals 10

55

1.5 hrs. & headquarters
 ferry time = 3.2 hrs. or
 1.5 hrs. & field camp ferry
 time = 1.6 hrs.

¹Creek = Creek except where noted

KEJULIK RIVER UNIT

<u>Creek¹</u>	<u>Length in Miles</u>	<u>Time Required</u>
Kejulik River (mainstem)	30	
Kejulik "A"	3	
Kejulik "B"	3	
Kejulik "C"	5	
Kejulik "E"	2	
Kejulik "D"	7	
East Fork	5	
Albert	3	
Margaret	15	
Katrine	7	
<hr/>		
Totals 10	80	1.7 hrs & headquarters ferry time = 3.3 hrs. or 1.7 hrs. & field camp ferry time = 2.0 hrs.
<hr/>		
¹ Creek = Creek except where noted		
<hr/>		

SHELIKOF STRAIT UNIT

<u>Creek</u> ¹	<u>Length in Miles</u>	<u>Time Required</u>
Kanatak	4	
Jute	2	
Rex	4	
Oil	3	
Katie	1	
Trail	1	
Dry	2	
Teresa	2	
Portage	4	
Helen	3	
Alinichak Lower Bay	2	
Alinichak Middle Bay	1	
Alinichak Upper Bay	2	
Alinichak "Y"	4	
<hr/>		
Totals 14	35	1.3 hrs. & headquarters ferry time = 3.3 hrs. or 1.3 hrs. & field camp ferry time = 1.9 hrs.
<hr/>		
¹ Creek = Creek except where noted.		
<hr/>		

Census Route: Refer to Exhibit 1.

Method of Transportation: Piper Super cub or comparable aircraft will be flown at 75 to 80 knots indicated air speed and 100 to 600 feet AGL depending upon terrain and weather conditions. In flight patterns

will be flown in a manner which permits observer optimum visibility of wildlife being inventoried. Where terrain and/or wind conditions dictate, surveys will be flown down stream.

Census Aids: Binoculars, hand-held tape recorded, 35mm camera with a 50 to 200 mm or comparable zoom lens, film, and sunglasses could at times be beneficial.

Equipment and Supplies: Complete survival gear for aircraft - life jackets if on floats, shoulder harnesses, aircraft intercom, flight helmets, Nomex flight suits and gloves, appropriate maps and forms, and pencils are required.

Photography: Shoot photographs at shutter speeds no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Field Data Form (FDF): Refer to Exhibit 2.

- 1) Fill in Date, Observer, Weather conditions and Unit name.
- 2) Record Stream and Start and Finish Time.
- 3) Record each bear or group of bears under the appropriate column, i.e. a sow with two cubs should be recorded as a 1 in the S/2C column.
- 4) Fill in Totals for each stream.
- 5) Check (✓) Salmon Run for each stream, i.e. fish Absent, Present, Abundant or Spawned Out; and record Species if known.
- 6) Note any pertinent Remarks, e.g. other bears seen between Units, and/or other wildlife observations.
- 7) Fill in Totals for Unit.

Summary Data Form (SDS): Refer to Exhibit 3.

- 1) Record Year.
- 2) Record Start/Finish Dates for each Survey.
- 3) Using the four completed FDF's for a Survey (one for each Unit), add Unit Totals and record the sums in the appropriate SDF columns. Include the total number of sows and cubs or yearlings for each sow category. For example a sow with two yearlings would be recorded as 1/2 under the S/2Y column.

Sampling Requirements: To maintain consistency, thus reliability, the units should be flown in order during each survey. A minimum of two complete surveys shall be flown for the survey area during the initial stage of the Inventory Procedure to determine peak use period and general use activity. During the peak use period, the survey area must be surveyed a minimum of twice to calculate composition and estimated refuge population.

Statistical Analysis: To determine both composition and size of the population, composition is first computed by determining the survey area population. The survey area population is then expanded to the estimated refuge population. It has been determined that because of cubs' relatively smaller size and thus lower observability, that approximately ten percent of the observed sows with cubs are mis-classified. In other words, a sow with three cubs is observed and recorded as a sow with two cubs, a sow with two cubs is observed and recorded as a sow with one cub, and a sow with one cub is observed and recorded as a single bear of small or medium size. In addition, sows with cubs, because of their seclusive nature, are twenty percent less observable than other categories of bears.

An intense study conducted by the Alaska Department of Fish and Game on the Alaska Peninsula using techniques comparable to these (Erickson and Simiff 1963), revealed that only 47% of an area's actual bear population is observed from aerial surveys. Based on this local study and our previously discussed assumptions, it is estimated that 40 percent of the sows with cubs are observed while the other classes of bears are observed at a rate of 60 percent.

To adjust the observed survey data compensating for the aforementioned, an algebraic expression has been formulated which determines the estimated population of the survey area (T_s).

$$T_s = (S/C)_s + (S/2C)_s + (S/3C)_s + C_s + (S/Y)_s + Y_s + I_s + I_m + I_l$$

Where: $(S/C)_s$ = Estimated number of sows with one cub

$$= 2.5(S/C)_o$$

where $(S/C)_o$ = number of sows observed with one cub

$(S/2C)_s$ = Estimated number of sows with two cubs

$$= 2.5[(S/2C)_o + 0.1(S/C)_o - 0.1(S/2C)_o]$$

where $(S/2C)_o$ = number of sows observed with two cubs

$(S/3C)_s$ = Estimated number of sows with three cubs

$$= 2.5[(S/3C)_o + 0.1(S/2C)_o]$$

where $(S/3C)_o$ = number of sows observed with three cubs

C_s = Estimated number of cubs

$$= (S/C)_s + 2(S/2C)_s + 3(S/3C)_s$$

$(S/Y)_s$ = Estimated number of sows with yearlings

$$= 1.67(S/Y)_o$$

where $(S/Y)_o$ = number of sows observed with yearlings for the three sow/yearling categories

Y_s = Estimated number of yearlings

$$= 1.67(Y)_o$$

where Y_o = number of yearlings observed for the three sow/yearling categories

I_s = Estimated number of small individuals observed

$$= 1.67[I_o - 0.05(S/C)_o]$$

where I_o = number of small individuals observed

I_m = Estimated number of medium individuals observed

$$= 1.67[I_o - 0.05(S/C)_o]$$

where I_o = number of medium individuals observed

I_l = Estimated number of large individuals

$$= 1.67(I_o)$$

where I_o = number of large individuals observed

Based on quantity and quality of summer bear habitat and observations of bear movements and activities, it is estimated that the survey area population represents 80 percent of the total refuge population

$$(T_r). \quad T_r = 1.25(T_s)$$

Computation Data Form (CDF): Refer to Exhibit 4.

- 1) Record Year.
- 2) Using the two highest SDF survey counts, total and average each bear category. Record the averages of each category in the appropriate Observed Population of Survey Area column.
- 3) Calculate and record the Estimated Population of Survey Area for each (T_s) bear category using the following expressions:
 - A) Estimated number of sows with one cub = $2.5 \times$ (the number of sows observed with one cub).
 - B) Estimated number of sows with two cubs = $2.5 \times$ (the number of sows observed with two cubs) + 10% of the number of sows observed with one cub - 10% of the number of sows observed with two cubs).
 - C) Estimated number of sows with three cubs = $2.5 \times$ (the number of sows observed with three cubs + 10% of the number of sows observed with two cubs).
 - D) Estimated number of cubs for each sow category is figured by multiplying the number of sows by the appropriate number of cubs for each sow/cub category.
 - E) Estimated number of sows with yearlings for each sow category = $1.67 \times$ (the number of sows observed with yearlings for each sow/yearling category).
 - F) Estimated number of yearlings for each sow category is figured as cubs were calculated.
 - G) Estimated number of small individuals = $1.67 \times$ (the number of small individuals observed minus 5% of the number of sows observed with one cub).
 - H) Estimated number of medium individuals = $1.67 \times$ (the number of medium individuals observed minus 5% of the number of sows observed with one cub).
 - I) Estimated number of large individuals = $1.67 \times$ (the number of large individuals observed).
 - J) Total estimated population of the survey area = the sum of the bear categories.
- 4) Calculate and record the Estimated Population of Refuge (T_r).
 - A) Multiply each (T_s) bear category by 1.25 and record the product in the appropriate (T_r) bear category. Incorporate the Sub-Totals of: T_r sows with cubs, cubs, sows with yearlings, yearlings and small, medium and large individuals in their respective columns.

- B) Determine cub/yearling Litter Size by dividing the Sub-Total cubs/yearlings by the Sub-Total sows associated with the respective category.
 - C) Determine Total Estimated Population of the Refuge by multiplying the Total Estimated Population of the Survey Area x 1.25.
- 5) Figure the compositional percent of the Estimated Population of the Refuge (T_T) for the Sub-Totals of: sows with cubs, cubs, sows with yearlings, yearlings and individuals. Compositional percentages are determined by dividing each of the aforementioned (T_T) bear categories by the Total Estimated Refuge Population (T_T) then multiplying the resultants by 100.

Data Filing:

- 1) File original under "Wildlife, Bear Surveys"
- 2) Send copies of survey to:
 - A) Operations Manager - South, U.S.F.W.S., Regional Office, 1011 E. Tudor Rd., Anchorage, AK 99503-6119

III. SPECIAL CONSIDERATIONS

Because of bear movement, it is imperative that each unit be completely covered during flights within the peak use period. Incomplete unit coverage renders comparison with past surveys impossible.

IV. MANPOWER AND COSTS

Mandays:

Pilot (GS-12) at \$160 per day for 16 days	\$2560
Observer (GS-07) at \$90 per day for 16 days	<u>1440</u>
Sub-Total	\$4000

Transportation: PA-18 Supercub

Availability at \$20 per day for 20 days	\$400
Rate at \$45 per hour for 40 hours	<u>1800</u>
Sub-Total	\$2200

Supplies and Materials:

Aviation fuel at \$2 per gallon and 7.5 gallons per hour for 40 hours	\$600
Field food and Supplies	500
Aircraft Charter to haul fuel and field supplies	<u>1000</u>
Field Per diem	240
Miscellaneous	<u>100</u>
Sub-Totals	\$2440

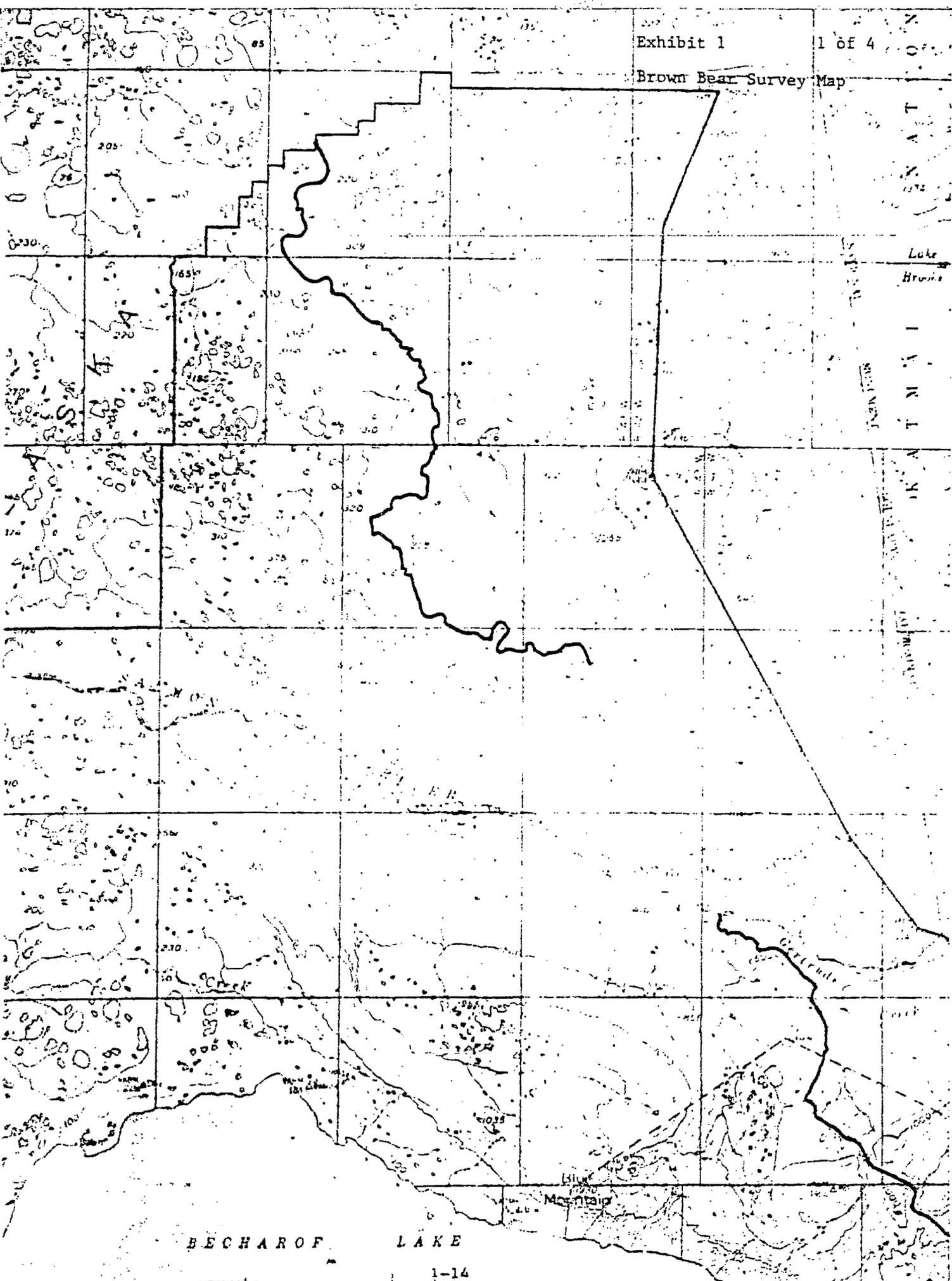
Total estimated costs \$8640

Prepared by: C. Randall Arment date: 06/09/83

Reviewed by: John J. Taylor date: 06/09/83

Approved by: Ralph C. Covert date: 4/11/84

Brown Bear Survey Map



BECHAROF LAKE

**BROWN BEAR
COMPUTATION DATA FORM
YEAR _____**

COMPUTATION	SOWS WITH CUBS						SOWS WITH YEARLINGS						INDIVIDUALS				TOTAL
	S	S	S	SUB-TOTAL		LITTER	S	S	S	SUB-TOTAL		LITTER	SMALL	MEDIUM	LARGE	SUB-TOTAL	
	1C	2C	3C	SOWS	CUBS	SIZE	1Y	2Y	3Y	SOWS	YRLS	SIZE					
DESIGNATED POPULATION OF SURVEY AREA	/						/										
ESTIMATED POPULATION OF SURVEY AREA (T _S)																	
ESTIMATED POPULATION OF REFUGE (T _R)																	
COMPOSITIONAL PERCENT																100	

Refuge: Becharof

Procedure No.: 2

Species: Caribou

Title: Caribou Wintering Population

I. PURPOSE

The purpose of this inventory is to fulfill the purposes for which the refuge was established. The Alaska National Interest Lands Conservation Act (ANILCA) identifies one of the purposes as: "... to conserve fish and wildlife populations and their habitats in their natural diversity including, but not limited to ... Alaska Peninsula caribou herd...." In order to carry out the mandates of ANILCA, the U.S. Fish and Wildlife Service must inventory the caribou populations, monitor their habitat against loss and degradation, and collect information for making management decisions related to sport hunting, subsistence and public use.

II. PROCEDURE

General: Aerial surveys will be conducted over the northern half of the refuge throughout fall and winter as the caribou have historically wintered in this general area. Censusing the area requires conducting as intense inventory procedure, however, this is currently precluded by funding levels. Therefore, a general transect type procedure will be used. All animals within $\frac{1}{2}$ mile of either side of the flight route will be tallied.

Number of Personnel: One pilot and observer.

Qualifications of Personnel: Pilot must be OAS qualified and observer must be familiar with caribou sexing and classification from fixed-winged aircraft.

Dates of Inventory: August through March - monthly,

Times of Day: 09:00 to 15:00

Weather Conditions: Optimal conditions include clear to partly cloudy skies, no precipitation, calm winds and good snow cover. Minimal conditions must not be less than 1,000 foot ceiling AGL, no less than ten miles visibility with light precipitation, no more than 20 to 25 knot winds and moderate snow cover. If sustained moderate to severe turbulence is encountered, survey will be suspended.

Survey Units: North Refuge Unit. Refer to Exhibit 1.

Census Route: The flight route which will be used to survey the North Refuge Unit is included in Exhibit 1.

Method of Transportation: Piper Supercub or comparable aircraft will be flown at 75 to 80 knots indicated and 300 to 700 feet AGL depending upon terrain and/or weather conditions. Flight patterns will be flown in a manner to permit observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, 35mm camera with 50 to 200mm or comparable zoom lens, film and sunglasses.

Equipment and Supplies: Complete survival gear for aircraft - shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves, appropriate maps and forms, and pencil.

Photography: Shoot photographs at shutter speeds no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Field Data Form (FDF): Refer to Exhibit 2.

- 1) Record: Date, Pilot/Observer and Weather.
- 2) Record location of observation via Segment Number.
- 3) Classify and record caribou observations in the appropriate columns for each Segment.
- 4) Add together the Bulls, Cows, Calves and Unknown and record the sum under Total.
- 5) Record any pertinent Remarks e.g. snow conditions.
- 6) Total each column and record the sum at the bottom of the page.

Summary Data Form (SDF): Refer to Exhibit 2.

Using the appropriate FDF.

- 1) Record: Month and Year.
- 2) Transfer survey totals into the appropriate columns.

Sampling Requirements: A minimum of one survey per month is required.

Statistical Analysis: The following formula will be used to estimate the North Refuge Unit wintering population using the SDF.

$$WP = \frac{TA * SP}{SA} = \frac{846 \text{ sq. mi.} * SP}{260 \text{ mi.}} = 3.25 (SP)$$

Where:

WP = Wintering population
 TA = Total area of the North Refuge Unit (846 sq. mi.).
 SP = Surveyed population
 SA = Surveyed Area (260 mi.)

