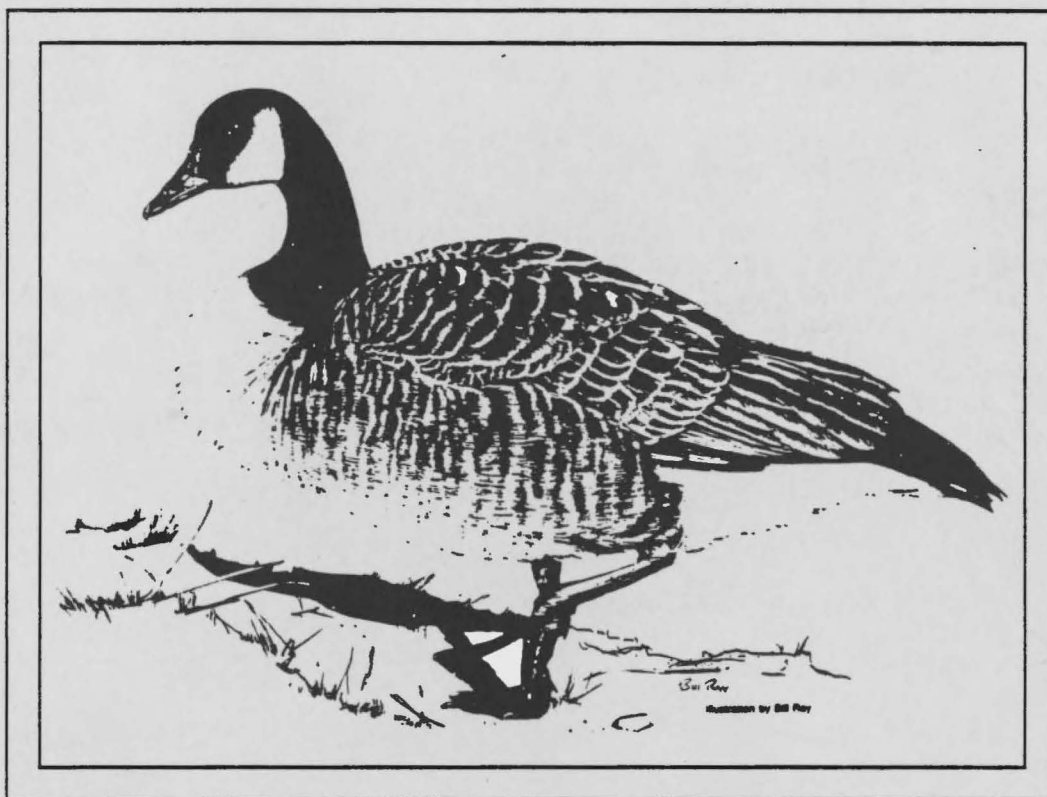


Alaska Department of Fish and Game
Division of Wildlife Conservation
Federal Aid in Wildlife Restoration
Annual Report of Survey—Inventory Activities
1 July 1987—30 June 1988

WATERFOWL



by
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1987-88
ALASKA WATERFOWL REGULATIONS SUMMARY
SEASONS AND LIMITS

Waterfowl (* Except by falconry)

DUCK STAMP No person, resident or nonresident, 16 years of age or older may take waterfowl unless he carries a current, signed federal migratory bird hunting stamp (duck stamp) on his person. A duck stamp is not required for hunting snipe or cranes. In addition, a state waterfowl tag (stamp) is required for taking waterfowl in the state, except by persons exempted by state law.

Units by Species	Bag Limits	All Hunters Open Seasons
DUCKS • Except sea ducks • Provided that not more than 2 per day, 6 in possession may be pintails, and 1 per day, 1 in possession may be a canvasback		
Units 1-4	Five a day, fifteen in possession	Sept. 1—Dec. 16
Units 5-7, 9, 10 (Unimak Island only), and 14-16	Six a day, eighteen in possession	Sept. 1—Dec. 16
Units 8 and 10 (except Unimak Island)	Five a day, fifteen in possession	Oct. 8—Jan. 22
Units 11-13 and 17-26	Eight a day, twenty-four in possession	Sept. 1—Dec. 16

SEA DUCKS • Elders, scoters, oldsquaw, harlequin, and mergansers

Units 1-7, 9, 10 (Unimak Island only) and 11-26	Fifteen a day, thirty in possession	Sept. 1—Dec. 16
Units 8 and 10 (except Unimak Island)	Eighteen a day, thirty in possession	Oct. 8—Jan. 22

CANADA GEESE

- Except Cackling Canada Geese
- No more than four a day or eight in possession may be any combination of Canada or white-fronted geese. The combined bag limit of Canada, white-fronted and snow geese is six a day, twelve in possession.

Units 1-4, 7, 9 (except 9E), 10 (Unimak Island only), 11-17, and 19-26	Four a day, eight in possession	Sept. 1—Dec. 16
Units 5 and 6	Four a day, eight in possession	Sept. 21—Dec. 16
Unit 8	No open season	
Units 9E, 10 (except Unimak Island) and 18	No open season	

CAKCLING CANADA GEESE

Units 1 thru 26	No open season	
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BRANT

Units 1-7, 9, 10 (Unimak Island only) and 11-26	Two a day, four in possession	Sept. 1—Dec. 16
Units 8 and 10 (except Unimak Island)	Two a day, four in possession	Oct. 8—Jan. 22

- No more than four a day or eight in possession may be any combination of Canada or white-fronted geese. The combined bag limit of Canada, white-fronted and snow geese is six a day, twelve in possession.

WHITE-FRONTED GEESE

Units 1-7, 9, and 14-18	Two a day, four in possession	Sept. 1—Dec. 16
Unit 8	Two a day, four in possession	Oct. 8—Jan. 22
Unit 10 (except Unimak Island)	Four a day*, eight in possession*	Oct. 8—Jan. 22
Units 10 (Unimak Island only), 11-13, and 19-26	Four a day*, eight in possession*	Sept. 1—Dec. 16

SNOW GEESE

- The combined bag limit for snow, Canada, and white-fronted geese is six a day, twelve in possession.

Units 1 (except 1E), 2-7, 9, 10 (Unimak Island only), and 11-26	Six a day, twelve in possession	Sept. 1—Dec. 16
Unit 1E	No open season	
Units 8 and 10 (except Unimak Island)	Six a day, twelve in possession	Oct. 8—Jan. 22

EMPEROR GEESE

Units 1—26	No open season	
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* The total combined bag and possession limits for migratory game birds taken with the use of a falcon under a falconry permit is three per day, six in possession and may not exceed more restrictive limits for any of the species listed in this subsection. Falconry season for migratory game birds is September 1 - December 16.

TUNDRA SWANS • 300 permits will be issued.

Units 22	One per season by registration permit only	Sept. 1—Oct. 10
All other Units	No open season	

CRANES

Units 1-7, 9, 10 (Unalakleet Island only) and 14-17	Two a day, four in possession	Sept. 1—Dec. 16
Units 8 and 19 (except Unalakleet Island)	Two a day, four in possession	Oct. 8—Jan. 22
Units 11, 12, 13, and 18-20	Three per day, six in possession	Sept. 1—Dec. 16

SNIFE

Units 1-7, 9, 10 (Unalakleet Island only) and 11-16	Eight a day, sixteen in possession	Sept. 1—Dec. 16
Units 8 and 19 (except Unalakleet Island)	Eight a day, sixteen in possession	Oct. 8—Jan. 22

NOTE: Neither a federal or state "duck stamp" is required for hunting snipe or cranes.

WEAPONS: Waterfowl may be taken with a shotgun (not larger than 10 gauge) or bow and arrow, but not rifle or pistol.

PLUGS: Shotguns must be plugged to a 3-shell capacity or less for waterfowl hunting.

CONVEYANCES: Hunting is not permitted from an aircraft, motor-driven vehicle, airboat, jet boat, or propeller driven boat, which the motor of such has not been completely shut off and its progress therefrom has ceased.

POSSESSION: No state tagging requirements, see Federal Regulations.