Data Filing:

- 1) File original under "Wildlife, Caribou Surveys".
- 2) Send copies of survey to:
 - A) Operations Manager - South, USFWS, Regional Office, 1011 E. Tudor Road, Anchorage, AK 99503-6119.
 - B) Wildlife Biologist, ADF&G, PO Box 37, King Salmon, AK 99613.

III. SPECIAL CONSIDERATIONS

Annual caribou surveys are conducted by ADF&G. Thus this inventory procedure has been established to supplement, not duplicate, those flown by ADF&G.

IV. MANPOWER AND COSTS

Mandays:

GS-12 at \$160 per day for 6 days	= \$960
GS-7 at \$90 per day for 6 days	= <u>540</u>
Subtotal	= \$1500

Transportation: Piper Supercub

Availability at \$30 per day for 6 days	= \$180
Rate at \$50 per hour for 32 hours	= <u>1600</u>
Subtotal	= \$1780

Supplies and Materials:

Aviation fuel at \$2 per gallon and
14 gallons per hour for 32 hours = \$896

Miscellaneous = 40

Subtotal = \$936

Total estimated costs \$4216

Prepared by: C. Randall Arment Date: 09/28/83

Reviewed by: John J. Taylor Date: 09/28/83

Approved by: Joseph C. Wood Date: 4/11/84

$$WP = \frac{TA * SP}{SA} = \frac{846 \text{ sq. mi.} * SP}{260 \text{ mi.}} = 3.25 (SP)$$

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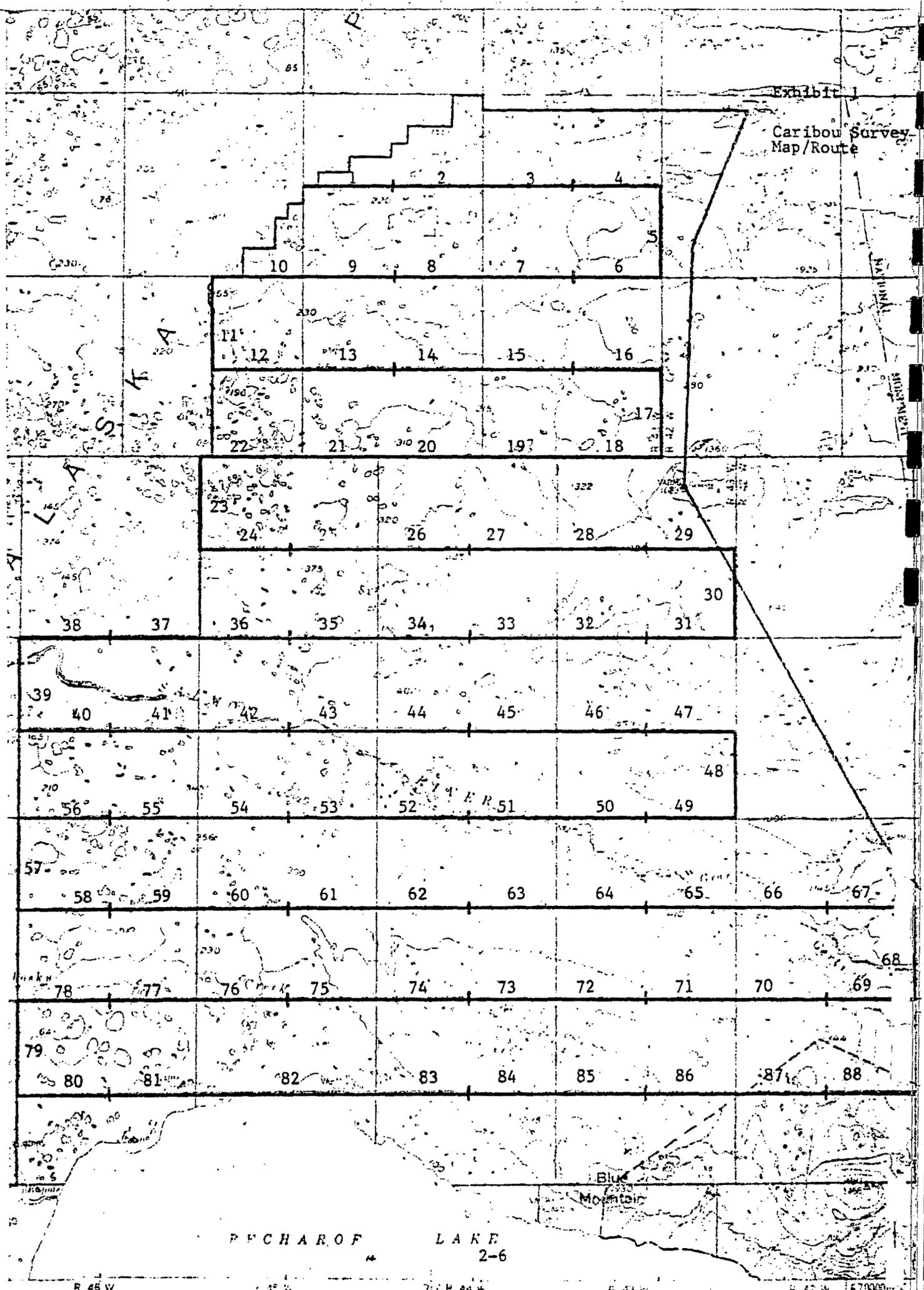
Total estimated costs \$4216

Prepared by: C. Randall Arment Date: 09/28/83

Reviewed by: John J. Taylor Date: 09/28/83

Approved by: George C. Smith Date: 4/11/84

Exhibit 1
Caribou Survey
Map/Route



LAKE
PECHAROF

PECHAROF LAKE
2-6

R 45 W R 46 W R 47 W R 48 W 670000

Refuge: Becharof

Procedure No.: 3

Species: Moose

Title: Moose Composition and Population Survey

I. PURPOSE

The purpose of this inventory is to fulfill the purposes for which the refuge was established. As outlined in the Alaska National Interest Lands Conservation Act (ANILCA), some of the purposes for establishment of Becharof NWR are: to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to... moose...including their restoration to historic levels...."In order to carry out the mandates of ANILCA, the U.S. Fish and Wildlife Service must inventory the species to determine population states and distribution, monitor the moose habitat against loss and degradation, and collect information for making management decisions related to sport hunting, subsistence and land use.

II. PROCEDURE

General: Currently aerial surveying is the only practical way to estimate moose numbers in most of North America (Rausch and Bratlie 1965, Rausch and Bishop 1968, Bishop 1969, Bergerud and Manuel 1969). Variation's of transect surveys have been used extensively in Alaska to obtain sex and age composition data. When year to year comparisons are made, these data provide useful insight into population trends (Gasaway, DuBais and Harbo 1981). Refuge surveys will be conducted along the major rivers and creeks during October/November and February/

March. The inventory procedure will serve to supplement those surveys conducted by Alaska Department of Fish and Game over other areas of the Alaska Peninsula. Search effort will average one pass per square mile. For the stream survey this will entail flying two passes parallel to and $\frac{1}{2}$ mile out from either side of the streams' centerlines. For the drainage survey this will entail flying transect segments having a width of 1 mile.

Number of Personnel: One pilot and observer.

Qualifications of Personnel: Pilot must be OAS qualified and observer must be familiar with moose identification in heavy vegetative cover via fixed-wing aircraft.

Dates of Inventory: October/November for sex and age composition and February/March for population estimations.

Times of Day: From 09:00 to 12:00 is preferred. However, depending upon weather and snow conditions, 12:00 to 15:00 may be better.

Weather Conditions: Optimal conditions include clear to partly cloudy skies, no precipitation, calm winds and 90 percent ground cover of fresh snow. Minimal conditions must not be less than 1,000 foot ceiling AGL, no less than ten miles visibility with light precipitation, no more than 20 to 25 knot winds, and no less 50 percent snow cover. If sustained moderate to severe turbulence is encountered, survey will be suspended.

Survey Units:

NORTH REFUGE UNIT

Survey Coverage

<u>Creek</u>	<u>Square Miles-Land</u>	<u>Linear Miles-Flight</u>
Big	60	60
Gertrude	30	30
"B"	24	24
<hr/>		
Totals 3	114	114

KEJULIK RIVER UNIT

Survey Coverage

<u>Quadrangle</u>	<u>Square Miles-Land</u>	<u>Linear Miles-Flight</u>
Karluk D-5	90	90
Karluk D-6	120	120
<hr/>		
Totals 2	210	210

Census Route: The flight route which will be used to survey the North Refuge Unit streams (Exhibit 1), consist of flying two passes parallel to and $\frac{1}{2}$ mile out from either side of the streams' centerlines. The route used to survey the Kejulik River Unit drainage (Exhibit 2), will consist of flying transect segments having a width of 1 mile. To accomplish this the pilot will refer to the appropriate quadrangle maps for navigation (Exhibit 3).

Method of Transportation: Piper Supercub or comparable aircraft will be flown at 75 to 80 knots indicated and 200-400 feet AGL depending upon terrain and/or weather conditions. Flight patterns will be flown in a manner to permit observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, 35mm camera with a 50 to 200mm or comparable zoom lens, film and sunglasses.

Equipment and Supplies: Complete survival gear for aircraft - shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves, appropriate maps and forms, and pencil.

Photography: Shoot photographs at shutter speed no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Field Data Form (FDF): Refer to exhibit 4.

- 1) Record: Unit, Pilot and Observer, Date, Weather and Snow Cover, Type of Plane, Start Time, Stop Time and Page Number. Snow cover will be classified according to three subjective

components: complete (good); some low vegetation showing (moderate); and distracting amounts of bare ground on herbaceous vegetation showing (poor).

- 2) Record observations of Bulls in the appropriate columns i.e., Large - Bulls, with antler spreads greater than 50 inches, Medium - bulls with antler spreads less than 50 inches, which are over two years old. Yearling - bull between one and two years old.
- 3) Record observations of Cows with Calves including Lone Calves in the appropriate columns.
- 4) Record observations of Unidentified individuals in the appropriate column.
- 5) Record the sum of the three bull moose categories for each observation in the Total Moose-Bulls column.
- 6) Record the sum of the cows, for the three Cow/Calf categories for each observations, in the Total Moose-Cows column.
- 7) Record the sum of the four calf categories for each observation in the Total Moose-Calves column.
- 8) Record the sum of the Unidentified, Total Moose-Bulls, Cows and Calves in the Total Moose-All column.
- 9) Record any pertinent Remarks.
- 10) Add all columns with figures and record Totals at Bottom of page.

Summary Data Form (SDF): Refer to Exhibit 5.

- 1) Record Month and Year of survey.
- 2) Using the FDF for each Unit, add together the Totals for each column and record the sums in the appropriate columns.
- 3) Record: Pilot/Observer, Aircraft and pertinent Remarks.

Sampling Requirements: At least one complete survey is needed each year for each time period. Snow cover should be complete and, if

possible, the snow should be fresh to permit better tracking. High overcast conditions are best as confusing shadows are eliminated and permits greater depth perception. Early morning tends to produce long shadows and/or dim lighting conditions while midday lighting conditions can produce too much glare.

Statistical Analysis: The October/November survey will be used to determine composition while both, especially the February/March survey, will be used to determine population trend. To determine population status versus trend requires an extremely intensive search effort which current funding precludes. The use of yearly population trend surveys should be valid, however several precautions must be exercised. Yearly differences in snow cover must be minimized, and effort must be made to eliminate differences in lighting conditions i.e. time of day, cloud cover and visibility.

Data Filing:

- 1) File original under "Wildlife, Moose Surveys".
- 2) Send copies of survey to:
 - A) Operations Manager - South, USFWS, Regional Office
1011 E. Tudor Rd., Anchorage, AK 99503-6119.
 - B) Wildlife Biologist, ADF&G, PO Box 37, King Salmon, AK
99613

III. SPECIAL CONSIDERATIONS

Surveys will be coordinated with ADF&G.

IV. MANPOWER AND COSTS

Mandays:

GS-12 at \$160 per day for 6 days = \$960
GS-7 at \$90 per day for 6 days = 540
Subtotal = \$1500

Transportation: Piper Supercub

Availability at \$20 per day for 6 days = \$120
Rate at \$45 per hour for 18 hours = 810
Subtotal = \$930

Supplies and Materials:

Aviation fuel at \$2 per gallons and
7.5 gallons per hour for 18 hours = \$270
Miscellaneous = 20
Subtotal = \$290

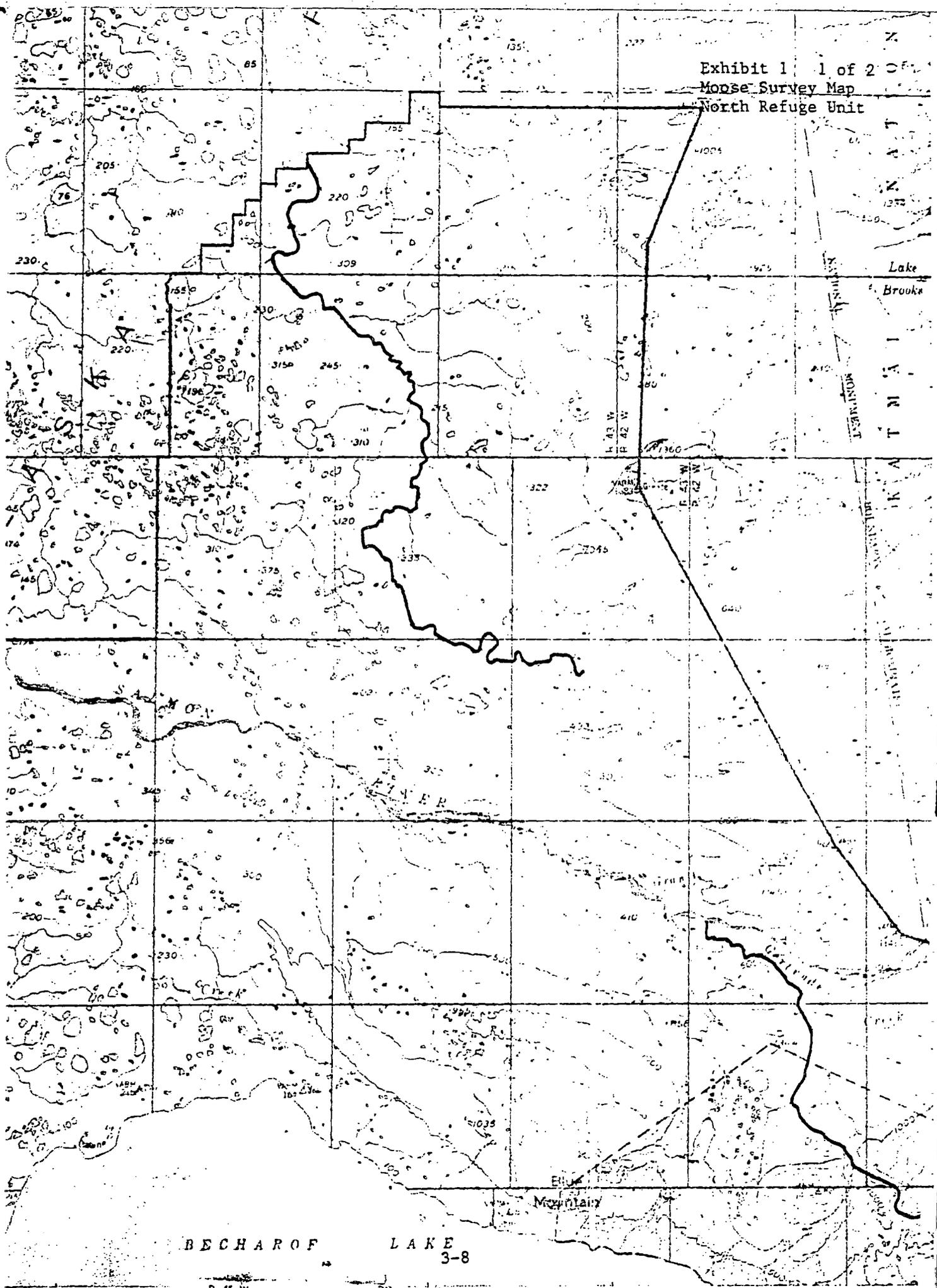
Total estimated costs = \$2220

Prepared by: C. Randall Arment Date: 09/28/83

Reviewed by: John J. Fyler Date: 09/28/83

Approved by: James L. Calvert Date: 4/11/84

Exhibit 1 1 of 2
Moose Survey Map
North Refuge Unit



BECHAROF LAKE
3-8

P. 45 W

R. 42 W

T. 16 N

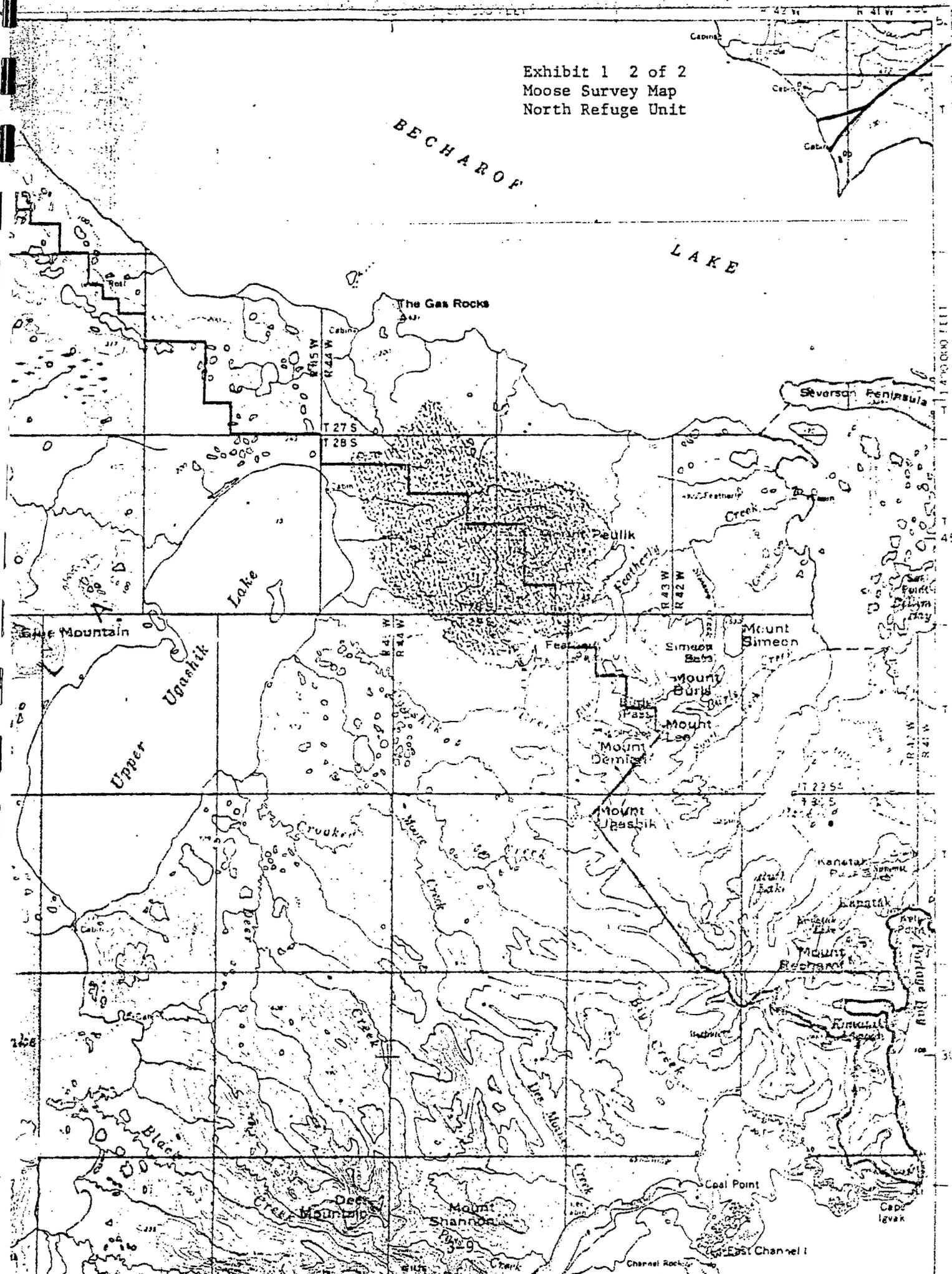
R. 43 W

T. 17 N

Exhibit 1 2 of 2
Moose Survey Map
North Refuge Unit

BECHAROF

LAKE



BRISTOL

ISLAND
1957

BRISTOL BAY
1953

NAKNEK(S)
1952

MT. KATMAI(S)
1951

LUGASHIK
1953

KARLUK(S)
1952

CHIGNIK
1963

SUTWIK ISLAND
1963

TRINITY ISLANDS(S)
1952

COLD BAY(S)
1954

FORT MOLLER
1928-50 RM

STEPOVAK BAY
1953

FALSE PASS(S)
1928-52 (PCY) RM

SIMEONOF ISLAND
1963

Exhibit 3
Moose Composition and
Population Maps
Required for Pilot Use

3-11

Refuge: Becharof

Procedure No.: 4

Species: Marine mammals

Title: Marine Mammals Survey

I. PURPOSE

Becharof National Wildlife Refuge was established to include the management of marine mammals (Title III, ANILCA). Additionally, the history of the Marine Mammal Protection Act, 1972 (especially in Alaska) make it advisable to monitor mammal populations in the marine environment (CFR, Title 50, Part 18).

Marine mammals are top level consumers in the ocean trophic level hierarchy, wholly dependent on the productivity of the trophic levels below them. The responses of marine mammals to short-term environmental changes is readily noticeable, particularly when conditions adversely affect the habitats of the coastal areas. Therefore, the health of marine mammals is one of the best, most visible environmental indicators for the ocean realm (Fay, et. al., 1979). Monitoring the status of these species along the refuge coast could provide indications of the functional state of the system in which they live.

II. PROCEDURE

Several methods are presently used to estimate marine mammal populations. For the scope of this survey plan, direct visual observations will be implemented.

Problems have been extensively discussed by Eberhardt et. al. (1979)

regarding survey techniques of sea mammals. Most relate to anomalies in observability (due to visibility and animal behavior), seasonal timing in annual and diel activity patterns, and environmental considerations like weather, cloud cover and changing tides that may inhibit maximum data collection. Smith (1973) found significant correlations between wind speed and percentage overcast with seal haul out patterns.

Some marine census techniques follow predetermined transect flight lines covering vast expanses of shorelines and pelagic zones. The refuge sea mammal survey will be limited to survey only those areas associated with the near Pacific coast, outlying islets, and pelagic zone between and "around" those areas.

Refuge funds are not presently earmarked for sea mammal surveys, therefore survey data will be gathered while conducting other wildlife surveys or refuge activities.

Islets off Cape Kekurnoi (between Paule and Alinchak Bays) will be thoroughly surveyed in addition to other land protuberances along the Becharof Coast and Shelikof Strait. Arneson (1980) stated the preferred aerial survey technique for seabirds included two observers and a pilot. Limited personnel will preclude this advantage when surveying sea mammals. Figure 1 identifies major fur sea mammal concentration areas along the Southern Alaska Peninsula coast.

Photography has become an important tool in direct counting (Eberhardt et. al. 1979) and should be implemented for sea mammal surveys as much as possible when groups of 25 or more are involved. When observing sea mammals during survey flights, several passes should be made, if

LEGEND

Sea Otter



High-use area

Medium-use area

Low-use area

Harbor Seal



Northern Sea Lion



1,000 to 9,999

100 to 999

10 to 99

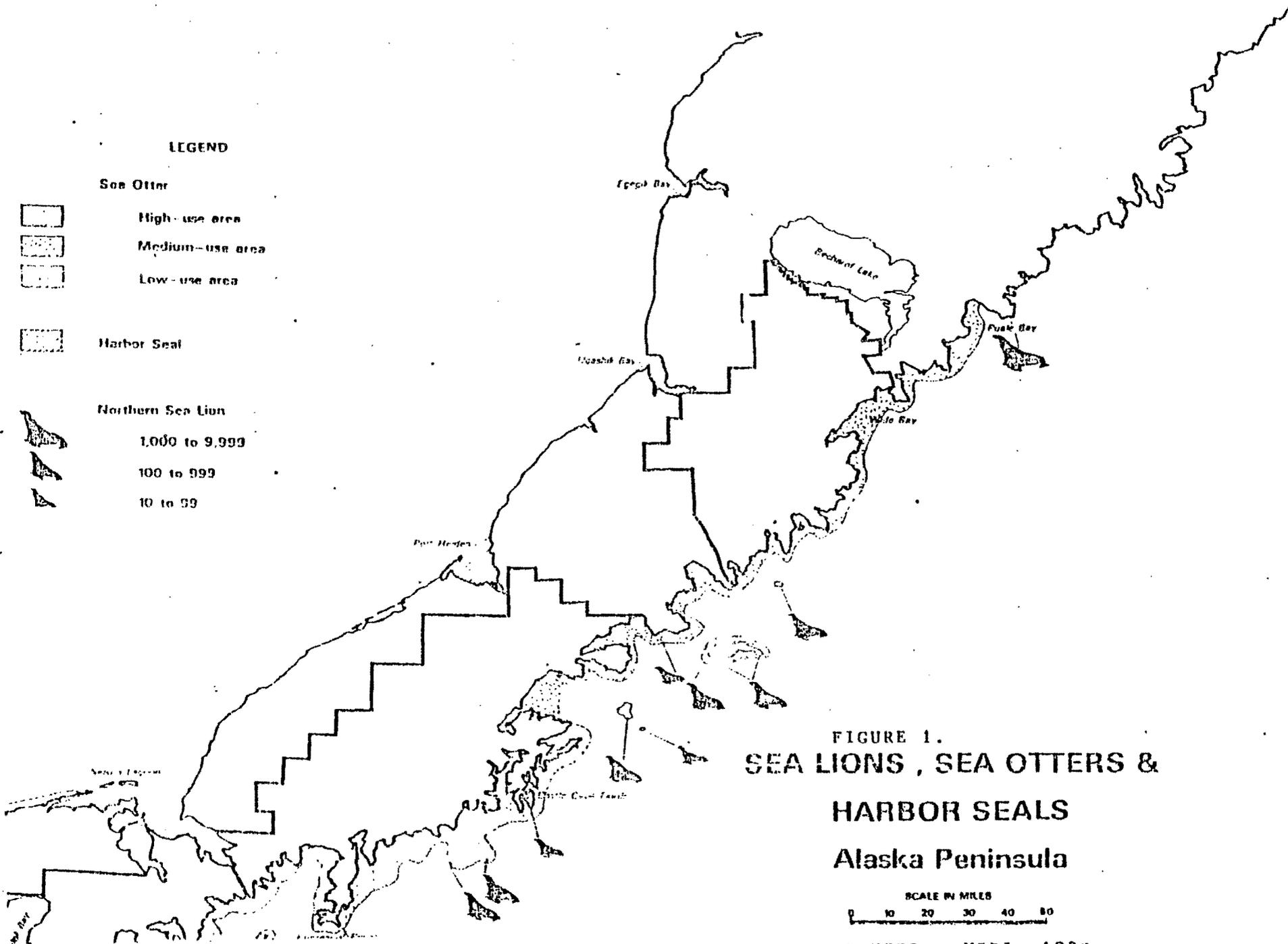


FIGURE 1.
SEA LIONS, SEA OTTERS &
HARBOR SEALS
Alaska Peninsula

SCALE IN MILES



source: USDI, 1980

necessary, to obtain accurate counts, identification, and adequate photographic documentation. Whale and porpoise species must be photographed and closely scrutinized for identification.

The survey route along the shoreline will follow the land contour and extend to outlying islets and seastacks. The flight path should be flown low along the shoreline within 100 m of the shore at about 110-130 km/hr. (68-81 mph).

The aircraft should be kept over water for safety purposes and far enough away from the shoreline so important viewing is not obscured from the primary observer by pontoons or wings during flight banking. Searches should NOT be conducted in rain or wind exceeding 25 km/hr. (15 mph) or if wind is gusty.

Photographs and visual estimates will be recorded directly on USGS 1:63360 topographic maps and numbered so observations can be later cross referenced to the MARINE MAMMAL SURVEY SUMMARY DATA FORM (Exhibit 1, BNWR "Pelagic Mammals" file W.I. 8.7.1). Ideally, occasional ground-truth counts and photos should be compared to (1) check reliability of aerial counts, and (2) to get a feeling for observer bias.

Marine mammal observations compiled from state and other federal agencies, and public sightings will be analyzed and filed when reported.

Beached carcasses should also be identified by species and recorded.

A comprehensive review of marine mammal census methods has been done by Eberhardt et. al. (1979).

When refuge funds and manpower are available specifically for marine mammal inventories, the BNR marine mammal inventory procedure will be modified for optimum data collection.

Number of Personnel: One pilot and one observer.

Qualifications of Personnel: Pilot must be OAS qualified, and observer must be familiar with techniques for aerial census of marine mammals, and proficient in photography.

Dates of Inventory: To be coordinated with other wildlife surveys or refuge activities along the Becharof NWR Pacific coast. If specific time is available for marine mammal surveys, refer to Table 1 for setting dates.

Time of Day: Daylight hours.

Weather Conditions: Optimal conditions - clear skies, no precipitation and calm winds. Survey activities should cease during precipitation or gusty winds or winds above 25 km/hr. (15 mph).

Survey Unit: Shelikof Strait side of Becharof NWR.

Census Route: Becharof NWR shoreline contour and outlying islets and seastacks.

TABLE 1. Species occurring along BNWR coast with "likely" occurrence times.
 (Source: Rearden, ed. 1981)

Species	Likely occurrence time along BNWR coast
Stellar Sea Lion (<u>Eumetopias jubatus</u>)	late May-June, winter
Harbor Seal (<u>Phoca vitulina</u>)	late May - mid-July
Sea Otter (<u>Enhydra lutris</u>)	April-June (pupping), at night, during storms
Dall Porpoise (<u>Phocoenoides dalli</u>)	spring, fall
Killer Whale (<u>Orcinus orca</u>)	year-round
Humpback Whale (<u>Magaptera novaeangliae</u>)	spring-fall
Minke Whale (<u>Balaenoptera acutorostrata</u>)	summer
Gray Whale (<u>Eschrichtius robustus</u>)	June-October

Method of Transportation: Piper Supercub or similar aircraft flown at 110-130 km/hr. (68-81 mph) and 100-200 feet AGL depending on terrain and weather conditions; flown in a manner which permits observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, portable tape-recorder (optional), 35mm camera w/70-210mm or comparable zoom lens, 50mm lens, 28mm zoom lens, film, two hand held tape recorders with voice activated microphones, tapes and sunglasses.

Photography: Photographs should be taken at shutter speeds no less than 1/250th second with appropriate aperture opening.

Summary Data Form: (Exhibit 1) Self-explanatory.

Disposition of Survey Data:

- 1) File original under W.I. 8.7.1. Pelagic/Marine Mammal Surveys.
- 2) Send copies to:
 - A) Operation Supervisor (S), USFWS Regional Office, 1011 E. Tudor Rd., Anchorage, AK 99503-6119.

III. SPECIAL CONSIDERATIONS

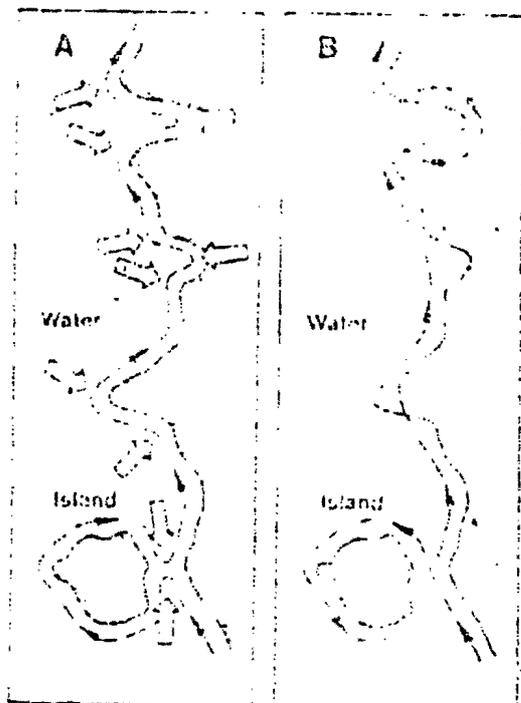


Fig. 3. Hazardous (A) and recommended (B) flight paths along the same shoreline. The path is marked as the difference and sharp turns are indicated by open arrows.

RECOMMENDATIONS FOR LOW-ALTITUDE AERIAL SURVEYS

Low-altitude flying is a slow and tiring job for both the observer and pilot. It is also hazardous; there is virtually no time to recover from problems. The following recommendations are based on our experiences and discussions with pilots, including the one who crashed.

The most important single consideration for low-altitude safety is the amount of turning and maneuvering. The chance of stalling increases proportionally with the number of turns and tightness of turns. Frequent turns are also fatiguing. Our crash resulted from a gust of wind that stalled the wing during a tight turn, causing a spin. Surveys that cannot use

completely straight transects, e.g., when searching for eagle nests, can still eliminate all or more tight turns as illustrated in Fig. 3.

Safety may also be improved by permitting some departure from standardized search methods depending on curvature of shoreline, quality of habitat, amount of water available for forced landings, and weather. It is sometimes possible to fly higher, over land, or down the middle of some islands, peninsulas, bays, and small bodies of water rather than following the shoreline closely. Proper judgment must be learned through training and experience.

The remaining suggestions involve common sense and may seem obvious, but they are too important and too frequently overlooked to rush flying simply to be assumed: (1) Only experienced and willing pilots should be used if at all possible. (2) Purpose of the work and intended flight plans, routes, and navigation responsibilities should be planned carefully and reviewed with the pilot prior to take-off. (3) Surveys should be discontinued or postponed under changing or unsafe flying conditions. The pilot has the final say on flying. (4) Pilot and observer(s) need proper sleep before flying, and should take occasional breaks by landing and resting during the day. Late nights or fatigue seriously impair alertness and reaction time. (5) All persons must be conscious of and respect each other's tasks and the pressures of such work.

SOURCE:

BEASLEY, S. E. C. AND M. S. SINGH. 1971. *Ornithol.*
J. Wildl. Manage. 35: 1-198.

IV. MANPOWER AND COSTS*

Mandays:

GS-12 at \$160 per day for 3 days = \$480
GS-7 at \$94 per day for 3 days = 282
Subtotal = \$762

Transportation: Cessna 180

Availability at \$30 per day for 3 days = \$ 90
Rate at \$50 per hour for 12 hours = \$600
Subtotal = \$690

Supplies and Materials:

Aviations fuel at \$2 per gallon and
7.5 gallons per hour for 12 hours = \$180

Total Estimated Costs = \$1542

Prepared by: Randall J. White Date: 9/28/83

Reviewed by: John J. Taylor Date: 9/28/83

Approved by: Samuel L. Caldwell Date: 4/11/84

* Listed are minimum costs - since most surveys will be flown incidental to other surveys, most expenses will be absorbed by those "other survey" costs.

Refuge: Becharof NWR

Procedure No.: 5

Species: Tundra Swan

Title: Nesting Census

I. PURPOSE

The purpose of this inventory procedure is to fulfill the purposes for which the refuge was established. As outlined in ANILCA one purpose for the establishment of Becharof NWR is: "... to conserve fish and wildlife populations and their habitats in their natural diversity including, but not limited to, ... shorebirds and other migratory birds...." In order to carry out the mandates of ANILCA, the Fish and Wildlife Service must inventory the tundra swan populations, monitor their habitat against loss and degradation and collect information for management decisions.

II. PROCEDURE

General: Comprehensive aerial swan surveys were initiated in Alaska in 1968 based on the quadrangel map system of recording observations. Survey coverage was expanded in 1975 and 1980 to keep pace with the rapidly expanding population. Brood surveys on nesting grounds have much value but are greatly enhanced with nesting surveys. The procedure will be conducted early June when swans are paired at nesting sites on the lakes.

Nesting occurs throughout the refuge on a limited basis. Considering nesting density coupled with available nesting habitat, this procedure leads itself to conducting a census type counting procedure.