TRANSPORTATION: Waterfowl may be plucked in the field, but one fully feathered wing or the head must remain attached while being transported.

SHOOTING HOURS: One half hour before sunrise to sunset.

STAMPS: No person 16 or more years of age may take waterfowl unless he carries a current validated Federal migratory bird hunting stamp (Duck Stamp) and Alaska Waterfowl Conservation tag (stamp) on his person.

SPECIAL RESTRICTIONS: Special vehicle regulations are in effect for Palmer May Flats State Game Refuge. Check the Alaska Game Regulations book or contact the local Fish and Game office for details.

SUMMARY OF FEDERAL REGULATIONS

In addition to State Regulations, these Federal rules apply to the taking, possession, transportation, and storage of migratory game birds:

Restrictions. No person shall take migratory game birds:

- From a sink box (a low-floating device, having a depression affording the hunter a means of concealment beneath the surface of the water).
- By the use or aid of live decoys.
- Using records or tapes of migratory bird calls, or sounds, or electrically-amplified imitations of bird calls.
- By the aid of baiting (placing feed such as corn, wheat, salt, or other feed to constitute a lure or enticement). Hunters should be aware that a baited area is considered to be baited for ten (10) days after the removal of bait, and it is not necessary for the hunter to know an area is baited to be in violation.

Field Possession Limit. No person shall possess more than one daily bag limit while in the field, or while returning from the field to one's car, hunt camp, etc.

Possession of Live Birds. Crippled birds must be immediately killed.

Transportation. No person shall import during any one week beginning on Sunday more than: 1) 25 doves and 10 pigeons from any foreign country, and 2) 10 ducks and 5 geese from any foreign country except Canada and Mexico (may not exceed Canadian or Mexican export limits and these vary from province to province and from state to state). In addition, one fully-feathered wing must remain attached to all migratory game birds being transported or shipped between a port of entry and one's home or to a migratory bird preservation facility. No person may import migratory birds belonging to another person.

Possession. Federal Regulations require migratory birds to be tagged before being left at any place other than the hunter's residence or placed in the custody of another person for any purpose. Tags must state the number and kind of birds, dated killed, and address and signature of hunter.

Shipment. No person shall ship migratory game birds unless the package is marked on the outside with: 1) the name and address of the person sending the birds, 2) the name and address of the person to whom the birds are being sent, and 3) the number birds, by species, contained in the package.

CAUTION: More restrictive regulations may apply to National Wildlife Refuges open to hunting. For additional information on Federal regulations, contact Special Agent-in-Charge, U. S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, AK 99503, telephone (907) 786-3311.

WATERFOWL HARVEST AND HUNTER ACTIVITY

GAME MANAGEMENT UNITS: All

GEOGRAPHIC DESCRIPTION: Statewide

PERIOD COVERED: 1 July 1987 - 30 June 1988

Introduction

During the period 1972 to 1985 state estimates of annual waterfowl harvest and hunter activity were generated from a survey of all resident hunters. Approximately 10% of the individuals on a license sales file maintained by the Alaska Department of Revenue were randomly selected to receive questionnaires each year. This was a very expensive, time-consuming survey that frequently produced questionable results. The small number of waterfowl hunters in the license file required a large sampling effort. From 4567 to 8531 questionnaires were mailed annually to obtain 449-1098 responses that were usable for harvest estimates (Table 1). Because of the difficulty in obtaining accurate, current license sales records that represented the entire state, the usefulness of these records is debatable; therefore the results of the survey are questionable. With the authorization of a state duck stamp in 1984, a list of waterfowl hunters became available for sampling. This reduced sampling costs considerably, but unfortunately, maintenance of records of stamp sales remained poor. As a result, the survey was temporarily discontinued in 1986.

A redesigned state survey was instituted in 1987. Results of this survey, along with data from the U. S. Fish and Wildlife Service (FWS) survey, were used to estimate hunter activity and harvest in Alaska during the 1987-88 waterfowl season. Because of the time schedule for this report, final FWS survey data for the reporting period are not available. Since FWS third-quarter harvest data for Alaska typically do not vary significantly from final survey data, they will be used in this report.

Methods

Major changes in the printing format of the state duck stamps, recording stamp sales, and distributing hunter questionnaires were made in 1987. Stamps were produced in booklets that included the following: (1) a record of each stamp for the Alaska Department of Revenue, (2) a copy of this record for ADF&G, (3) a self-addressed and preposted hunter questionnaires for the first 2 individuals purchasing stamps out of each booklet (Fig. 1), and (4) instructions to the licensing officers. The distribution of questionnaires to hunters when stamps were purchased reduces the dependency of the survey on license sales records. Sales information is now needed only for accounting purposes and as a source of stamp buyer names and addresses, should a reminder

Table 1. Sample effort and return rates for the Alaska state waterfowl hunter survey, 1972-85.

Year	Number of licensed resident hunters	Sample rate (%)	Number of questionnaires	Total Number of questionnaires returned	Return rate (%)	Number of questionnaires usable	% Usable
1972	58,747	9.8	5,756	3579	67.8	910	15.8
1973	66,872	6.8	4,567	3161	70.8	735	16.1
1974	65,697	10.1	6,610	4249	64.9	1019	15.4
1975	64,720	10.0	6,500	3324	51.5	911	14.0
1976	69,614	10.1	7,000	4143	60.2	1098	15.7
1977-81	No State Survey Conducted						
1982	79,000	9.7	7,639	3892	50.9	716	9.4
1983	80,610	10.0	8,061	4661	58.8	781	9.7
1984	76,981	11.0	8,531	4881	57.2	743	8.7
1985	75,070	10.0	7,506	3135	42.5	449	6.0

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

WATERFOWL HUNTER SURVEY 1987 - 1988

STAMP NO. 057031

DEAR HUNTER:

Your cooperation is needed to better manage Alaska's waterfowl. By accurately answering the questions below concerning your hunting activities in 1987, you can help insure proper management and good hunting for the future. If you can't remember exact numbers, give your best estimates. Complete the form printed below and drop this card in the mail. No postage stamp is necessary: Thank you for your cooperation.

NUMBER BIRDS SHOT AND RETRIEVED

— PLACES HUNTED —

(FOR EXAMPLE, MINTO FLATS, STIKINE FLATS, SUSITNA FLATS, ETC.)

PART I (ALL RECIPIENTS COMPLETE)

- A. DID YOU BUY A FEDERAL DUCK STAMP IN 1987? YES ☐ NO ☐
- B. HOW MANY ALASKA STATE DUCK STAMPS DID YOU BUY? ☐
- C. DID YOU HUNT FOR WATERFOWL DURING THE 1987-1988 SEASON? YES ☐ NO ☐

PART II (COMPLETE ONLY IF YOU HUNTED)

- D. PLEASE LIST ALL THE PLACES WHERE YOU HUNTED WATERFOWL, NUMBER OF DAYS HUNTED AT EACH LOCATION AND NUMBER OF BIRDS SHOT AND RETRIEVED.

	9. DAYS HUNTED	10. DUCKS	11. SEA DUCKS & MERGANSERS	12. CANADA GESE	13. SNOW GESE	14. WHITE-FRONTED GESE	15. BRANT	16. EMPEROR GESE	17. UNKNOWN GESE	18. CRANE	19. SNIFE
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											

Fig. 1. Alaska State waterfowl hunter questionnaire.

questionnaire become necessary.

Harvest location information from the questionnaires were coded by a hierarchical system based on specificity of responses. Locations were coded to the lowest level, or most specific location, when possible. When a specific location was not reported, a general area was assigned, based on the respondent's residence ZIP Code. These were then coded according to a geographical region (Fig. 2). For example, if a reported harvest of ducks from the Fairbanks area could not be assigned to a specific harvest location, the harvest would be coded to the Central Region (005). For reporting purposes, when the harvests for several locations were low and scattered throughout a local geographical area, harvest data were combined. For example, reported harvests from Kenai Lake, Skilak Lake, Kenai River, and Kasilof River were combined and reported as the Greater Kenai Peninsula area (119). Table 2 summarizes codes used to assign and report harvest locations in Alaska. To allow comparison of ADF&G and FWS data, harvest locations were also categorized according to location codes used in the FWS parts collection survey.