It will be the pilot's responsibility to locate swans and ensure the observer sees and records them at the proper location on the 1:63,360 maps (Exhibit 1). To do this the pilot uses the relevant 1:250,000 map (Exhibit 2) for orientation. The pilot should note coverage on his/her map. Each 1:63,360 map will be completely searched until all birds have been tallied. Optimum locating altitude is approximately 400 feet AGL. Swans are sometimes off their nest making it possible to count eggs, however repeated buzzing of an incubating swan to get it to uncover the eggs is dangerous and shall not be practiced.

The observer's duties are to: record date and weather; mark flight path and indicate direction on the quadrangle map (Exhibit 1); and mark the location of each swan observation on the map with a dot. Each dot is numbered beginning with one (1) on each quadrangle map. These numbers are repeated in a column on the map's right margin, noting the number and status of swans observed at each location and circling off refuge observations. Swans are recorded as S for singles, P for pairs, P/N for pairs with nest and F for flocks, e.g. a flock of three adults would be recorded a F3. The field data is later transferred to the summary Data Form (Exhibit 3) to determine refuge population.

Number of Personnel: One pilot and observer.

Qualifications of Personnel: Pilot must be OAS qualified and observer must be familiar with swan identification and enumeration from fixed-wing aircraft.

Dates of Inventory: June 1 to June 15 (approximate).

Times of Day: Daylight hours.

Weather Conditions: Optimal conditions include clear to partly cloudy skies, no precipitation and calm winds. Minimal conditions must not be less than 1,000 foot ceiling AGL, no less than ten miles visibility with light precipitation and no more than 15 to 20 knot winds. If sustained moderate to severe turbulence is encountered, census will be suspended.

Survey Units: Quadrangle maps: Naknek A-1,2 and 3; B-1,2 and 3; C-1 and 2; Ugashik C-1; D-1,2 and 3; Karluk(s) C-6; D-5 and 6. Refer to Exhibits 1 and 2.

Census Route: The pilot will fly lake to lake where lakes are far apart and use a transect system where lakes are close together.

Method of Transportation: Cessna 185 or a comparable aircraft will be flown at 95 to 100 knots indicated and 100 to 500 feet AGL depending upon terrain and/or weather conditions. Flight patterns will be flown in a manner to permit observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, 35mm camera with a 50 to 200mm or comparable zoom lens, film and sunglasses.

Equipment and supplies: Complete survival gear for aircraft - life jackets if on floats, shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves, appropriate maps and forms, and pencil.

Photography: Shoot photographs at shutter speeds no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Summary Data Form (SDF): Refer to Exhibit 3.

Using the appropriately marked quadrangle maps:

- 1) Record Date.
- 2) Record number of refuge observations for : Singles, Pairs, Pairs with Nest and Flocks.
- 3) Add figures under Singles, Pairs, Pairs with Nest and Flocks, and record the sum under Observations.
- 4) Total the individual birds included as Pairs and Pairs with Nest, and record the amount under Paired Birds.
- 5) Total the individual birds included in Flocks and record the amount under Flocked Birds.
- 6) Add together the adult birds, i.e. Singles, Paired Birds and Flocked Birds, and record the sum under Total Adult Birds.
- 7) Record: Pilot/Observer, Aircraft and any Remarks.
- 8) Determine Refuge Totals by adding Columns.

Computation Data Form (CDF): Refer to Exhibit 4.

- 1) Record Month and Year of census.
- 2) Using the SDF Refuge Swan Nesting Totals Calculate:
 - A) Percent Paired Birds by dividing the Paired Birds by the Total Adult Birds, then multiplying the resultant by 100.

- B) Percent Pairs with Nest by dividing the number of Pairs with Nest by the sum of (Pairs and Pairs with Nest), then multiplying the resultant by 100.

Sampling Requirements: All swans located within the area covered by the 14 quadrangle maps which make up the refuge's swan habitat, must be tallied. Random refuge sampling demonstrated that swans are rarely present (less than five percent) above the 300 foot elevation level. Therefore, areas above 500 feet in elevation are not included in the procedure.

Statistical Analysis: A comprehensive system for storage and retrieval of data collected via this inventory procedure is being developed. When the system is perfected, comparable data from any source can be entered and printouts in tabular form and/or maps can be quickly produced.

Data Filing:

- 1) File original under "Wildlife, Swan Surveys".
- 2) Send copies of census to:
 - A) Operations Manager - South, USFWS, Regional Office, 1011 E. Tudor Rd., Anchorage, AK 99503-6119, for insertion in the computer bank and for machine print out of comparison with past surveys.
 - B) Wildlife Biologists, ADG&G, PO Box 37, King Salmon, AK 99613.
 - C) Migratory Bird Management - North, USFWS, 1412 Airport Way, Fairbanks, AK 99701

III. SPECIAL CONSIDERATIONS

All swans located within the area covered by the 15 quadrangle maps, which make up the refuge's swan habitat, must be tallied. Incomplete counts render comparisons with past and future census data impossible.

IV. MANPOWER AND COST

Mandays:

GS-12 at \$160 per day for 3 days	= \$480
GS-7 at \$90 per day for 3 days	= <u>270</u>
Subtotal	= \$750

Transportation: Cessna 185

Availability at \$30 per day for 3 days	= \$90
Rate at \$50 per hour for 16 hours	= <u>800</u>
Subtotal	= \$890

Supplies and Materials:

Aviation fuel at \$2 per gallon and 14 gallons per hour for 16 hours	= \$448
Miscellaneous	= <u>10</u>
Subtotal	= \$458
	= \$2098

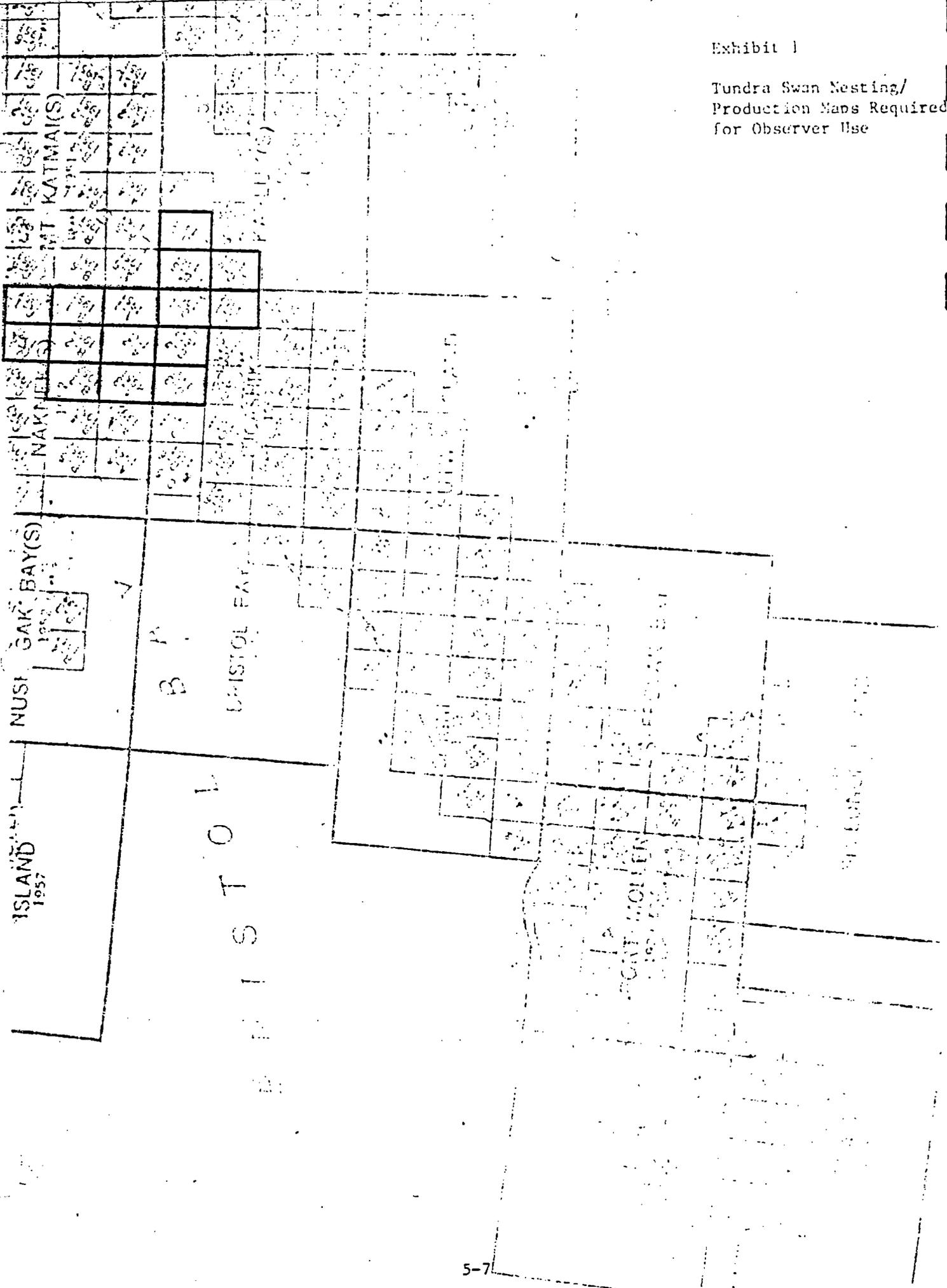
Prepared by: C. Randall Arnest Date: 09/28/83

Reviewed by: John T. Taylor Date: 07/28/83

Approved by: George L. Caldwell Date: 4/16/84

Exhibit 1

Tundra Swan Nesting/
Production Maps Required
for Observer Use



Tundra Swan Nesting/
Production Map for Pilot
Use
Nalnek Quadrangles

C-2

C-1

0-300

Line
Break

S
T
A

N
A
L
N
E
K
Q
U
A
D
R
A
N
G
L
E
S

B-3

B-2

B-1

A-3

A-2

A-1

B E C H A R O F L A K E

Tundra Swan Nesting
Production Map for Pilot
Use
Ugashik Quadrangles

BECHAROV

D-2

D-1

The Gas Rocks

Severod Peninsula

275
285

Lake

Blue Mountain

Upper
Ugashik

Simon Peak

Mount
Simon

Mount
Burt

Mount
Zion

Mount
Denison

C-1

Mount
Ugashik

2700
1800

Kanatar

Kanatak

Old
Mountain

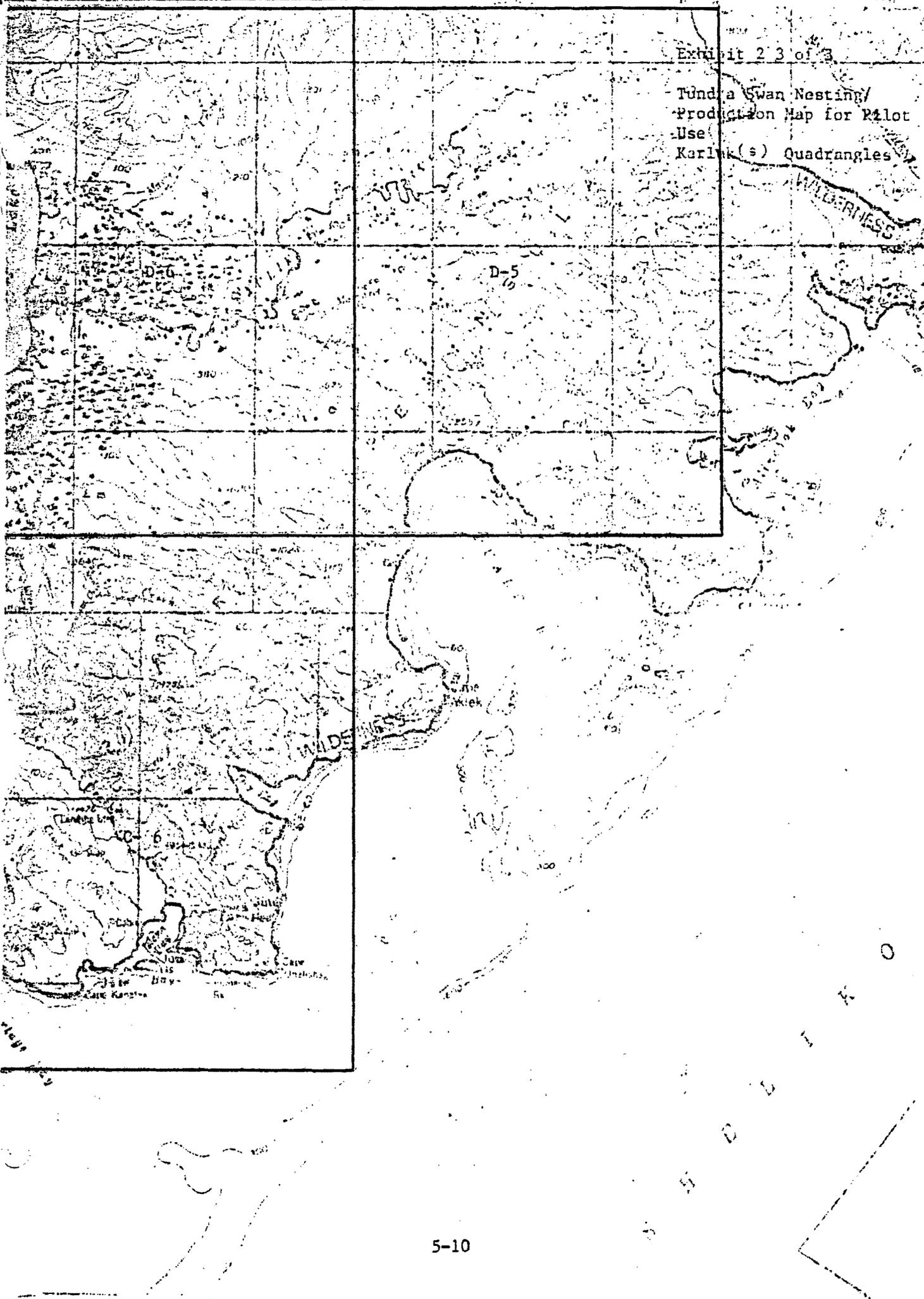
Mount
Shannon

5-9

Mount Shannon

Exhibit 23 of 3

Tundra Swan Nesting/
Production Map for Pilot
Use
Karluk (?) Quadrangles



TUNDRA SWAN NESTING/PRODUCTION/REPRODUCTION DATA FORM

Quadrangle	Month/Day/Year	Singles	Pairs	Pairs with Nest or Brood	Flocks	Observations	Paired Birds	Flocked Birds	Total Adult Birds	Broods	Total Young of Year	Total All Swans	Pilot/ Observer	Aircraft	Remarks
N:A-1															
N:A-2															
N:A-3															
N:B-1															
N:B-2															
N:B-3															
N:C-1															
N:C-2															
U:C-1															
U:D-1															
U:D-2															
U:D-3															
K:C-6															
K:D-5															
K:D-6															
Refuge Totals															

Refuge: Becharof NWR

Procedure No.: 6

Species: Tundra Swan

Title: Production Census

I. PURPOSE

The purpose of this inventory procedure is to fulfill the purposes for which the refuge was established. As outlined in ANILCA one purpose for the establishment of Becharof NWR is: "... to conserve fish and wildlife populations and their habitats in their natural diversity including, but not limited to, ...shorebirds and other migratory birds...." In order to carry out the mandates of ANILCA, the Fish and Wildlife Service must inventory the tundra swan populations, monitor their habitat against loss and degradation and collect information for management decisions.

II. PROCEDURE

General: Comprehensive aerial swan surveys were initiated in Alaska in 1968 based on the quadrangle map system of recording observations. Survey coverage was expanded in 1975 and 1980 to keep pace with the rapidly expanding population. Brood surveys on nesting grounds have much value and are greatly enhanced with nesting surveys. The procedure will be conducted late July/early August just after the latest cygnets are hatched.

Nesting occurs throughout the refuge on a limited basis. Considering nesting density coupled with available nesting habitat, this procedure leads itself to conducting a census type counting procedure.

It will be the pilot's responsibility to locate swans and ensure the observer sees and records them at the proper location on the 1:63,000 maps (Exhibit 1). To do this the pilot uses the relevant 1:250,000 map (Exhibit 2) for orientation. The pilot should note coverage on his/her map. Each 1:63,000 map will be completely searched until all birds have been tallied. Optimum locating altitude is approximately 400 feet AGL.

The observer's duties are to: record date and weather; mark flight path and indicate direction on the quadrangle map (Exhibit 1); and mark the location of each swan observation on the map with a dot. Each dot is numbered beginning with one (1) on each quadrangle map. These numbers are repeated in a column on the map's right margin, noting the number and status of swans observed at each location and circling off refuge observations. Swans are recorded S for singles, P for pairs, P/B for pairs with brood and F for flocks, e.g. a pair with brood of four would be recorded as P/B4. The field data is later transferred to the Summary Data Form (Exhibit 3) to determine refuge population.

Number of Personnel: One pilot and observer.

Qualifications of Personnel: Pilot must be OAS qualified and observer must be familiar with swan identification and enumeration from fixed-wing aircraft.

Dates of Inventory: July 20 to August 10 (approximate).

Times of Day: Daylight hours.

Weather Conditions: Optimal conditions include clear to partly cloudy skies, no precipitation and calm winds. Minimal conditions must not be less than 1,000 foot ceiling AGL, no less than ten miles visibility with light precipitation and no more than 15 to 20 knot winds. If sustained moderate to severe turbulence is encountered, census will be suspended.

Survey Units: Quadrangle maps: Naknek A-1,2 and 3; B-1,2 and 3; C-1 and 2; Ugashik C-1; D-1,2 and 3; Karluk(s) C-6; D-5 and 6. Refer to Exhibits 1 and 2.

Census Route: The pilot will fly lake to lake where lakes are far apart and use a transect system where lakes are close together.

Method of Transportation: Cessna 185 or a comparable aircraft will be flown at 95 to 100 knots indicated and 100 to 500 feet AGL depending upon terrain and/or weather conditions. Flight patterns will be flown in a manner to permit observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, 35mm camera with a 50 to 200mm or comparable zoom lens, film and sunglasses.

Equipment and Supplies: Complete survival gear for aircraft - life

jackets if on floats, shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves, appropriate maps and forms, and pencil.

Photography: Shoot photographs at shutter speeds no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Summary Data Form (SDF): Refer to Exhibit 3.

Using the appropriately marked quadrangle maps:

- 1) Record Date.
- 2) Record number of refuge observations for: Singles, Pairs, Pairs with Brood and Flocks.
- 3) Add figures under Singles, Pairs, Pairs with Brood and Flocks, and record the sum under Observations.
- 4) Total the individual birds included as Pairs and Pairs with Brood, and record the amount under Paired Birds.
- 5) Total the individual birds included in Flocks and record the amount under Flocked Birds.
- 6) Add together the adult birds, i.e. Singles, Paired Birds and Flocked Birds, and record the sum under Total Adult Birds.
- 7) Record number of refuge observations for Broods.
- 8) Total the individual cygnets included as Broods and record the amount under Total Young of Year.
- 9) Add together the Total Adult Birds and Total Young of Year and record sum under Total All Swans.
- 10) Record: Pilot/Observer, Aircraft and any Remarks.
- 11) Determine Refuge Totals by adding Columns.

Computation Data Form (CDF): Refer to Exhibit 4.

- 1) Record Month and Year of census.

- 2) Using the SDF Refuge Swan Production Totals calculate:
 - A) Percent Pairs with Brood by dividing the number of Pairs with Brood by the sum of (Pairs and Pairs with Brood), then multiplying the resultant by 100.
 - B) Average Brood Size by dividing the Total Young of Year by the number of Broods.
 - C) Percent Young of Year by dividing the Total Young of Year by the Total of All Swans, then multiplying the resultant by 100.

Sampling Requirements: All swans located within the area covered by the 14 quadrangle maps which make up the refuge's swan habitat, must be tallied. Random refuge sampling demonstrated that swans are rarely present (less than five percent) above the 300 foot elevation level. Therefore, areas above 500 feet in elevation are not included in the procedure.

Statistical Analysis: A comprehensive system for storage and retrieval of data collected via this inventory procedure is being developed. When the system is perfected, comparable data from any source can be entered and printouts in tabular form and/or maps can be quickly produced.

Data Filing:

- 1) File original under "Wildlife, Swan Surveys".
- 2) Send copies of census to:
 - A) Operations Manager - South, USFWS, Regional Office, 1011 E. Tudor Rd., Anchorage, AK 99503-6119, for insertion in the computer bank and for machine print out of comparison with past surveys.
 - B) Wildlife Biologists, ADG&G, PO Box 37, King Salmon, AK 99613
 - C) Migratory Bird Management - North, USFWS, 1412 Airport Way, Fairbanks, AK 99701

III. SPECIAL CONSIDERATIONS

All swans located within the area covered by the 15 quadrangle maps, which make up the refuge's swan habitat, must be tallied. Incomplete counts render comparisons with past and future census data impossible.

IV. MANPOWER AND COST

Mandays:

GS-12 at \$160 per day for 3 days	= \$480
GS-7 at \$90 per day for 3 days	= <u>270</u>
Subtotal	= \$750

Transportation: Cessna 185

Availability at \$30 per day for 3 days	= \$90
Rate at \$50 per hour for 16 hours	= <u>800</u>
Subtotal	= \$890

Supplies and Materials:

Aviation fuel at \$2 per gallon and 14 gallons per hour for 16 hours	= \$448
Miscellaneous	= <u>10</u>
Subtotal	= \$458
	= \$2098

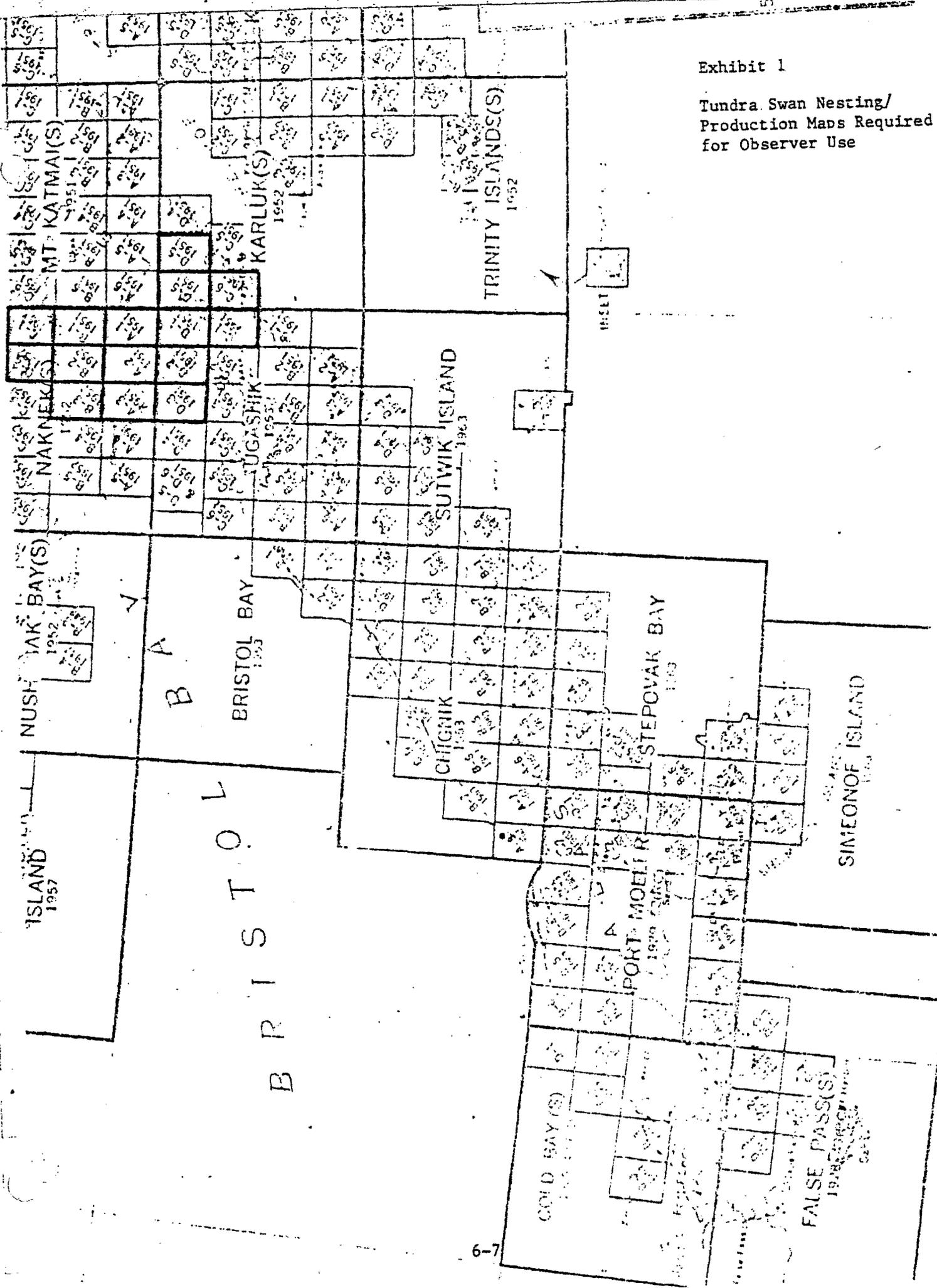
Prepared by: C. Randall Arment Date: 09/28/83

Reviewed by: John L. Foy Date: 09/28/83

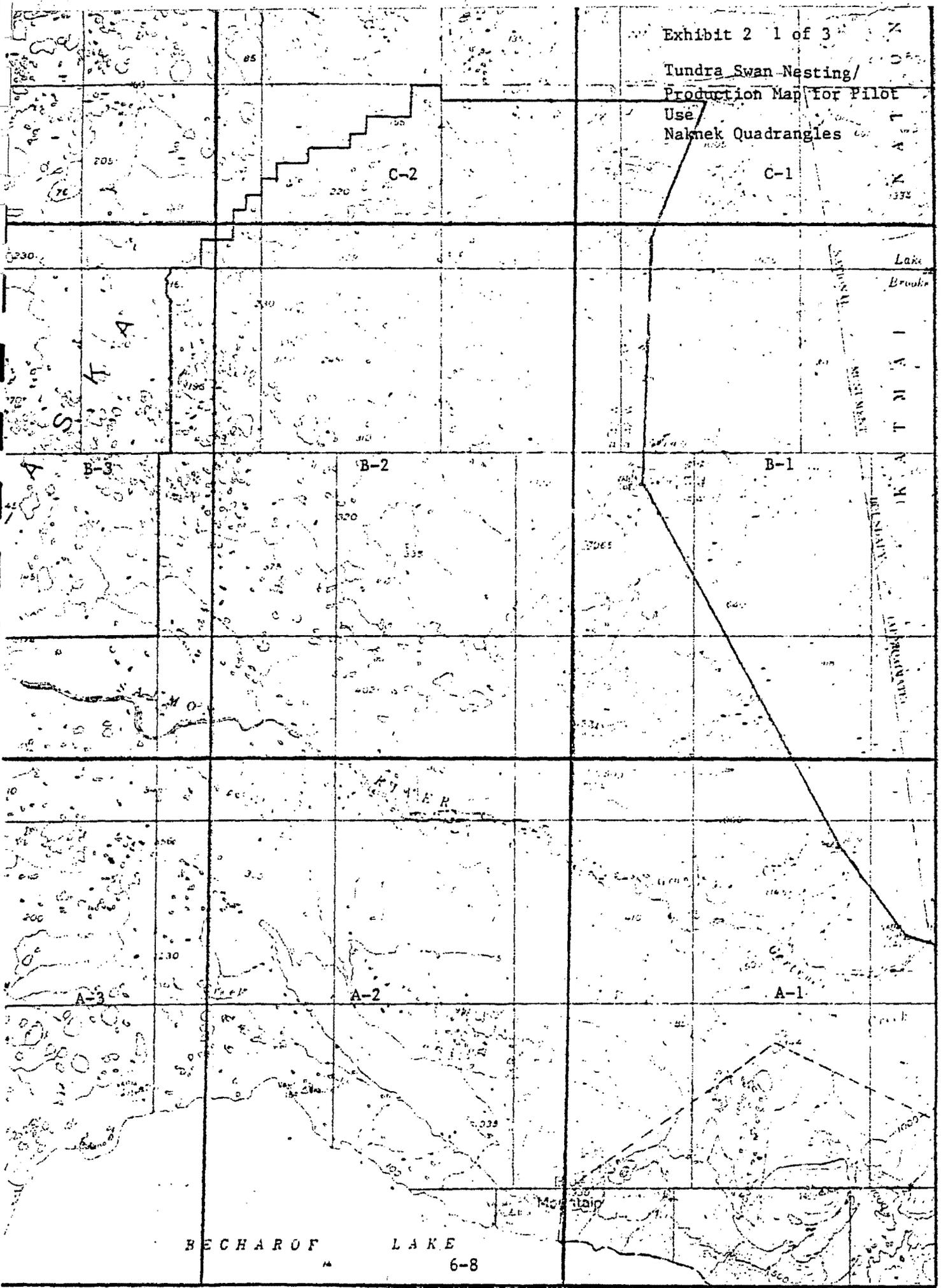
Approved by: Samuel L. Caldwell Date: 10/11/84

Exhibit 1

Tundra Swan Nesting/
Production Maps Required
for Observer Use

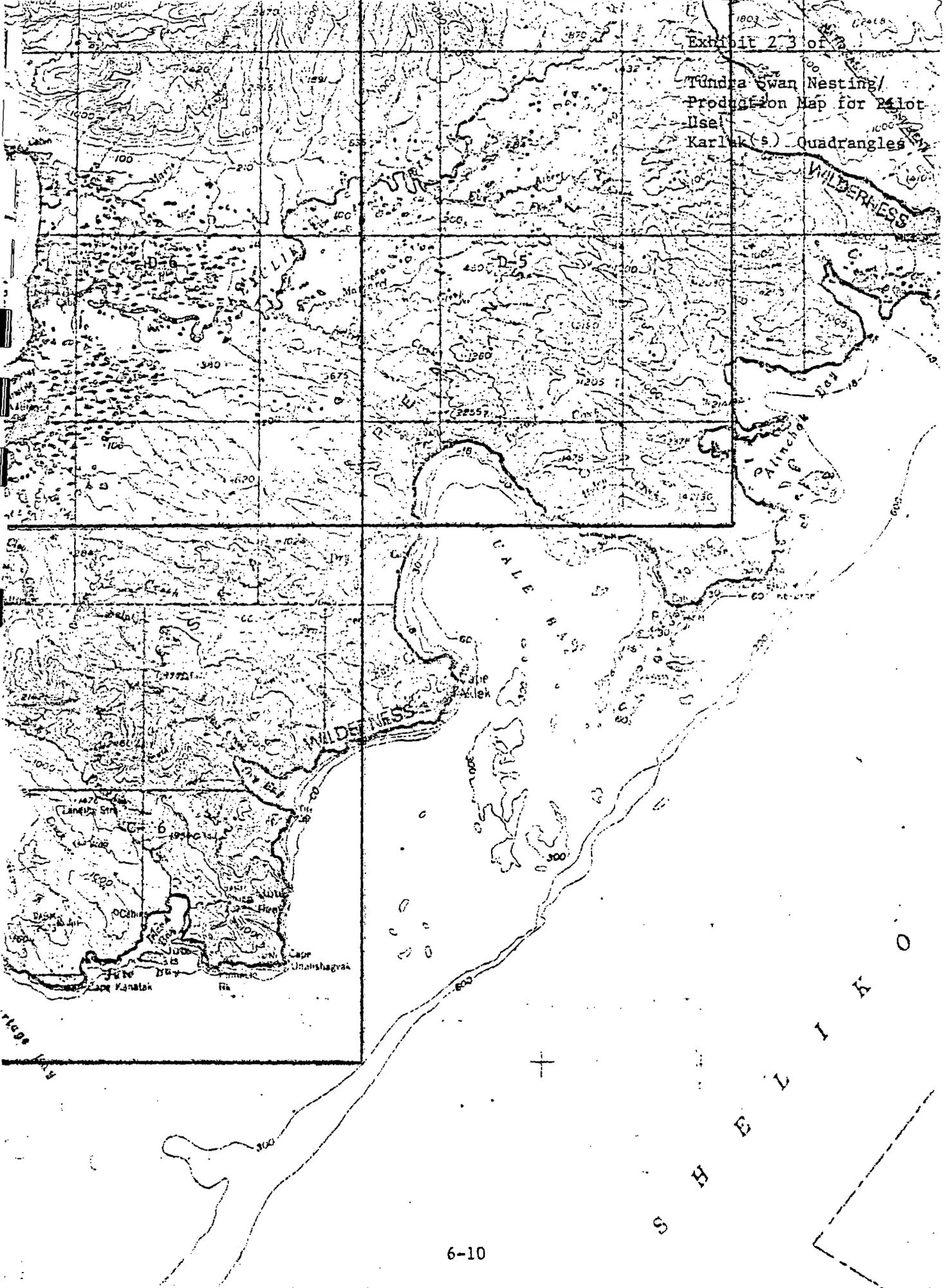


Tundra Swan Nesting/
Production Map for Pilot
Use
Naknek Quadrangles



BECHAROF LAKE
6-8

Exhibit 2.3 of 3
Tundra Swan Nesting/
Production Map for Pilot
Use
Karluk (s) Quadrangles



TUNDRA SWAN NESTING/PRODUCTION SUMMARY DATA FORM

Quadrangle	Month/Day/Year	Singles	Pairs	Pairs with Nest or Brood	Flocks	Observations	Paired Birds	Flocked Birds	Total Adult Birds	Broods	Total Young of Year	Total All Swans	Pilot/Observer	Aircraft	Remarks
N:A-1															
N:A-2															
N:A-3															
N:B-1															
N:B-2															
N:B-3															
N:C-1															
N:C-2															
U:C-1															
U:D-1															
U:D-2															
U:D-3															
K:C-6															
K:D-5															
K:D-6															
Refuge Totals															

Refuge: Becharof NWR

Procedure No.: 7

Species: Waterfowl

Title: Spring and Fall Migration Survey

I. PURPOSE

The purpose of this inventory is to fulfill the purposes for which the refuge was established. As outlined in the Alaska National Interest Lands Conservation Act (ANILCA), the purposes for establishment of Becharof NWR include: "... to conserve fish and wildlife populations and their habitats in their natural diversity including, but not limited to, ... shorebirds and other migratory birds..." In order to carry out this mandate, the U.S. Fish and Wildlife Service must inventory migrating waterfowl populations to monitor individual species status and to collect information for making management decisions.

II. PROCEDURE

General: Bi-weekly aerial waterfowl counts will be conducted during the spring and fall migration periods. Migratory waterfowl use occurs throughout the refuge on a limited basis, however, the majority is confined to the northern and eastern portions. Considering the density of waterfowl use coupled with cost benefit ratio, lends itself to conducting a sample type inventory procedure. To accomplish this, two sample areas (one in the northern and one in the eastern portion of the refuge) will be surveyed. The two areas include the complete coverage of two quadrangle maps (Exhibit 1). To do this the sample areas will be flown in segments having a width of $\frac{1}{2}$ mile.

The aircraft's flight will be flown east and west as shorter segments facilitate more precise map coverage. The quadrangle maps (Exhibits 1 and 2) will be used for navigation and recording of observations. The observer, using the appropriate map, will record date and weather; mark flight path and indicate direction; and tabulate observations in a column on the map's margin. Tabulations are to include all migratory water birds and raptors. The field data is then transferred to the Summary Data Form (Exhibit 3) to determine refuge populations.

Number of Personnel: One pilot and observer.

Qualifications of Personnel: Pilot must be OAS qualified and observer must be familiar with waterfowl identification and enumeration from fixed-wing aircraft.

Dates of Inventory: Spring - April to May 31, depending upon ice breakup. Fall - September 1 to October 31, depending upon freezeup.

Times of Day: Daylight hours.

Weather Conditions: Optimal conditions include clear to partly cloudy skies, no precipitation and calm winds. Minimal conditions must not be less than 1,000 foot ceiling AGL, no less than ten mile visibility with light precipitation and no more than 15 to 20 knot winds. If sustained moderate to severe turbulence is encountered, census will be suspended.