Reporting bias was corrected during data analysis, as described by Voelzer et al. (1982). Briefly, this was done by correcting for memory and prestige response biases by multiplying the reported duck and goose bags by 0.7895 and 0.8516, respectively. Adjustments for junior hunter activity were made by multiplying the estimated ducks and geese bagged by 1.0451 and 1.0871, respectively.

Because of the number of people in Alaska hunting without duck stamps and the incidence of hunting outside legal seasons, the assessment of waterfowl hunter activity and waterfowl harvest is complicated (Timm 1972). Because 24 people reported hunting without a federal duck stamp or did not respond to the relevant question, their data were not included in the analysis. Data on number of hunters, harvest, etc. in this report are based solely on federal duck stamps sales and, therefore, reflect only the reported fall harvest.

Results

Number of Hunters:

Based on licensing reports, 5,476 questionnaires were distributed to state duck stamp buyers; of these, 2515 were returned, representing a response rate of 45.9%. Two thousand three hundred and ninety-eight or 95.3% of the returned questionnaires contained sufficient information to be used in the survey.

Of the 2,279 hunters who reported purchasing a state duck stamp, 1,606 (70.5%) also reported hunting (Table 3), compared with a 1987 FWS estimate of 72.7% , a 1971-76 and 1982-85 state survey average of 68.4% active hunters, and a 1967-86 FWS average of 69.7% active hunters (Fig. 3). Based on the sale of 14,392 federal duck stamps

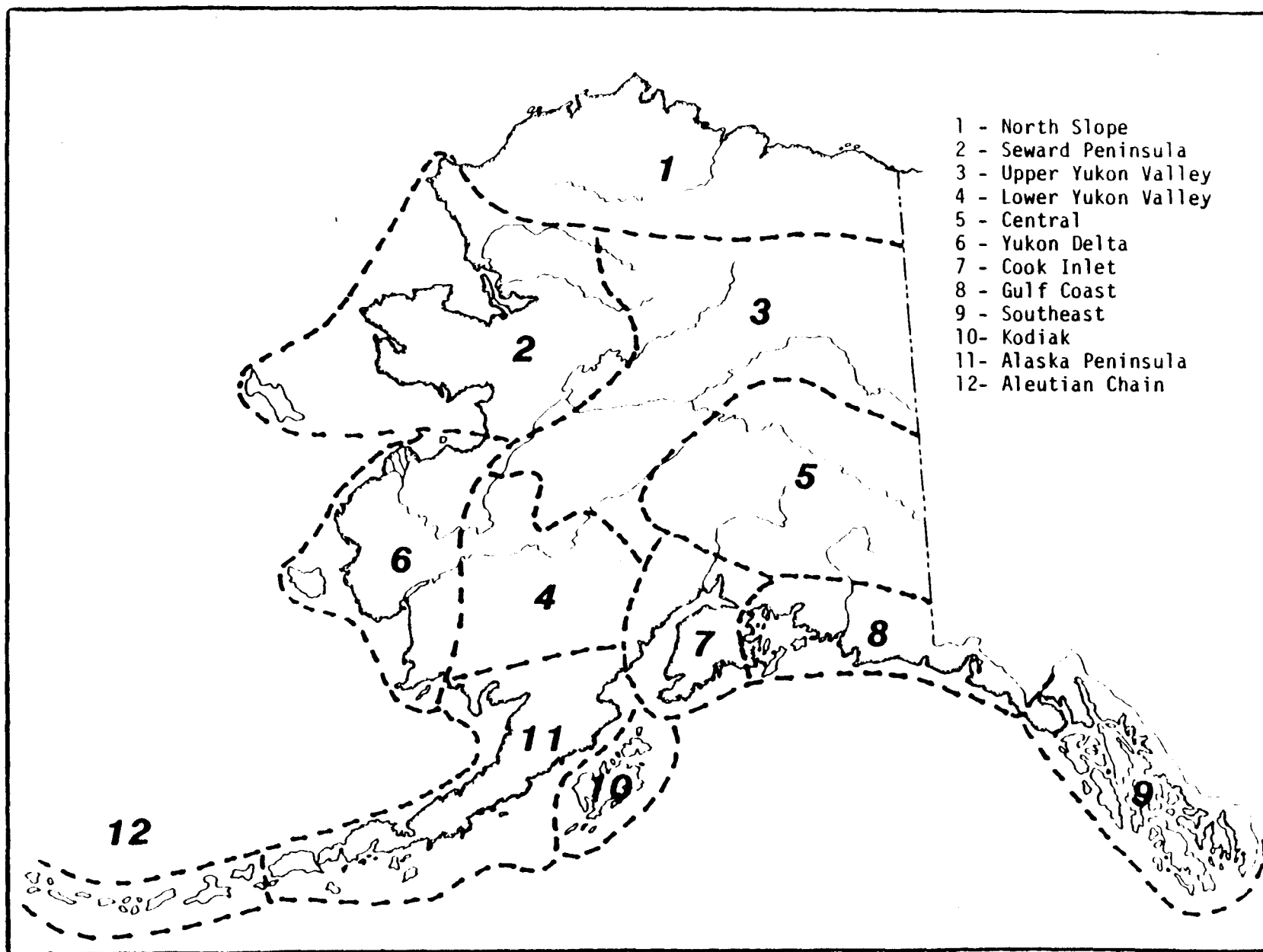


Figure 2. State waterfowl and crane harvest survey areas.

Table 2. Summary of codes used to assign harvest locations in Alaska.

ADF&G Code	FWS Code	ADF&G geographical region (R) and harvest location names	Original FWS "country" name	FWS harvest zone
000	0000	Unknown	Unknown	Unknown
001	0101	North Slope (R)	Arctic Slope	Northwest
002	0301	Seward Peninsula (R)	Seward Peninsula	NW
020	----	Shishmaref	Seward Peninsula	NW
021	----	Norton Sound	Seward Peninsula	NW
022	----	Nome area	Seward Peninsula	NW
023	----	Safety Lagoon	Seward Peninsula	NW
024	----	Serpentine River	Seward Peninsula	NW
003	0502	Upper Yukon Valley	Upper Yukon-Kuskokwim	Central
004	0502	Lower Yukon Valley	Upper Yukon-Kuskokwim	C
005	0702	Central (R)	Fairbanks-Minto	C
070	0752	Delta area	Fairbanks-Minto	C
071	----	Denali Highway	Fairbanks-Minto	C
079	0722	Eielson AFB	Fairbanks-Minto	C
080	----	Fort Wainwright	Fairbanks-Minto	C
081	0742	Healy Lake area	Fairbanks-Minto	C
082	0712	Minto Flats	Fairbanks-Minto	C
083	----	Salcha River	Fairbanks-Minto	C
084	0732	Salchaket Slough	Fairbanks-Minto	C
085	----	Tanana Flats	Fairbanks-Minto	C
086	----	Tetlin Flats	Fairbanks-Minto	C
087	0762	Tok-Northway	Fairbanks-Minto	C
006	0901	Yukon Delta (R)	Yukon-Kuskokwim Delta	NW
007	1103	Cook Inlet (R)	Anchorage-Kenai	Southcentral
115	1153	Chickaloon Flats	Anchorage-Kenai	SC
116	----	Eagle River	Anchorage-Kenai	SC
117	1133	Goose Bay	Anchorage-Kenai	SC
118	1193	Kachemak Bay	Anchorage-Kenai	SC
119	----	Greater Kenai Pen. area	Anchorage-Kenai	SC
120	----	Jim-Swan Lakes area	Anchorage-Kenai	SC
121	1123	Palmer Hay Flats	Anchorage-Kenai	SC
122	1163	Portage	Anchorage-Kenai	SC
123	1143	Potter's Marsh	Anchorage-Kenai	SC
124	1183	Redoubt Bay	Anchorage-Kenai	SC
125	1113	Susitna Flats	Anchorage-Kenai	SC
126	1173	Trading Bay	Anchorage-Kenai	SC
008	1303	Gulf Coast (R)	Cordova-Copper River	SC
150	1313	Copper River Delta	Cordova-Copper River	SC
151	1333	Prince William Sound	Cordova-Copper River	SC
152	1323	Yakutat area	Cordova-Copper River	SC
009	1503	Southeast Coast (R)	Juneau-Sitka	Southeast
170	1523	Blind Slough	Juneau-Sitka	SE

Table 2. Continued.