Survey Units: Quadrangel maps: Naknek B-2 and Karluk D-6. Refer to Exhibits 1 and 2.

Census Route: The aerial census route is that of a transect type. Using the appropriate quadrangle map, the pilot will fly east and west segments and cover the entire quadrangle. For the purpose of this inventory procedure, a segment is defined as having a width of $\frac{1}{2}$ mile ($\frac{1}{4}$ mile on either side of the aircraft). At the termination of each segment and prior to the start of the next, the aircraft's altitude may be increased to aid identification and location of landmarks to be used in navigating the succeeding segment(s).

Method of Transportation: Piper supercub or comparable aircraft will be flown at 75 to 80 knots indicated and 100 to 150 feet AGL depending upon terrain and/or weather conditions.

Census Aids: Binoculars, 35mm camera with a 50 to 200mm or comparable zoom lens, film and sunglasses.

Equipment and Supplies: Complete survival gear for aircraft - life jackets, shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves, appropriate maps and forms, and pencil.

Photography: Shoot photographs at shutter speeds no less than 1/250th second with appropriate aperture opening. Haze reducing filters are also recommended.

Summary Data Form (SDF): Refer to Exhibit 3.

- 1) Record: Dates, Pilot, Observer and Aircraft.
- 2) Using the appropriately marked quadrangle maps:
 - A) Record for each Species, the total birds surveyed in each Quadrangle -Sample Indicated Total Birds.
 - B) Record Other Waterfowl sightings.
- 3) The Sample Population Index is determined by multiplying the Sample Indicated Total Birds for each Quadrangle and Species by the appropriate Visibility Rate as depicted on the form.
- 4) The Refuge Population Index is determined by adding together the two Sample Population Index totals for each Quadrangle and Species, then multiplying the resultant by two.
- 5) Include any remarks.
- 6) Determine: Total Geese, Total Dabbling Ducks and Total Diving Ducks by summing the appropriate columns.
- 7) Total Ducks are determined by the sum of the Total Dabbling Ducks and Total Diving Ducks.

Sampling Requirements: During waterfowl migration, species and numbers are constantly fluctuating. Thus once a biweekly survey is begun, it should continue with no interruption (weather permitting) until completed.

Statistical Analysis: The survey area represents approximately 22 percent of the refuge. However, based upon refuge water acreage, associated topography and random waterfowl observations, approximately 44 percent of the refuge is conducive to waterfowl staging. Thus, the survey area represents approximately $\frac{1}{2}$ of the refuge waterfowl staging area.

Data Filing:

- 1) File original under "Wildlife, Waterfowl Migration Surveys".

2) Send copies of survey to:

- A) Operations Manager - South, USFWS, Regional Office,
1011 E. Tudor Rd., Anchorage, AK 99503-6119.
- B) Wildlife Biologist, ADF&G, PO Box 37, King Salmon, AK 99613
- C) Waterfowl Investigations - USFWS, PO Box 1287, Juneau, AK
99802

III. SPECIAL CONSIDERATIONS

All of the waterfowl staging habitat located within the area covered by the two quadrangle maps must be surveyed. Incomplete surveys render comparisons with past and future procedure data impossible.

IV. MANPOWER AND COSTS

Mandays:

GS-12 at \$160 per day for 16 days	=	\$2560
GS-7 at \$90 per day for 16 days	=	<u>1440</u>
Subtotal	=	\$4000

Transportation: Piper Supercub

Availability at \$20 per day for 16 days	=	\$320
Rate at \$45 per hour for 112 hours	=	<u>5040</u>
Subtotal	=	\$5360

Supplies and Materials:

Aviation fuel at \$2 per gallon and 7.5 gallons per hour for 112 hours = \$1680

Miscellaneous = 50

Subtotal = \$1730

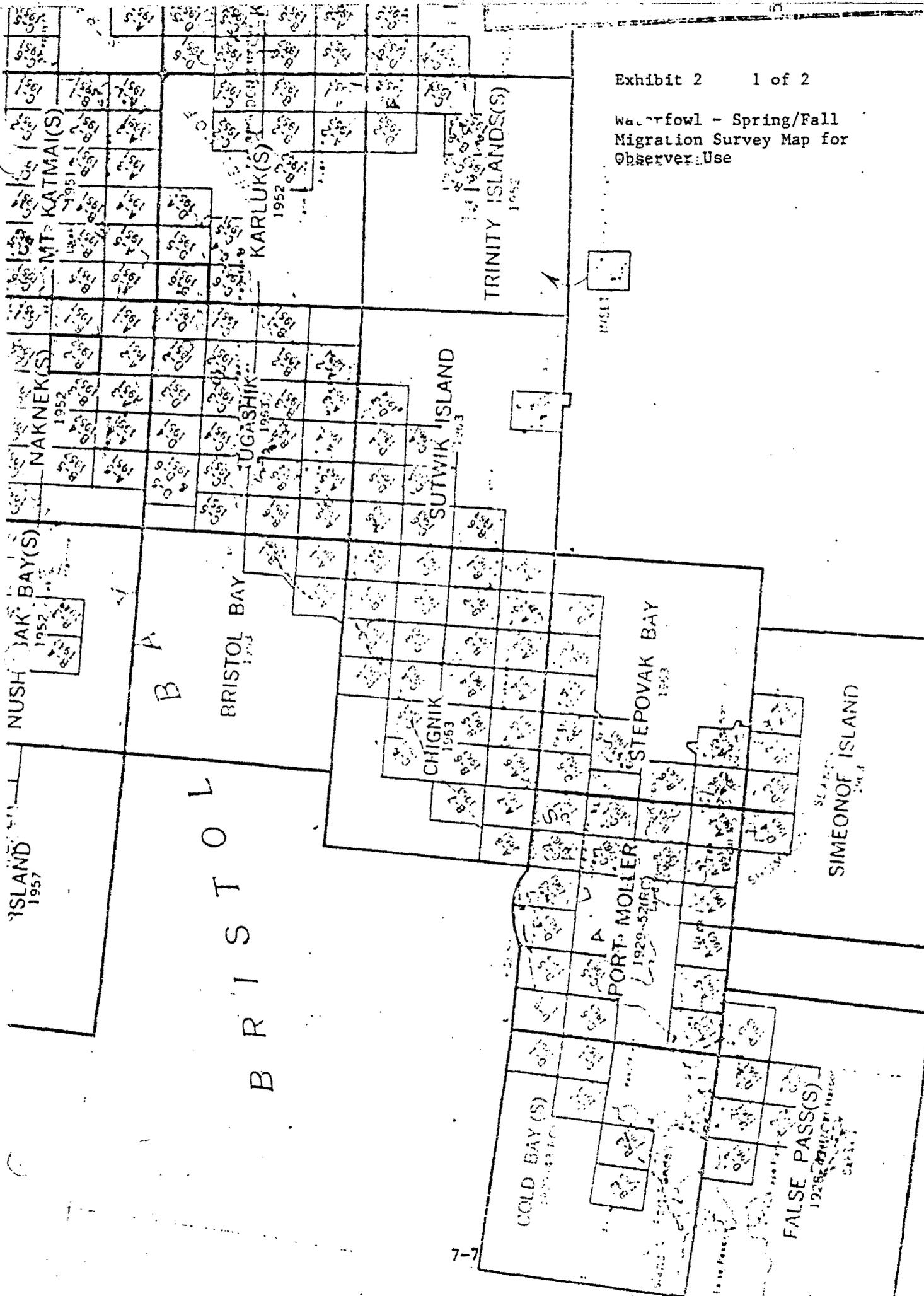
Total estimated costs = \$11,090

Prepared by: C. Randall Arnest Date: 09/28/83

Reviewed by: John S. Leigh Date: 09/28/83

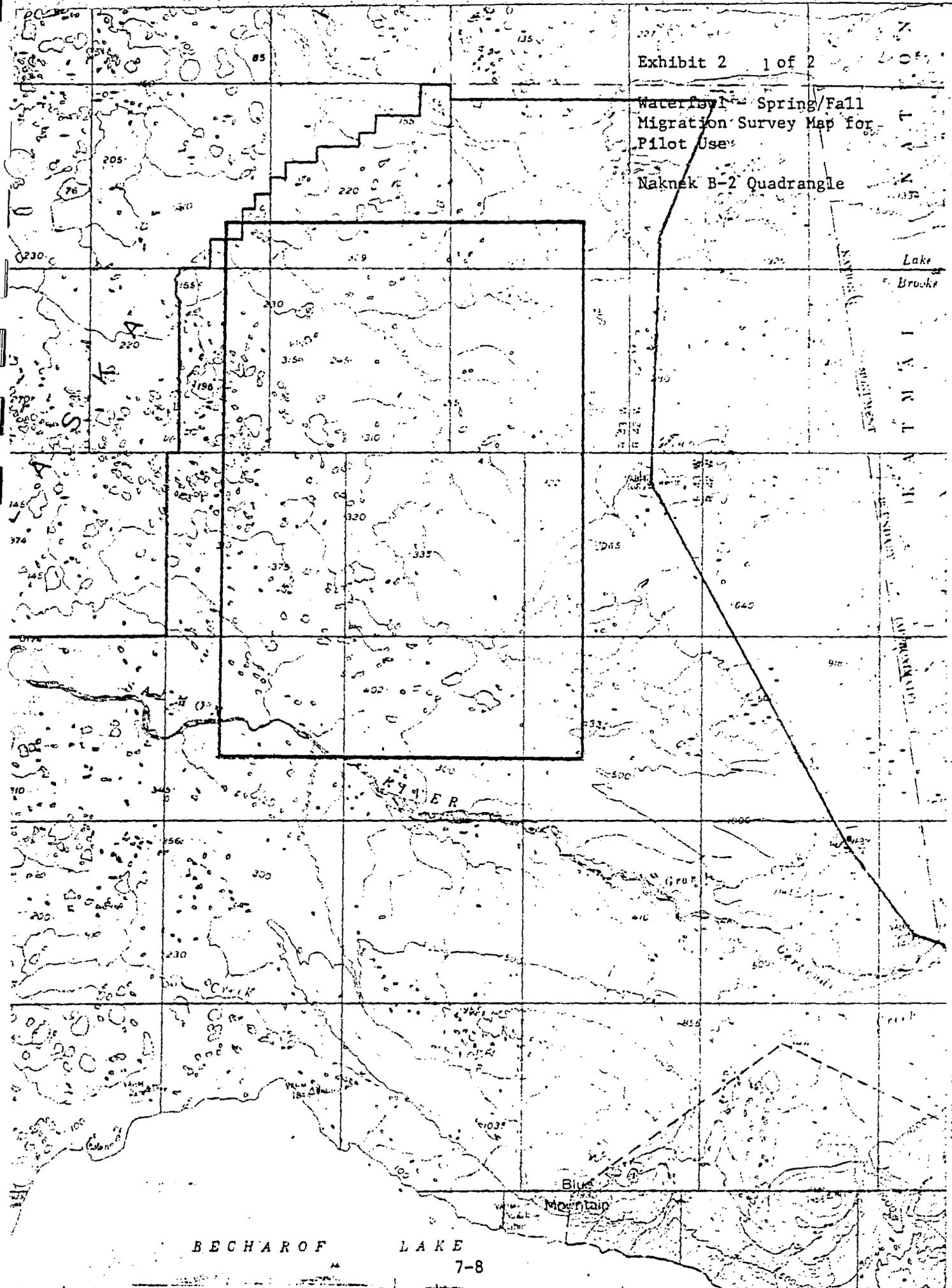
Approved by: Samuel C. Caldwell Date: 4/11/84

Waterfowl - Spring/Fall
Migration Survey Map for
Observer Use



Waterfowl - Spring/Fall
Migration Survey Map for
Pilot Use

Naknek B-2 Quadrangle



BECHAROF LAKE
7-8

Dates:
 Pilot:
 Observer:
 Aircraft:

Exhibit 3

WATERFOWL - SPRING/FALL MIGRATION SUMMARY DATA FORM

Species	Sample Indicated		Visibility Rate	Sample Population Index		Refuge Population Index	Remarks
	N:B-2	K:D-6		N:B-2	K:D-6		
Whistling swan			1.00				
Canada goose			1.00				
White-fronted goose			1.00				
Snow goose			1.00				
Total Geese							
Mallard			3.16				
Pintail			3.87				
American widgeon			5.40				
Shoveler			3.84				
Green-Winged teal			9.53				
Total Dabbling Ducks							
Greater scaup			2.69				
Common Goldeneyes			5.50				
Barrow's goldeneye			5.50				
Buffelhead			2.70				
Oldsquaw			6.50				
Black scoter			1.30				
Common merganser			2.00				
Red-breasted merganser			2.00				
Total Diving Ducks							
Total Ducks							
Other waterfowl							
Black brant							
Emperor goose							
Harliquin duck							
Common eider							

Refuge: Becharof

Procedure No.: 8

Species: Raptors

Title: Becharof NWR Raptor Inventory Procedure

I. PURPOSE

Becharof NWR was established and is managed to include the conservation of wildlife habitats for migratory birds (Title III, ANILCA). Included in this category are birds of prey.

Public interest in birds of prey is high (Todd and Schempf, 1981; Schempf, 1983). Three major laws protect raptors: (1) Bald Eagle Protection Act, 1940, 1959. (2) Migratory Bird Treaty Act, 1918, 1972, and (3) The Endangered Species Act, 1973.

The ecological niche that raptors occupy is well known. The sensitivity of raptors to habitat disturbance and environmental contaminants has been well-documented in the literature.

Alaska contains the last remaining non-threatened/non-endangered Bald Eagle (Haliaeetus-leucocephalus) and Peregrine Falcon (Falco peregrinus)* populations in the United States. Though the species are "recovering" in some areas of the conterminous United States, Alaska's populations are stable (Schempf, 1983).

Bailey and Faust (1981) identified several raptor nests on the refuge coast. Wilk and Arment identified at least two active eagle nests on seastacks during refuge brown bear surveys on the Shelikof Strait in late July, 1983. Both bald eagles and Peale's peregrines nest on

* Peale's peregrine (F.p. Pealei) is not threatened/endangered; Arctic peregrine (F.p. tundrius) and American peregrines (F.p. Anatum) are threatened/endangered.

Shelikof Strait cliffs, islets and seastacks.

A disproportionate amount of effort has been placed on bald eagles and Peregrines with little or no work on the other 26 recorded raptor species.** Therefore, little is known about other raptors in Alaska (Schempf, 1983).

The Alaska USF&WS Raptor Management Plan lists Peregrine Falcons and Bald Eagles as "priority species" based on various criteria (Schempf, 1983). The plan does not preclude other raptors, however, and equal emphasis should be considered for all birds of prey, when observations are made.

Federal law prohibits hunting of raptors but some exceptions exist for subsistence use in Alaska (CFR 50). It is vital to monitor status and breeding viability of identified raptors in the refuge. Additionally, by relating productivity and population changes to environmental changes we will ensure habitat quality for raptors and other wildlife on the Becharof NWR.

II. PROCEDURE

There are two aspects of raptor surveys: (1) nesting populations, and (2) wintering populations, each requiring unique survey strategies. They can be time-consuming and costly.

Henry, et. al. (1977) cite high nest visibility, limited nesting habitat and a synchronized nesting cycle as characteristics that render

** Other raptor species known to inhabit BNWR include gyrfalcon, goshawk, sharp-shinned hawk, marsh hawk, rough-legged hawk, pigeon hawk, osprey, hawk-owl, boreal owl, short-eared owl, snowy owl, great-horned owl, and great gray owl (BNWR ann. narr. 1982).

the osprey (Pandion haliaetus) suitable subjects for aerial censusing. On the refuge these criteria apply equally well to bald eagles and other cliff nesting raptors along the refuge Pacific coast. Along streams and rivers of the refuge interior, adult birds are relatively conspicuous in riparian habitats of the Alaska Peninsula tundra. In effect, eagle nesting, perching and roosting sites have been observed on several occasions incidental to other aerial surveys conducted on BNRW.

Fraser et. al. (1983) noted bald eagle reproduction is frequently assessed using 2 sets of observations made from fixed-wing aircraft. One flight (activity flight) is conducted early in the nesting season (late March to early May) to assess adult pairs and pairs w/eggs. A second flight is flown later in the season (late June to early August) to count nestlings, thereby determining successful production. Riparian nest surveys are run after the first snowfall, when leaves are off trees. On the refuge, manpower and funds are limited and surveys will be coordinated with other surveys along the Pacific coast where raptor nesting has been documented. Along waterways of the interior refuge, bald eagle and other raptor activity will be noted when conducting bear surveys, tundra swan surveys or other refuge activities. On Pacific coast surveys, the survey route along the shoreline will follow the land contour and extend to outlying islets and seastacks. The flight path should be flown low along the shoreline within 100 metres of the shore at about 110-130 km/hr (68-80 mph) (Grier, et. al. 1981). The aircraft should be kept over water for safety purposes and far enough away from the shoreline so important viewing is not obscured from the primary observer by pontoons or wings during flight banking.

Surveying should be conducted preferably when the sun is at low angles - probably from 2 hours after sunrise to 2 hours before sunset (Grier et. al., 1981). Observations should be recorded in pencil directly on 1:63360 USGS topo. maps, noting location, species, number and related biological data (Exhibit 1). Searches should not be conducted in rain or wind exceeding 25 km/hr. or if wind is gusty.

All raptor observations will be recorded on the refuge raptors survey data sheets as well as listing them in the raptor survey log of the refuge wildlife observation book. (Exhibit 1).

Observations made by state, and other federal agencies and the public will be recorded in the raptor survey data file.

When noting raptor nest sites on interior observations one should keep in mind the similarities of nest structure of ravens and osprey (Grier, 1977).

Surveys should be conducted annually, within the same time periods each year. When refuge funds and manpower make it possible to conduct raptor surveys specifically, the Becharof NWR raptor Inventory procedure will be modified for optimal data collection.

Number of Personnel: One pilot/one observer.

Qualifications of Personnel: Pilot must be OAS qualified. Observer must be familiar with BNWR aerial survey techniques and raptor identification.

Dates of Inventory: One minimum flight, Pacific coast, in late March to early May in conjunction with other BNWR wildlife surveys or refuge activities. One flight, Pacific coast, in late June to early August in conjunction with other BNWR wildlife surveys or refuge activities.

Time of Day: Some time between 2 hours AFTER sunrise to 2 hours BEFORE sunset.

Time of Day: Daylight hours.

Weather Conditions: Optimal conditions - clear skies, no precipitation and calm winds. Survey activities should cease during precipitation or gusty winds or winds above 25 km/hr. (15 mph).

Survey Unit: Shelikof Strait side of Becharof NWR.

Census Route: Becharof NWR shoreline contour and outlying islets and seastacks.

Method of Transportation: Piper Supercub or similar aircraft flown at 110-130 km/hr. (68-81 mph) and 100-200 feet AGL depending on terrain and weather conditions; flown in a manner which permits observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, portable tape-recorder (optional), 35mm camera w/70-210mm or comparable zoom lens, film, sunglasses.

I. SPECIAL CONSIDERATIONS

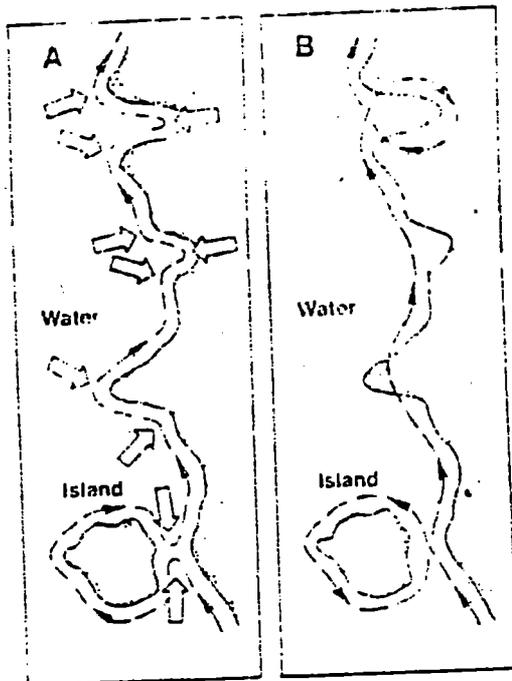


Fig 3. Hazardous (A) and recommended (B) flight paths along the same shoreline. The path is marked as the dashed line and sharp turns are indicated by open arrows.

RECOMMENDATIONS FOR LOW-ALTITUDE AERIAL SURVEYS

Low-altitude flying is tedious and tiring for both the observer and pilot. It is also hazardous; there is virtually no time to recover from problems. The following recommendations are based on our experiences and discussions with pilots, including the one who crashed.

The most important single consideration for low-altitude safety is the amount of turning and maneuvering. The chance of stalling increases proportionally with the number of turns and tightness of turns. Frequent turns are also fatiguing. Our crash resulted from a gust of wind that stalled the wing during a tight turn, causing a spin. Surveys that cannot use

completely straight transects, e.g., when searching for eagle nests, can still eliminate all or most tight turns as illustrated in Fig. 3.

Safety may also be improved by permitting some departure from standardized search methods depending on curvature of shoreline, quality of habitat, amount of water available for forced landings, and weather. It is sometimes possible to fly higher, over land, or down the middle of some islands, peninsulas, bays, and small bodies of water rather than following the shoreline closely. Proper judgment must be learned through training and experience.

The remaining suggestions involve common sense and may seem obvious, but they are too important and too frequently overlooked in bush flying simply to be assumed. (1) Only experienced and willing pilots should be used if at all possible. (2) Purpose of the work and intended flight plans, routes, and navigation responsibilities should be planned carefully and reviewed with the pilot prior to take-off. (3) Surveys should be discontinued or postponed under changing or unsafe flying conditions. The pilot has the final say on flying. (4) Pilot and observer(s) need proper sleep before flying, and should take occasional breaks by landing and resting during the day. Late nights or fatigue seriously impair alertness and reaction time. (5) All persons must be conscious of and respect each other's tasks and the pressures of such work.

SOURCE:
BIAS IN SURVEYS OF NESTING EAGLES. Grier et al.
J. Wildl. Manage. 47:11, 1984

Equipment and Supplies: Complete survival gear for aircraft - if on floats - life jackets, shoulder harnesses, aircraft intercom, flight helmets, nomex flight suits and gloves - applicable topographic maps and notebook; pencils.

Photography: Photographs taken at 1/250th second w/appropriate aperture opening. Haze reducing filters recommended.

Data filing:

- 1) File original under "Wildlife, Raptor Surveys".
- 2) Send copies of survey to:
 - A) Operations Manager (South) USF&WS Regional Office, 1011 E. Tudor Rd., Anchorage, AK 99503-6119

IV. MANPOWER AND COSTS*

Mandays:

GS-12 at \$160 per day for 3 days	=	\$480
GS-7 at \$94 per day for 3 days	=	<u>282</u>
Subtotal	=	\$762

Transportation: PA-18 Supercub

Availability at \$20 per day for 3 days	=	\$ 60
Rate at \$45 per hour for 12 hours	=	<u>540</u>
Subtotal	=	\$600

Supplies and Materials:

Aviation fuel at \$2 per gallon and 7.5 gallons per hour for 12 hours	=	\$180
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* Listed are minimum costs - since most surveys will be flown incidental to other surveys, most expenses will be absorbed by those "other survey" costs.

Total Estimated Costs

= \$1542

Prepared by: *Candall John Witt* Date: *9/28/83*

Reviewed by: *John J. Taylor* Date: *9/28/83*

Approved by: *Sam L. O'Connell* Date: *4/11/84*

Refuge: Becharof

Procedure No.: 9

Species: Seabirds and associated seaducks and waterfowl

Title: BNWR Seabird Surveys

I. PURPOSE

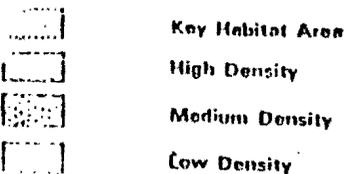
The Becharof National Wildlife Refuge was established to include the conservation and management of wildlife populations and habitats in their natural diversity including, but not limited to... marine birds... (ANILICA, Title III).

The sensitivity of marine birds and waterfowl to environmental menaces has been discussed (Sowl and Bartonek, 1974; Nettleship, 1977; Bailey and Faust, 1981). Additionally, their recreational, scientific, and economic values, public interest and data on distribution and abundance in Alaska has become increasingly important. Their Alaskan numbers may equal or exceed the total of seabirds in the remainder of the northern hemisphere (Sowls, et. al., 1978). Though numerous surveys have been conducted, no systematic program for censusing seabird colonies has occurred along most of the Alaska coast (Sowls, et. al. 1978).

The Pacific coast of the refuge has been identified to contain probably all major colonies (Figure 1) of cliff nesting species located in the region (Bailey and Faust, 1981). This unique distinction makes the refuge coast an ecologically desirable area for monitoring the variety of sympatric seabirds in their local habitats, and will provide indications of the functional state of the system in which they live.

LEGEND

Shore Birds .



Key Habitat Area

High Density

Medium Density

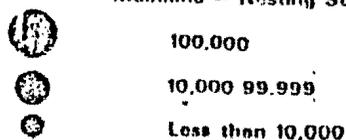
Low Density

Peregrine Falcon



Low Density

Mainland - Nesting Seabirds



100,000

10,000-99,999

Less than 10,000

9-2

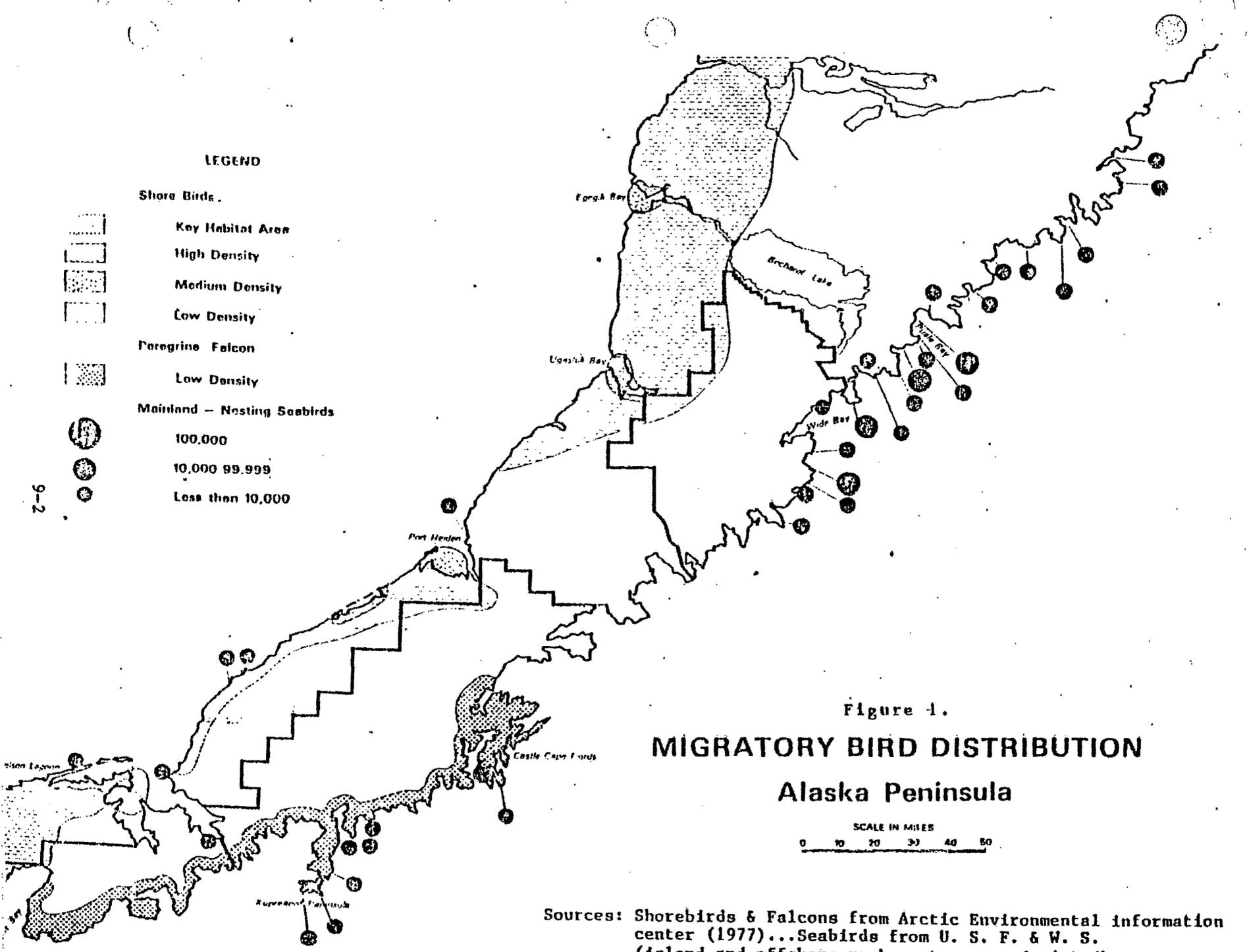
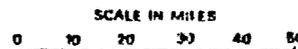


Figure 1.

MIGRATORY BIRD DISTRIBUTION

Alaska Peninsula



Sources: Shorebirds & Falcons from Arctic Environmental information center (1977)...Seabirds from U. S. F. & W. S. (island and offshore rock nesters not depicted)

From: Alaska Peninsula EIS, 1980.

II. PROCEDURE

Surveying seabird colonies or rafts of seabirds and waterfowl is multifaceted, involving several modes of transportation and technique, depending on monetary and personnel limitations. Bailey and Faust (1980, 1981) intensively surveyed 550 km (341 miles) of Alaska Peninsula coastline in seven weeks with an inflatable raft. Sowl (1982) and Arneson (1980) have emphasized the need for similar inventory methods if good estimates of seabird populations are to be obtained. This involves "on-ground" (or "on-water") surveying and ground-truthing (spotting scope), not only as census tools, but as cross-checks to aerial observer bias. Burrowing, reclusive species with nocturnal habits, like storm petrels (family Procellariidae), Ancient Murrelets (Synthliboramphus antiquus) and Cassins (Ptychoramphus aleuticus) and Rhinoceros Auklets (Cerorhiuca monocerata) could be present but aerial survey techniques are not adequate to detect them. Some species have been observed in low numbers but could be more plentiful than data indicate (Pigeon Guillemot, Kittlitzs and Marbled Murrelet, puffins, bald eagle and falcons) (Sowls, et. al., 1978).

The 169 km (105 miles) refuge coastline could be surveyed by raft in about two or three weeks with experienced personnel. This, however is not economically possible. Therefore, an aerial reconnaissance will be coordinated in conjunction with other refuge wildlife inventories or related refuge activities.

The largest mainland nesting colonies known on the Alaska Peninsula exist in Becharof NWR, therefore, accurate assessment of colony populations is paramount.

On aerial surveys, the flight route along the shoreline will follow the land contour and extend to outlying islets and seastacks. The flight path should be flown low along the shoreline within 100 metres of the shore at about 110-130 km/hr. (68-81 mph). Searches should not be conducted in rain or wind exceeding 25 km/hr. (15 mph) or if wind is gusty.

The aircraft should be kept over water for safety purposes and far enough away from the shoreline so important shoreline is not obscured from the primary observer by pontoons or wings during flight banking.

Several passes of bird groups should be flown when estimating numbers. The pilot should take precautions when making passes so not to "haze" birds, creating a flight hazard or causing them to prematurely abandon nests. Arneson (1980) stated the preferred method for surveying seabirds in Alaska utilized two observers and a pilot. The use of a PA-18 Piper Supercub, coupled with limited personnel will preclude this advantage.

A 35mm SLR camera should be used extensively for accurate counts and later cross-checked with observer estimates to learn bias estimation tendencies. Groups larger than 25 should be photographed with a 50mm or 28mm wide angle lens, depending on location and distribution (spread) of colony size. All observations should be recorded immediately on USGS 1:63360 topographic maps, noting date, time, weather, species, etc. and applicable data. Data should be summarized on USFWS colony status records (Exhibit 1) to include and update the Catalog of Alaska Seabird Colonies.

A hand held tape recorder w/voice-activated microphones should be used to supplement observations with verbal notes.

Bailey and Faust (1981) documented extensive predation of seabird colonies on islands off Becharof and other Alaska Peninsula shores. Bear sign (swaths through grass; visual observation) or any other predator sign should be noted on the field map or tape recorder and later documented in a summary.

A minimum of two complete Pacific side surveys should be carried out per season. Once begun, survey dates should be consistent each year. Nysewander and Patten (1983) and Nelson and SOWLS (1982) visited colonial waterbird nesting areas between 8-11 July (before gull chicks fledged) during studies in South central Alaska. Therefore late June may be optimal for observing nesting colonies in peak numbers (early count). This survey will be coordinated with the refuge tundra swan nesting surveys conducted in June.

A "late season" survey will be coordinated with aerial brown bear surveys based at Becharof Lake, or combined with marine mammal and/or raptor surveys in mid-August. When refuge funds and manpower permit seabird inventories specifically, the inventory procedure will be modified for optimum data collection.

Number of Personnel: One pilot and one observer.

Qualifications of Personnel: Pilot must be OAS qualified. Observer must have familiarity with judging bird colony sizes and species while conducting aerial surveys.

Dates of Inventory: Survey 1 - late June; Survey 2 - mid-August

Time of Day: Daylight hours.

Weather Conditions: Optimal conditions - clear skies, no precipitation and calm winds. Survey activities should cease during precipitation or gusty winds or winds above 25 km/hr. (15 mph).

Survey Unit: Shelikof Strait side of Becharof NWR.

Census Route: Becharof NWR shoreline contour and outlying islets and seastacks.

Method of Transportation: Piper Supercub or similar aircraft flown at 110-130 km/hr. and 100-200 feet AGL depending on terrain and weather conditions; flown in a manner which permits observer optimum visibility of wildlife being inventoried.

Census Aids: Binoculars, portable tape-recorder (optional), 35mm camera w/70-210mm or comparable zoom lens, 50mm lens, 28mm wide angle lens, film, sunglasses and two hand-held tape recorders with voice activated microphones.

Equipment and Supplies: Complete survival gear for aircraft - if on floats - life jackets, shoulder harnesses, aircraft intercom, flight helmets, flight suits, and gloves - applicable topographic maps, notebook, pencils and clipboard.

Photography: Photographs should be taken at shutter speeds no less than 1/250th second with appropriate aperture opening.

Summary Data Forms: Utilize the USFWS Colony Status Record.

Data Filing:

- 1) Original to refuge file.
- 2) Copies to Operations Supervisor (S) Regional Office, USFWS, Anchorage, AK.
- 3) Colony Status Record form to: Wildlife Assistance Marine Bird Mgt. Project, Anchorage Regional Office. For incorporation in the Alaskan Seabird Colony Catalog-Archives.

III. SPECIAL CONSIDERATIONS

Sowls, et. at. (1978) pointed out some concerns in assessing seabird colony numbers:

- 1) The numbers of seabirds at colonies vary greatly with time of day, weather, stage in the nesting cycle, and level of reproductive effort in a given year.
- 2) The ability of individuals to accurately and quickly assess large numbers of birds may be highly variable with no universal bias in one direction or another.

Therefore to make a relatively accurate assessment of large numbers of colonial or rafted birds, individuals must learn their bias tendencies, and practice their technique prior to flying seabird surveys. Aerial population estimate should be exercised periodically.

III. SPECIAL CONSIDERATIONS

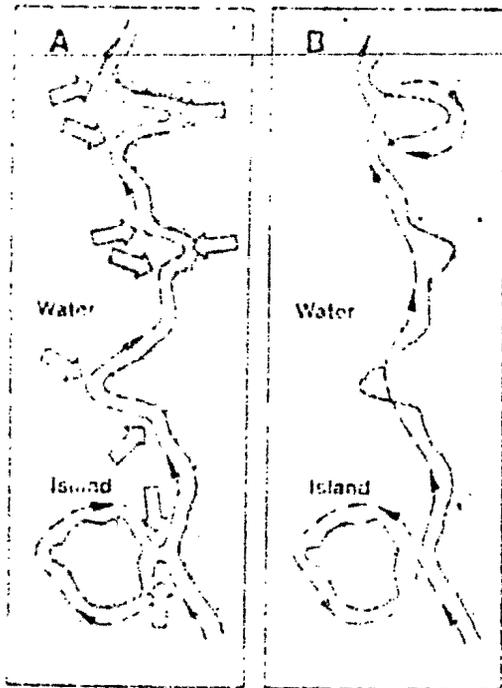


Fig. 3. Hazardous (A) and recommended (B) flight paths along the same shoreline. The path is shown as the dashed line and its direction is indicated by arrows.