ADF&G Code	FWS Code	ADF&G geographical region (R) and harvest location names	Original FWS "country" name	FWS harvest zone
171	1513	Chilkat River	Juneau-Sitka	SE
172	1543	Duncan Canal	Juneau-Sitka	SE
173	1573	Farragut Bay	Juneau-Sitka	SE
174	----	Icy Strait	Juneau-Sitka	SE
175	----	Ketchikan area	Juneau-Sitka	SE
176	1563	Mendenhall Flats	Juneau-Sitka	SE
177	----	Petersburg area	Juneau-Sitka	SE
178	----	Prince of Wales Island	Juneau-Sitka	SE
179	1533	Rocky Pass	Juneau-Sitka	SE
180	----	Seymour Canal	Juneau-Sitka	SE
181	----	Sitka area	Juneau-Sitka	SE
182	1553	St. James Bay	Juneau-Sitka	SE
183	1583	Stikine River Delta	Juneau-Sitka	SE
194	----	Thorne Bay	Juneau-Sitka	SE
195	----	Lynn Canal	Juneau-Sitka	SE
010	1704	Kodiak (R)	Kodiak Island	Southwest
200	1714	Kalsin Bay	Kodiak Island	SW
201	----	Middle Bay	Kodiak Island	SW
202	----	Old Harbor	Kodiak Island	SW
203	----	Ouzinkie	Kodiak Island	SW
204	----	Raspberry Straits	Kodiak Island	SW
205	----	Womens Bay	Kodiak Island	SW
011	1904	Alaska Peninsula (R)	Cold Bay-AK Peninsula	SW
220	----	Cinder River	Cold Bay-AK Peninsula	SW
221	1914	Cold Bay	Cold Bay-AK Peninsula	SW
222	----	Naknek River	Cold Bay-AK Peninsula	SW
223	1924	Pilot Point	Cold Bay-AK Peninsula	SW
224	1934	Port Moller	Cold Bay-AK Peninsula	SW
225	1944	Port Heiden	Cold Bay-AK Peninsula	SW
012	2104	Aleutian Chain (R)	Aleutian-Pribilofs	SW
240	----	Unimak	Aleutian-Pribilofs	SW

Table 3. Summary of Alaska waterfowl hunter activity and harvest from the State survey, 1987-88.

Number of survey cards issued: 5,476

Number of survey cards returned: 2,515 (45.9%)

Number of survey cards usable for data analysis: 2,389 (95.3%)

Projected number of fall sport hunters:

Total federal duck stamps sold^a: 14,392

Federal duck stamps sold to potential hunters in Alaska: 13,225

Number of active hunters: 10,142 (70.5%)

Calculated statewide fall sport harvest:

Ducks: Dabblers/divers: 69,627; Sea ducks: 6,597; Total: 76,224

Geese: Canada: 4,476; white-fronted: 376; brant: 328; snow: 145;

emperor: 7; unknown species: 56; Total: 5,389

Cranes: 1,014

Snipe: 2,654

Calculated hunter Days: 57,828

^a Carney et al. 1988.

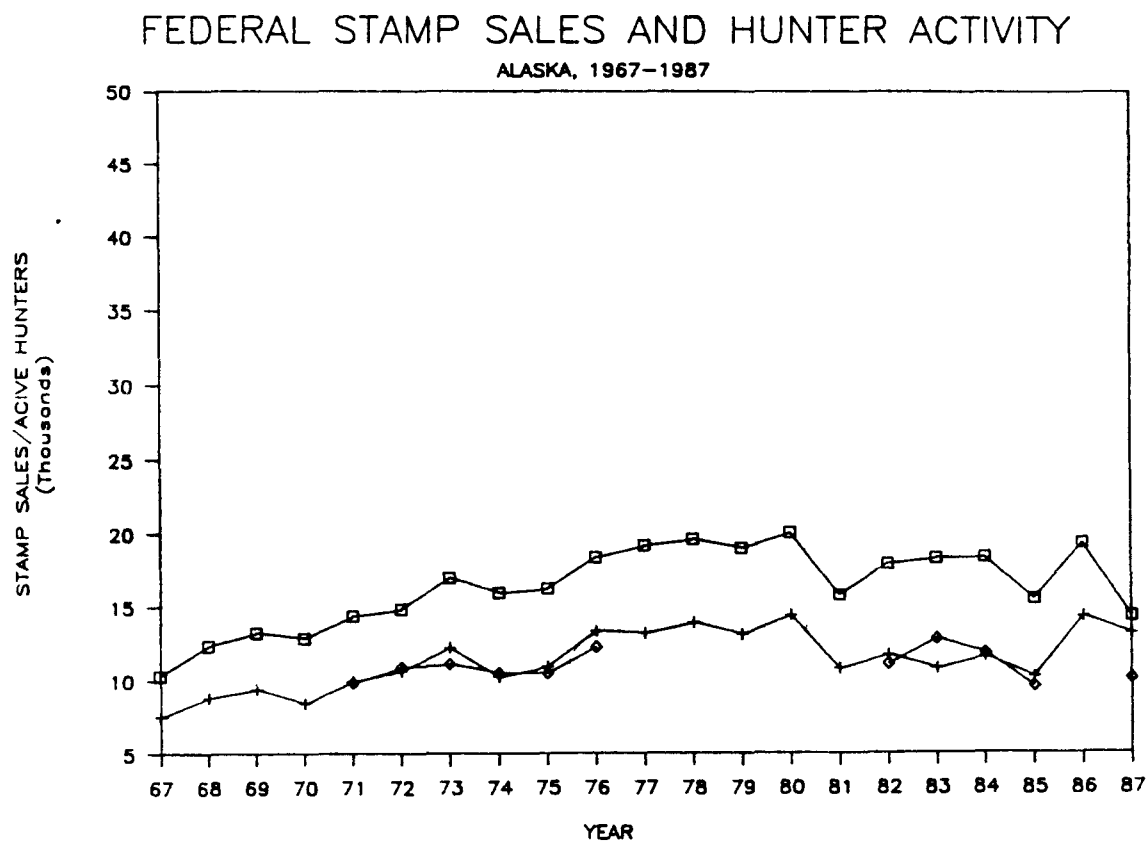
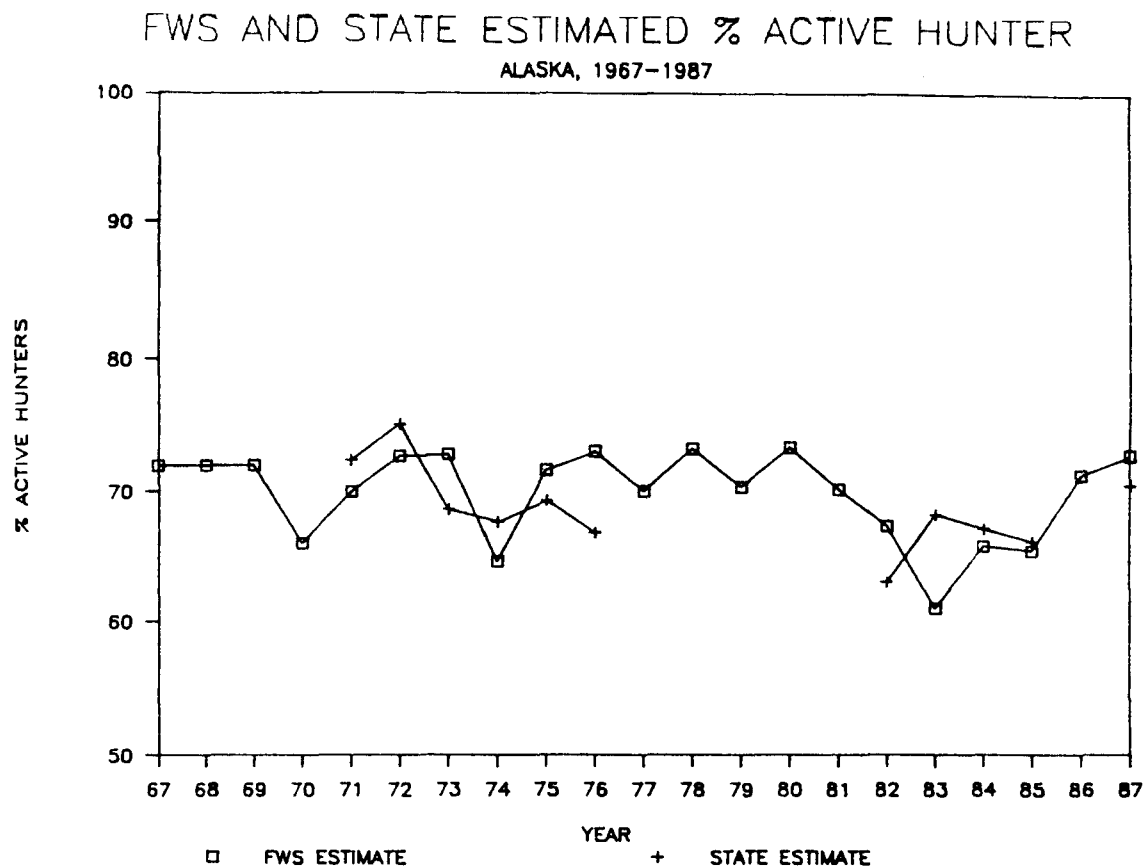


Fig. 3. Fish and Wildlife Service and State estimated hunter activity and federal duck stamp sales in Alaska for 1968-87.

in Alaska, which was down 26% from 1986 and 12% below the 1967-86 average (Fig. 3), a calculated 10,142 people hunted waterfowl during the 1987-88 season (Table 3), compared with a FWS estimate of 13,225 active hunters (Carney et al. 1988). The 1987 state estimate of active hunters is similar to the 1971-76 and 1982-85 state survey average of 10,059 active hunters, while the FWS estimate of active hunters is 8% below 1986 but nearly 17% above the 1967-86 average (Fig. 3).

Hunting Activity:

Hunters reported hunting an average of 5.7 days during the 1987-88 season; this represents a total of 57,828 waterfowl hunter days (Table 3) and is comparable to the federal estimate of 57,628 hunter days. The 1987 state hunter days estimate was down about 4% from the 1971-76 and 1982-85 averages, and the FWS estimate was down about 16% from the 1965-86 average (Fig. 4). The distributions of hunter days and resulting harvest are summarized by region in Table 4 and by specific hunting locations in the following sections.

Duck Harvest:

An average of 9.7 ducks/active hunter was taken in 1987. The FWS estimate for 1987 was 6.2 ducks/active hunter (Carney et al. 1988). This compares with a FWS 1965-86 average of 5.6 ducks/active hunter and 1971-76 and 1982-85 state averages of 8.5 ducks/active hunter (Fig. 5). The calculated average daily hunting success was 1.7 ducks/hunter in 1987.

The projected statewide harvest was 76,224 ducks, of which 69,627 (91.3%) were dabbling and diving ducks and 6,597 (8.6%) were sea ducks and mergansers (Table 4), compared with the FWS estimated harvest of 84,649, of which 81,178 (94.9%) were dabbling and diving ducks and 3,471 (5.1%) were sea ducks and mergansers (Table 5) (Carney et al. 1988). The 1987 state duck harvest estimate was down 13% from the FWS 1965-86 average and 19.8% below the 1971-76 and 1982-85 state averages (Fig. 5).

Based on the FWS parts collection survey, which is believed to provide the best estimate of species composition in the harvest, the mallard (Anas platyrhynchos) was the most important game duck in 1987, composing about 31% of the harvest, followed by the American wigeon (Anas americana) (18%), green-wing teal (Anas crecca) (15%), and Northern pintail (Anas acuta) (13%) (Table 5). Species composition of the statewide duck harvest has remained relatively constant during the past 21 years; 86% of the harvest has been composed of dabbling ducks, 10% diving ducks, and 4% sea ducks and mergansers (Table 6).

As calculated from the state survey, about 40% of the statewide duck harvest occurred in Cook Inlet, followed by 20% in the central and 16% in the southeastern regions of the state (Table 4). Data from specific harvest locations (Table 7) indicate that the Susitna