RECOMMENDATIONS FOR LOW-ALTITUDE AERIAL SURVEYS

Low-altitude flying is tedious and tiring for both the observer and pilot. It is also hazardous; there is virtually no time to recover from problems. The following recommendations are based on our experiences and discussions with pilots, including the one who crashed.

The most important single consideration for low-altitude safety is the amount of turning and maneuvering. The chance of stalling increases proportionally with the number of turns and tightness of turns. Frequent turns are also fatiguing. Our crash resulted from a gust of wind that stalled the wing during a tight turn, causing a spin. Surveys that cannot use

completely straight transects, e.g., when searching for eagle nests, can still eliminate all or most tight turns as illustrated in Fig. 3.

Safety may also be improved by permitting some departure from standardized search methods depending on curvature of shoreline, quality of habitat, amount of water available for forced landings, and weather. It is sometimes possible to fly higher, over land, or down the middle of some islands, peninsulas, bays, and small bodies of water rather than following the shoreline closely. Proper judgment must be learned through training and experience.

The remaining suggestions involve common sense and may seem obvious, but they are too important and too frequently overlooked in bush flying simply to be assumed. (1) Only experienced and willing pilots should be used if at all possible. (2) Purpose of the work and intended flight plans, routes, and navigation responsibilities should be planned carefully and reviewed with the pilot prior to take-off. (3) Surveys should be discontinued or postponed under clearing or unsafe flying conditions. The pilot has the final say on flying. (4) Pilot and observers need proper sleep before flying, and should take occasional breaks by landing and resting during the day. Late nights or fatigue seriously impair alertness and reaction time. (5) All persons must be conscious of and respect each other's tasks and the pressures of such work.

SOURCE:
BIAS IN SURVEYS OF NESTING EAGLES - Grier et al.
J. Wildl. Manage. 15:11, 1951

IV. MANPOWER AND COSTS*

Mandays:

GS-12 at \$160 per day for 3 days	=	\$480
GS-7 at \$94 per day for 3 days	=	<u>282</u>
Subtotal	=	\$762

Transportation: Piper Supercub

Availability at \$20 per day for 3 days	=	\$ 60
Rate at 45 per hour for 12 hours	=	<u>540</u>
Subtotal	=	\$600

Supplies and Materials:

Aviation fuel at \$2 per gallon and 7.5 gallons per hour for 12 hours	=	\$180
Total Estimated Costs	=	\$1542

Prepared by: Randall John With Date: 9/28/83

Reviewed by: John J. Taylor Date: 9/28/83

Approved by: Larry R. Calvert Date: 4/14/84

* Listed are minimum costs, since most surveys will be flown incidental to other surveys. Therefore, costs may be absorbed in "other surveys" funds.

Description of Colony

Access _____

Vegetation & Physiographic Characteristics _____

Human Activity _____

Mammalian Predators, Livestock, etc. _____

Marine Mammals _____

Census Methods & Data Status _____

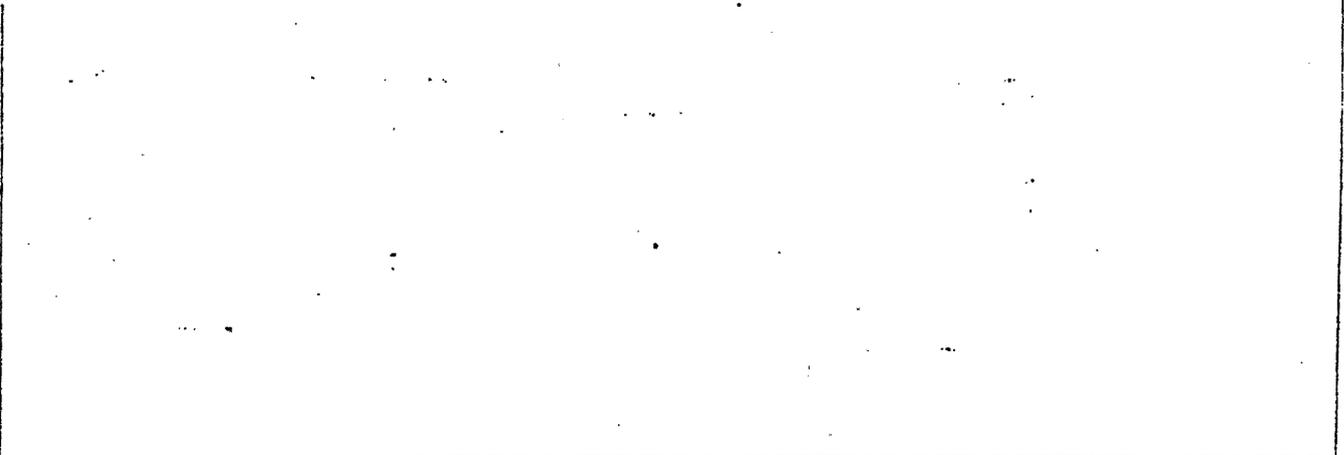
Sample Plots Established _____

Photo Coverage _____

Overall Evaluation of Colony _____

Supplemental Material & Data Attached (list) _____

General Colony Sketch



Refuge: Becharof

Procedure No.: 10

Species: Homo sapiens sapiens

Title: Public Use

I. PURPOSE

Becharof National Wildlife Refuge (BNWR) was established to include the management and conservation of fish and wildlife populations and habitats (Title III, ANILCA). Additionally, diverse subsistence and recreational opportunities like hunting, fishing, trapping, berrypicking and wilderness hiking and camping have been determined to be compatible with the establishment of BNWR. A public use inventory procedure is necessary to meet reporting requirements, but more importantly, to assist with planning and program direction by determining the types of public use which are in greatest demand, have the greatest impact on fish and wildlife, and have the greatest potential for conflicting with the purposes for which the refuge was established.

BACKGROUND - BNWR includes 1.4 million acres on the Alaska Peninsula. Becharof Lake, located within the boundaries of the refuge, is Alaska's second largest lake with the world's second largest sockeye salmon run, occurring in the numerous streams that feed the lake.

The southeastern one-third of the refuge is designated wilderness. The Alaska Peninsula is internationally known for its prized species of brown bear, moose, caribou and several species of salmon and trout. This is evidenced by the high visitation by foreign recreation enthusiasts. Alaskans from local and metropolitan areas sojourn to the Peninsula primarily to hunt and fish. In addition to participating in other

forms of recreation, residents from local villages regularly take fish and game from the refuge for subsistence. Airplane and boat are the primary modes of access to the refuge.

The public use inventory plan is general in nature. Public use estimates for the vast refuge area is collected from tidbits of non-random data. The data extrapolations necessary to meet existing reporting requirements and planning needs are inherently inaccurate and statistically indefensible, but are the best that can presently be collected with available funds and existing manpower. Competing demands limit refuge operations in the area of public use monitoring.

II. PROCEDURE

Few affordable sources of public use data exist. All individuals conducting commercial guiding operations on the refuge are required to submit annual reports detailing the number of clients, client time in the field, and take of fish and wildlife. Information provided by guides is generally reliable for non-residents, since most non-residents are required to be guided when hunting brown bear. However, data on non-guided residents and non-residents, and subsistence users is not available from this source.

All caribou, moose and brown bear hunters on the Alaska Peninsula are required to file harvest report cards to the Alaska Dept. of Fish & Game (ADF&G) annually. The cards provide harvest data by game management sub-unit and by hunting season (i.e. July 1-June 30, annually). The report cards are of marginal value to BNWR since much of the information

cannot be differentiated between on and off refuge activity. Local non-compliance with the report card filing is widespread.

Field checks of refuge users during law enforcement or other refuge patrols provides some data on public use, however, this data is non-random. Individuals operating from established landing sites can be visited with relative ease while people operating from boats or away from airstrips can be contacted only with difficulty and expense.

Interviews with people at locations such as King Salmon airport provides some insight into quantity and types of use occurring on BNWR. The effort is labor intensive since only a small percentage of people passing through King Salmon are destined for the refuge.

Air taxi operators may be willing to provide information. Most non-local users visit the refuge via aircraft. Questionnaires, if supplied to air taxi operators could possibly provide some information, however, record keeping by air taxi operators is not designed to provide this type of information so their responses, if any, may be mostly estimates.

A substantial, but unknown percentage of refuge users are residents from local villages and personnel from the King Salmon Air Force Station. House to house surveys provide sufficient information to develop indices for estimating public use from this source. This type of survey is currently being conducted by local ADF&G subsistence personnel and is made available to the refuge as it is gathered.

Monthly inquiries received by the refuge regarding visits to the refuge will be maintained in the public use file. Number, location (state of origin) and type of public use will be listed on the form.

If possible, a guest register will be maintained with the air taxi services in King Salmon and Naknek in hopes of gathering refuge use data. Materials will be provided by the refuge.

The attached procedure for filling out public use and hunt reports will be used until better data can be collected. Entries are estimates based on staff observations and contacts, conversations with ADF&G, guides, air taxi operators, village residents and others with knowledge of the area. As estimating procedures are changed they will be documented.

Number of Personnel: One individual from refuge staff.

Qualifications of Personnel: Warm personality, willingness to deal with the public.

Survey Units: Local sources identified in narrative.

Method of Transportation: Pa-18 Supercub; Refuge vehicle (truck).

Equipment and Supplies: Pencil, paper, 35mm SLR camera (to document public use activities on refuge).

Summary Data Form: Instructions for completing monthly report (see Exhibit 2).

Disposition of Survey Data:

- 1) File original in BNWR file under RE 7.8.2. Public Use.
- 2) Send copies to: Operations Supervisor (S), USFWS Reg. Office, Anchorage, AK

III. MANPOWER AND COSTS

Mandays:

GS-12 at \$160 per day for 2 days = \$320
GS-7 at \$94 per day for 12 days = 1128
Subtotal = \$1448

Transportation: PA-18 Supercub

Availability at \$20 per day for 2 days = \$ 40
Rate at \$45 per hour for 16 hours = 720
Subtotal = \$760

Supplies and Materials:

Aviation fuel at \$2 per gallon and
7.5 gallons per hour for 16 hours = \$120
Supplies, misc., paper, pencil, xerox, mail, etc. = 10
Guest registers = 10
Boat fuel, and oil \$2 per gallon and
18 gallons per day for 3 days = 108
Subtotal = \$248

Total Estimated Costs = \$2456

Prepared by: Randall John Wolk Date: 9/28/83

Reviewed by: John J. Taylor Date: 9/28/83

Approved by: Larry A. Coburn Date: 4/10/84

PUBLIC USE REPORT

Exhibit 1

Organization Number

Name

Report Period
Yr Mo

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0						0	0						

OUTPUT TYPE	LINE CODE										NO. VISITS 27-35	ACTIVITY HOURS 36-45	LEAVE BLANK 46-55	
	18	19	20	21	22	23	24	25	26					
INTERPRETATION														
Wildlife Trails - Nonmotorized														
Self Guided	0	1	1	0	0	0	0	P	S					
Conducted	0	1	2	0	0	0	0	P	C					
Wildlife Tour Routes - Motorized														
Self Guided	0	2	1	0	0	0	0	P	U					
Conducted	0	2	2	0	0	0	0	P	T					
Interpretive Center	0	3	0	0	0	0	0	P	R					
Visitor Contact Station	0	4	0	0	0	0	0	P	Q					
Interpretive Exhibits - Demonstra														
Self Guided	0	5	1	0	0	0	0	P	A					
Conducted	0	5	2	0	0	0	0	P	M					
Other On-Refuge Programs	0	6	0	0	0	0	0	P	R					
ENVIRONMENTAL EDUCATION														
Students	1	0	0	0	0	0	0	P	E					
Teachers	1	1	0	0	0	0	0	P	H					
RECREATION-WILDLIFE CONSUMPTIVE														
Hunting Mig. Birds - Waterfowl														
Ducks	2	0	1	0	0	0	0	P	D					
Geese	2	0	2	0	0	0	0	P	G					
Swans	2	0	3	0	0	0	0	P	N					
General Waterfowl	2	0	4	0	0	0	0	P	W					
Hunting Mig. Birds - Other	2	0	5	0	0	0	0	P	X					
CONTROL TOTALS														
	9	9	2	0	0	0	0	R	Z					

Region _____ Station _____ Date Prepared _____

Name _____

PUBLIC USE REPORT EXHIBIT 1

IR Code	Organization Number				Name				Report Period						
	3	4	5	6	7	8	9	10	11	12	13	14	Yr. 15	Mo 16	17
	1	0					0	0							

OUTPUT TYPE	LINE CODE										NO. VISITS	ACTIVITY HOURS	LEAVE BLANK		
	18	19	20	21	22	23	24	25	26	27-35				36-45	46-55
RECREATION-WILDLIFE CONSUMPTIVE (c't)															
Hunting Resident Game															
Upland Game Birds	2	1	1	C	0	0	0	P	L						
Big Game				Species (Code)											
Deer - Gun	2	1	2					P	H						
Deer - Bow	2	1	3					P	J						
	2	1	4					P	K						
	2	1	4					P	K						
	2	1	4					P	K						
	2	1	4					P	K						
Small Game	2	1	5	0	0	0	0	P	Z						
Other Game	2	1	6	0	0	0	0	P	U						
Trapping	2	1	7	0	0	0	0	U	G						
Fishing															
Warmwater	2	2	1	0	0	0	0	U	W						
Coldwater	2	2	2	0	0	0	0	U	C						
Saltwater	2	2	3	0	0	0	0	U	S						
Clams, Crabs, Oysters, Frogs	2	2	4	0	0	0	0	U	Y						
Other Consumptive Wildl. Rec.	2	3	0	0	0	0	0	U	M						
RECREATION-WILDLIFE NON-CONSUMPTIVE															
Camping	3	0	0	0	0	0	0	U	H						
Picnicking	3	1	0	0	0	0	0	U	B						
CONTROL TOTALS	9	9	2	0	0	0	0	R	Z						

PUBLIC USE REPORT

EXHIBIT 1

Page 3 of 3

Organization Number										Name				Report Period			
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Yr	Mo	Da
1	0						0	0									

OUTPUT TYPE	LINE CODE										NO. VISITS 27-35	OUTPUT UNITS 36-45	LEAVE BLANK 46-55
	18	19	20	21	22	23	24	25	26	27			
RECREATION-WILDLIFE NON-CONSUMPTIVE												Act. Hr.	
Wildlife/Wildlands Observation													
Foot	3	2	1	0	0	0	0	U	E				
Land Vehicle	3	2	2	0	0	0	0	U	N				
Boat	3	2	3	0	0	0	0	U	L				
Other	3	2	4	0	0	0	0	U	P				
Photography	3	3	0	0	0	0	0	U	T				
Field Trials	3	4	0	0	0	0	0	U	X				
RECREATION - NON-WILDLIFE													
Camping	4	0	0	0	0	0	0	R	C				
Picnicking	4	1	0	0	0	0	0	R	D				
Swimming	4	2	0	0	0	0	0	R	S				
Boating	4	3	0	0	0	0	0	R	B				
Waterskiing	4	4	0	0	0	0	0	R	W				
Off Road Vehicling	4	5	0	0	0	0	0	R	V				
Other	4	6	0	0	0	0	0	R	M				
TOTAL VISITS TO REFUGE	0	9	0	0	0	0	0	P	V				
FISH & WILDLIFE INFORMATION											Pet. Saps		
Public Inquiries	5	0	1	0	0	0	0	F	P				
News Releases	5	0	2	0	0	0	0	F	N				
Personal Appearances	5	0	3	0	0	0	0	F	A				
Professional Services	5	0	4	0	0	0	0	F	S				
Exhibits	5	0	5	0	0	0	0	F	E				
CONTROL TOTALS	9	9	2	0	0	0	0	0	0	0			

Region _____ Station _____ Date Prepared _____

Name _____

MONTHLY REPORT

PUBLIC USE REPORT

TR Code 301

Form No. 3-239 a, b, c, Rev. 12/75

Information in this series includes everything in the interpretation, education, and recreation categories.

The form consists of three pages. It is to be submitted monthly within ten (10) working days of the end of the the month.

InstructionsChecklist

Complete the identification block for each page, entering "Report Period" information as follows:

Is the identification block complete, correct, and the same on each page?

- (15) Report Period-Year.
Enter the last digit of the CALENDAR year, and not the FISCAL YEAR.

Is the report year correct for the given month?

- (16-17) Report Period-Month.
Enter calendar month number covered by the report. Months 1-9 are recorded with a leading zero (0) e.g., January = 01.

Must be completed.

OUTPUT TYPE

- (18-26) Line Code.
Most output types are preprinted. The only exception occurs on page 2 when big game are hunted. In that case, print the name of the species hunted on one of the blank lines under "Hunting Resident Game, Big Game" and insert the appropriate four-digit species code in Columns 21-24 (see Wildlife Species Code List-Mammals on page 50).

On page 2, is the name and species base code entered for all reported big game species?

- (27-35) No. Visits.
The number of visits to each activity during the report month.

Are both Number of Visits and Activity Hours recorded for each activity reported?

- (36-45) Activity Hours.
The number of hours credited to each activity occurring on the refuge. If the activity is being reported for more than one site, enter the total of all sites. Visits and activity hours may be recorded only in preprinted lines of activities.

InstructionsChecklist

- (46-55) Non-Standard Total Refuge Benefit Units Columns must be blank.
 (RBUs).
 Not applicable. Do not use this column.

TOTAL VISITS TO REFUGE

- (19-26) Line Code.
 Pre-printed. Are total visits reported?
 Is this number as large as the number of visits to any one activity?
- (27-35) Enter total visits to the refuge for the month. This figure should be less than or equal to the sum of the visits for all activities. However, this number should be at least as large as the number of visits to any one activity.

CONTROL TOTALS

Add entries in each column. Total columns on EACH PAGE SEPARATELY.

Remember to fill in all the identification information at the bottom of each page.

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