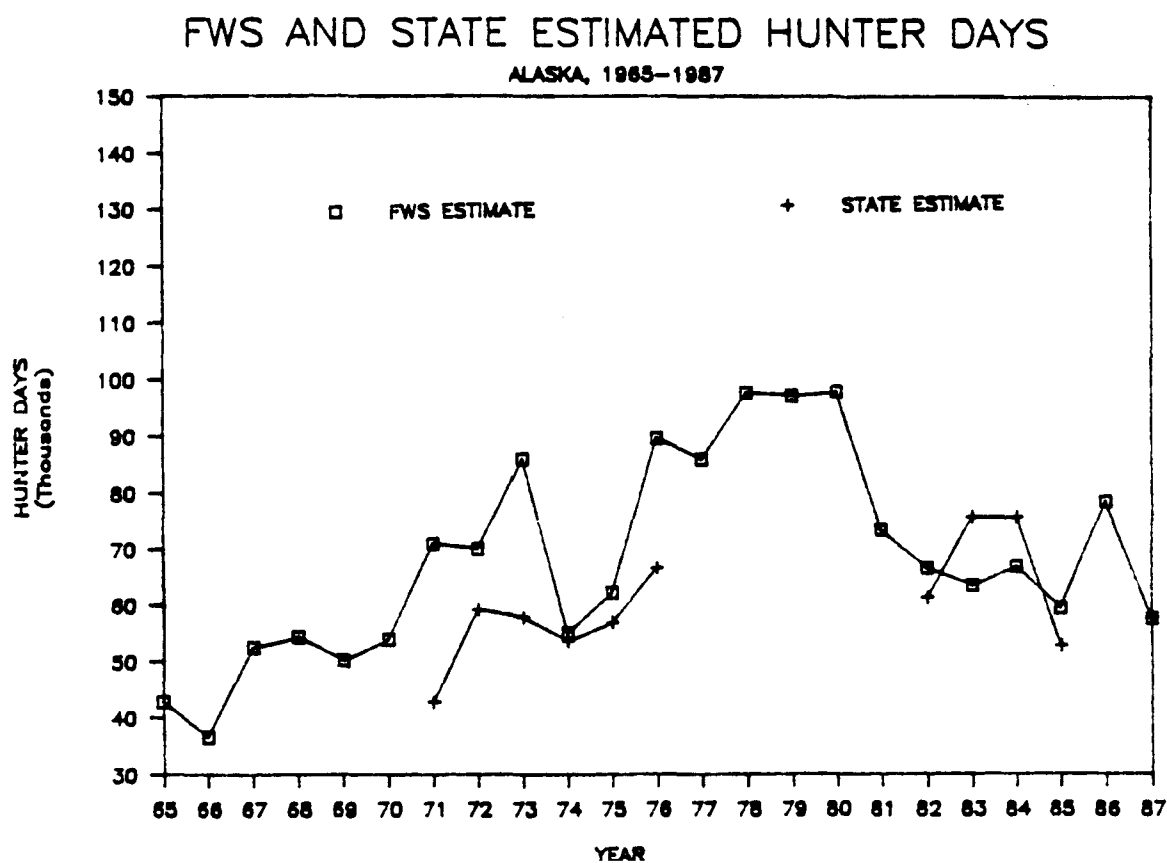
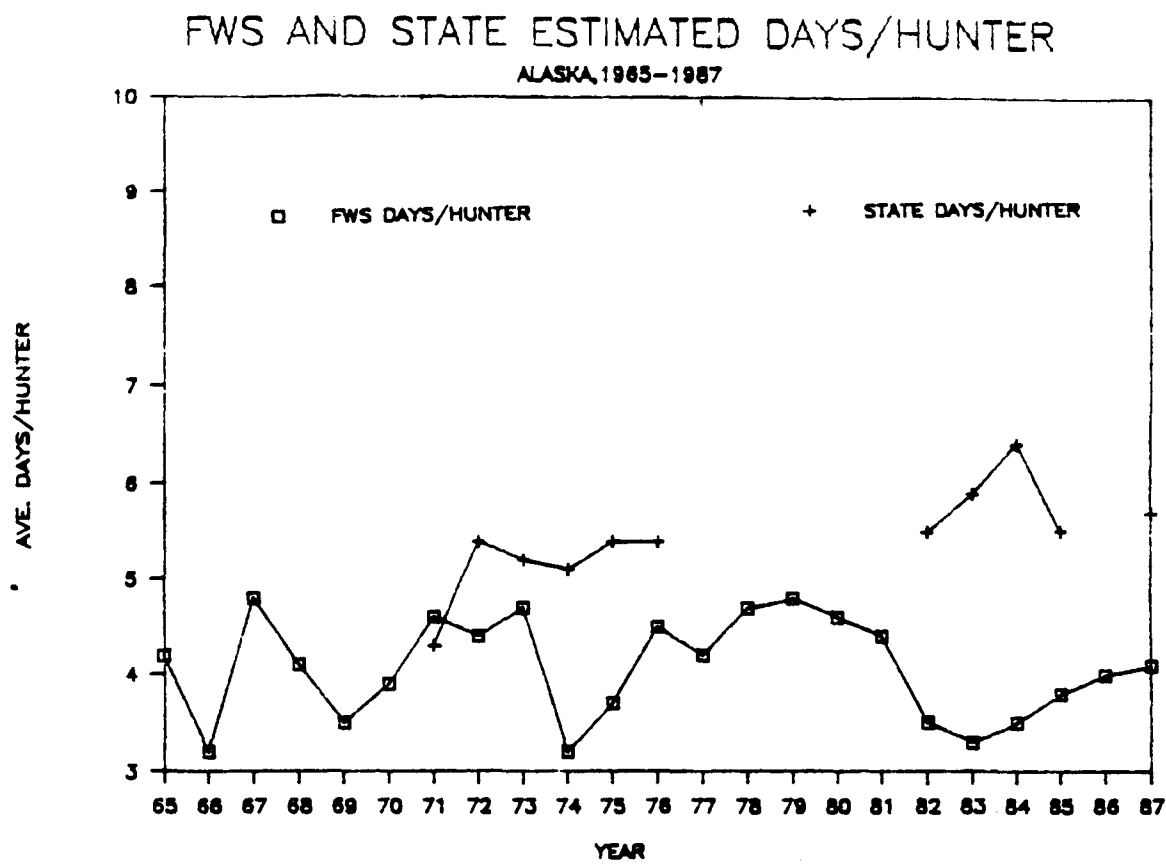


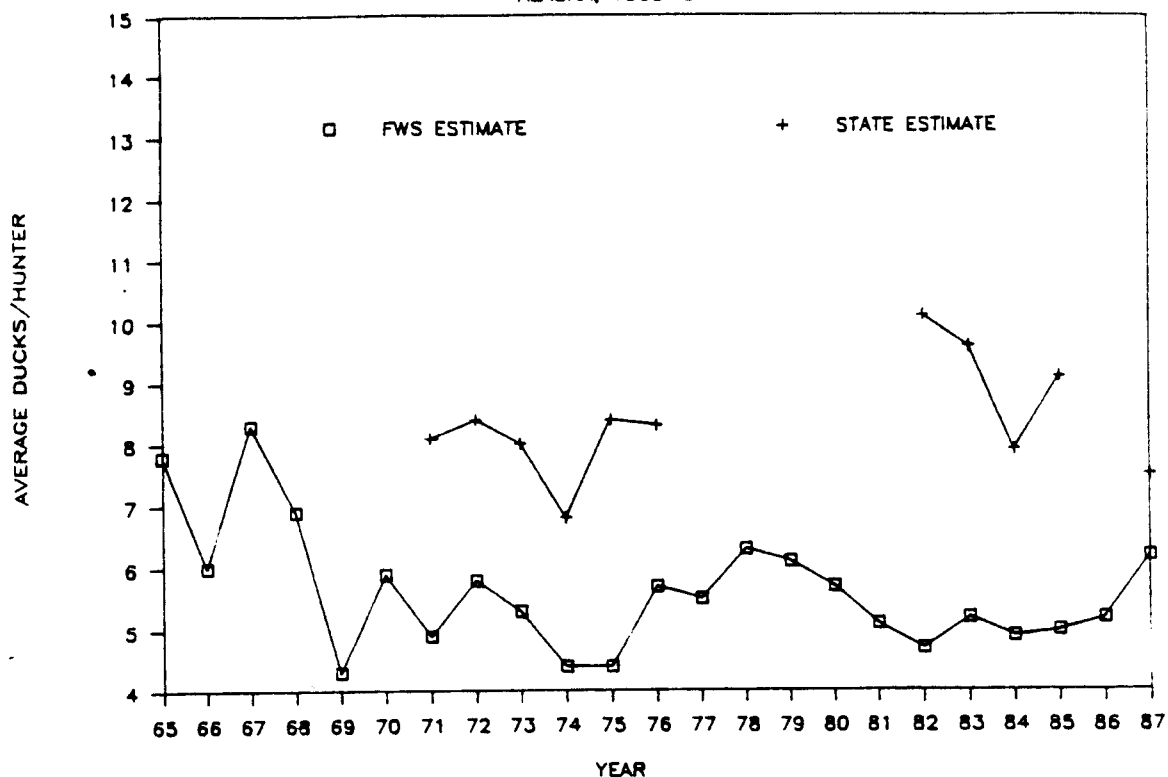
Fig. 4. Fish and Wildlife Service and State calculated waterfowl hunter days and average days per hunter in Alaska, 1965-1987.

Table 4. Proportion (%) of duck, goose, crane, and snipe sport harvests and hunter activity in the fall by geographic region calculated from the state survey for 1987-88.

Harvest Region	Hunter Days	Dabblers/Divers	Sea Ducks	Geese	Cranes	Snipe
North Slope	0.1	0.0	0.0	0.2	0.0	0.0
Seward Pen.	0.8	0.4	0.8	0.6	2.6	0.0
Upper Yukon Valley	1.2	1.0	0.2	0.8	0.4	0.8
Lower Yukon Valley	0.8	0.8	0.0	0.2	0.0	0.0
Central	20.0	22.3	3.2	14.6	79.4	20.5
Yukon Delta	0.9	0.6	2.5	2.8	0.0	2.5
Cook Inlet	40.3	43.3	28.4	29.9	10.3	35.1
Gulf Coast	5.5	6.3	5.8	3.4	0.7	9.3
Southeast	19.4	15.0	24.6	20.4	5.5	28.7
Kodiak	4.7	3.5	29.7	0.0	0.0	0.8
Alaska Pen.	5.3	5.9	1.7	26.3	1.1	2.0
Aleutian Chain	1.0	0.5	2.9	0.1	0.0	0.1
Unknown	0.2	0.3	0.2	0.1	0.0	0.1
Statewide Days/Harvest	57,828	69,627	6,597	5,389	1,014	2,654

FWS AND STATE AVERAGE DUCKS/HUNTER

ALASKA, 1965-87



FWS AND STATE CALCULATED DUCK HARVEST

ALASKA, 1965-87

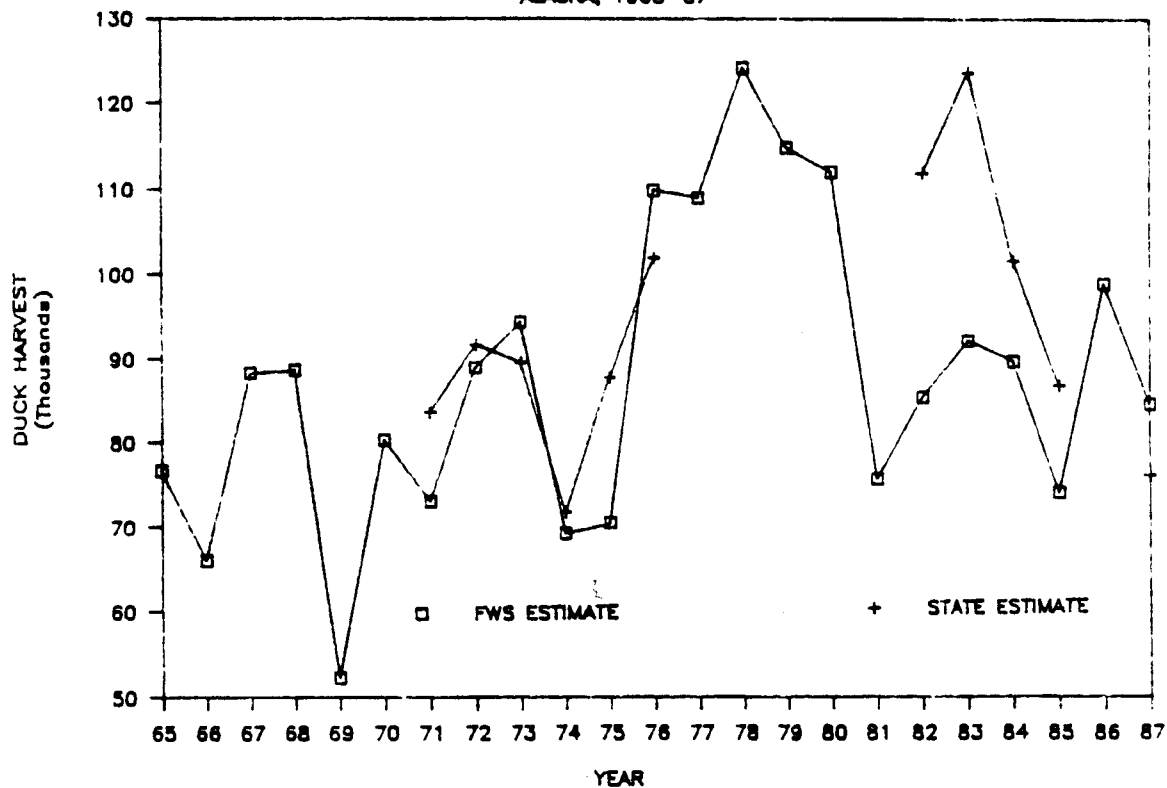


Fig. 5. Fish and Wildlife Service and State calculated ducks harvested per hunter and annual duck harvest in Alaska, 1965-1987.

Table 5. Regional species composition of the 1987-88 Alaska duck harvest from FWS Parts Collection Survey^a

Species	Yukon Valley	Central	Cook Inlet	Gulf Coast	Southeast	Kodiak	Alaska Pen.	Aleutian Chain	Statewide ^b
Mallard	0.0	29.4	29.4	37.3	38.8	39.1	14.8	2.0	30.5
American Wigeon	0.0	28.4	13.5	24.1	13.4	5.2	35.2	0.0	18.4
Green-winged Teal	60.0	8.9	17.9	16.6	18.2	1.7	14.1	22.4	14.9
Pintail	20.0	17.7	17.7	8.3	6.2	1.7	24.6	0.0	13.3
Northern Shoveler	0.0	3.1	8.8	2.6	1.3	0.0	4.9	0.0	4.5
Gadwall	0.0	0.2	1.0	2.4	0.8	27.8	0.7	4.1	3.1
Total Dabblers	80.0	87.7	88.3	91.3	78.6	75.6	94.4	28.6	84.8
Bufflehead	0.0	1.5	3.5	1.4	3.8	1.7	0.7	18.4	3.0
Lesser Scaup	20.0	3.9	1.9	1.6	1.8	0.0	0.7	0.0	1.9
Barrow's Goldeneye	0.0	0.0	0.8	1.0	3.6	7.0	0.0	0.0	1.5
Greater Scaup	0.0	0.2	1.9	0.6	1.8	0.0	3.5	0.0	1.4
Common Goldeneye	0.0	0.5	1.7	1.0	0.3	0.9	0.7	0.0	1.0
Ring-necked Duck	0.0	3.4	0.4	0.8	1.0	0.0	0.0	0.0	1.0
Canvasback	0.0	2.3	0.0	0.0	0.3	0.0	0.0	0.0	0.4
Redhead	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1
Total Divers	20.0	11.8	10.4	6.5	12.5	9.6	5.6	18.4	10.1
White-winged Scoter	0.0	0.2	0.4	0.0	1.0	0.9	0.0	24.5	1.1
Harlequin	0.0	0.0	0.4	0.0	0.5	5.2	0.0	14.3	1.0
Surf Scoter	0.0	0.0	0.4	0.0	5.1	0.0	0.0	0.0	0.9
Common Merganser	0.0	0.0	0.0	1.9	0.3	0.9	0.0	0.0	0.6
Black Scoter	0.0	0.0	0.0	0.0	1.0	2.6	0.0	8.1	0.6
Oldsquaw	0.0	0.0	0.2	0.0	0.0	0.9	0.0	6.1	0.3

Table 5. Continued.

Species	Yukon Valley	Central	Cook Inlet	Gulf Coast	Southeast	Kodiak	Alaska Pen.	Aleutian Chain	Statewide ^b
Steller's Eider	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.3
Red-breasted Merganser	0.0	0.2	0.0	0.2	0.8	0.9	0.0	0.0	0.3
Hooded Merganser	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Total Seaducks/Mergansers	0.0	0.4	1.3	2.1	8.6	14.8	0.0	53.0	5.1
Total Ducks	100.0	99.9	100.0	99.9	99.7	100.0	100.0	100.0	100.0

^a No harvest reported by FWS for the North Slope, Seward Peninsula, and Yukon Delta regions.

^b Includes birds harvested in unknown locations.

Table 6. Composition (%) of the statewide duck harvest in Alaska, 1966-87^a.

Year	Dabbling ducks	Diving ducks	Seaducks/mergansers
1966	86.5	10.3	3.0
1967	84.6	10.1	5.1
1968	89.6	8.9	1.8
1969	83.8	10.1	6.1
1970	86.0	9.0	5.0
1971	89.7	5.9	4.3
1972	90.0	7.6	2.3
1973	90.5	8.7	0.9
1974	82.3	16.4	1.4
1975	88.0	5.8	6.2
1976	82.6	9.5	7.9
1977	88.2	10.3	1.5
1978	82.5	11.1	6.5
1979	87.5	8.2	4.2
1980	85.0	12.5	2.5
1981	87.8	9.9	2.3
1982	85.4	11.0	3.6
1983	82.7	15.3	2.2
1984	88.3	9.6	1.8
1985	84.0	10.9	4.9
1986	82.7	13.1	4.2
1987	84.8	10.1	5.1
$\bar{x}$	86.0	10.2	3.8
S.D.	± 2.7	± 2.5	± 1.9

^a Based on FWS parts collection surveys.

Table 7. Calculated hunting activity and duck harvest for specific locations in Alaska where more than 0.2% of the harvest occurred in 1987-88.

Location	Ducks		Hunter Days	
	<u>N</u>	% of state total	<u>N</u>	% of state total
Susitna Flats	11,796	15.5	6,644	11.5
Minto Flats	6,004	7.9	2,825	4.9
Palmer Hay Flats	5,613	7.4	4,203	7.3
Mendenhall	2,471	3.2	2,659	4.6
Copper River Delta	2,240	2.9	1,730	3.0
Kachemak Bay	2,042	2.7	1,160	2.0
Redoubt Bay	1,703	2.2	666	1.2
Tok-Northway	1,640	2.2	602	1.0
Stikine River Flats	1,614	2.1	1,281	2.2
Healy Lake	1,562	2.0	653	1.1
Chickaloon Flats	1,435	1.9	955	1.7
Prince William Sound	1,409	1.8	711	1.2
Naknek River	947	1.2	897	1.6
Potters Marsh	943	1.2	1,704	2.9
Cold Bay	928	1.2	935	1.6
Portage	883	1.2	1,096	1.9
Pilot Point	809	1.1	199	0.3
Duncan Canal	783	1.0	525	0.9
Tanana Flats	764	1.0	910	1.6
Yakutat	764	1.0	493	0.9
Prince Wales Is.	727	1.0	564	1.0
Trading Bay	656	0.9	333	0.6
Jim Creek-Swan Lake	637	0.8	551	1.0
Delta	585	0.8	2,319	4.0
Ketchikan area	533	0.7	564	1.0
Womens Bay, Kodiak	526	0.7	327	0.6
Goose Bay	514	0.7	372	0.6
Adak	432	0.6	384	0.7
Blind Slough	391	0.5	666	1.2
Denali Highway	350	0.5	250	0.4
Eagle River Flats	350	0.5	237	0.4
Icy Strait	306	0.4	154	0.3
Petersburg area	283	0.4	205	0.4
Middle Bay, Kodiak	265	0.3	211	0.4
Sitka area	239	0.3	243	0.4
Eielson AFB	231	0.3	237	0.4
Kalsin Bay, Kodiak	175	0.2	167	0.3
Raspberry Strait	153	0.2	51	0.1
Rocky Pass	149	0.2	122	0.2
Farragut Bay	134	0.2	64	0.1
Port Heiden	123	0.2	77	0.1
Subtotals	54,108	71.0	8,948	67.4
Statewide Totals	76,224	100.0	57,828	100.0

Flats near Anchorage ranks first in duck harvesting and hunter days; the Palmer Hay Flats at the north end of Cook Inlet is also a major duck harvesting area. Minto Flats, northwest of Fairbanks, ranked second in the statewide duck harvest, and the Delta Junction area is also a focus for Interior waterfowl hunting.

Goose Harvest:

Hunters reported taking an average 0.5 geese/active hunter in 1987. This was considerably lower than the 1971-76 and 1982-85 average of 1.3 geese/active hunter (Fig. 6). The FWS estimate of 0.4 geese/active hunter (Carney et al. 1988) was also lower than the 1965-86 average of 0.8 geese/active hunter (Fig. 6).

The calculated 1987 goose harvest was 5,389 (Table 3), down over 60% from the 1971-76 and 1982-85 average of 13,875 (Fig. 6). The FWS estimated harvest of 5,636 geese (Carney et al. 1988) was down about 54% from the 1965-86 average of 12,125 (Fig. 6).

The Canada goose (Branta canadensis) was by far the most common goose harvested by sport hunters in 1987 (Table 3). This species made up over 83% of the harvest, followed by the white-fronted goose (Anser albifrons) (7%), Pacific brant (Branta bernicla) (6%), snow goose (Chen caerulescens) (3%), Emperor goose (Chen canagica) (1%), and unknown geese (1%). The FWS estimated that Canada geese made up 82% of the harvest, followed by white-fronted geese (18%) (Carney et al. 1988). No harvests of snow geese, Pacific brant, or other geese were reported by the FWS. These estimates compare with a 1986 harvest composition as follows: 85% Canadas, 10% white-fronts, 2% Pacific brant, and 1% snow geese (FWS survey data).

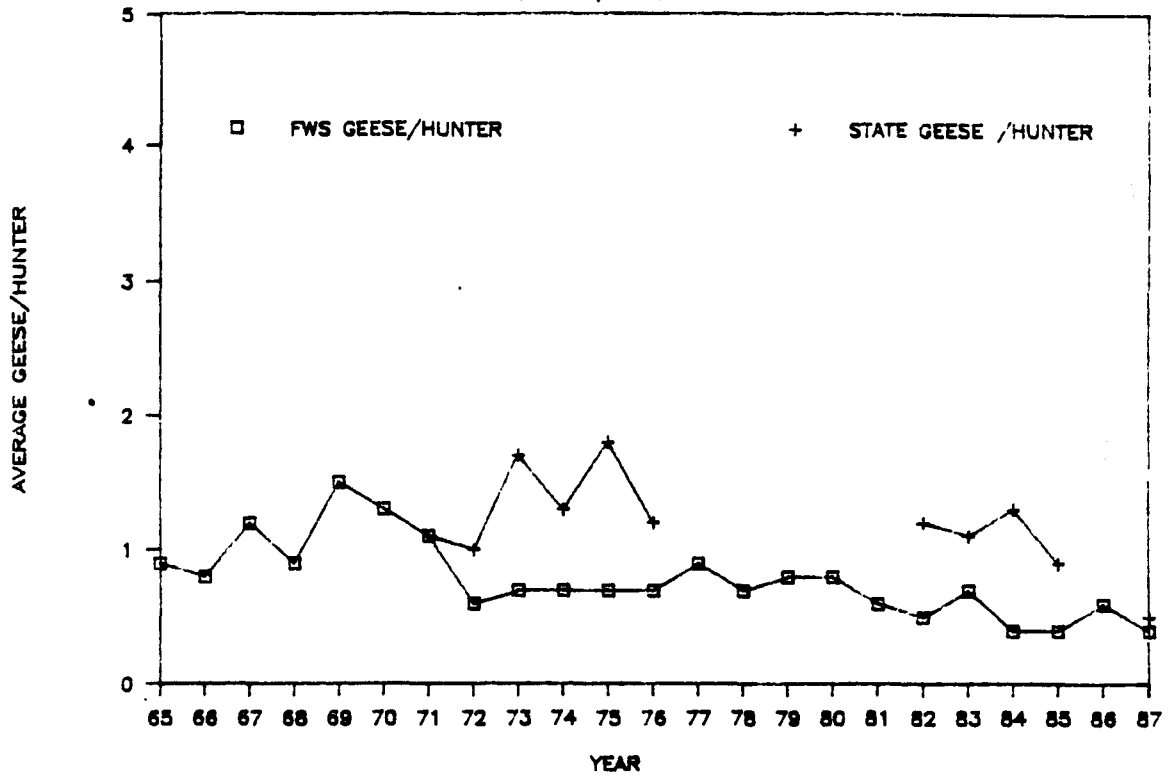
A regional breakdown of the 1987 goose harvest indicates that, similar to the duck harvest, about a third of the harvest occurred in Cook Inlet (Table 8). The Alaska Peninsula region contributed an additional 26%, followed by Southeast (20%) and Central Alaska (14%). Major regions for the Canada goose harvest were Cook Inlet (30%), Southeast (24%), and Alaska Peninsula (26%). Most of the white-fronted geese were harvested in Central Alaska (50%) and Cook Inlet (26%), while most of the Pacific brant harvest occurred on the Alaska Peninsula (74%); snow geese were harvested primarily on the Yukon Delta (51%). The harvest of Taverner's Canada geese near Izembek Lagoon (Cold Bay) continues to rank first in goose hunting statewide, but the collective harvest of lesser Canadas in the Susitna, Chickaloon, and Palmer areas of Upper Cook Inlet is significant to hunter opportunity (Table 9). Lesser Canadas and midcontinent white-fronts contributed to Delta Junction's third-ranked harvest.

Crane Harvest:

A calculated 1,014 sandhill cranes (Grus canadensis) were harvested in 1987 (Table 3), compared with the FWS estimate of 1206 (Sorensen

FWS AND STATE AVERAGE GEESE/HUNTER

ALASKA, 1965-87



FWS AND STATE CALCULATED GOOSE HARVEST

ALASKA, 1965-1987

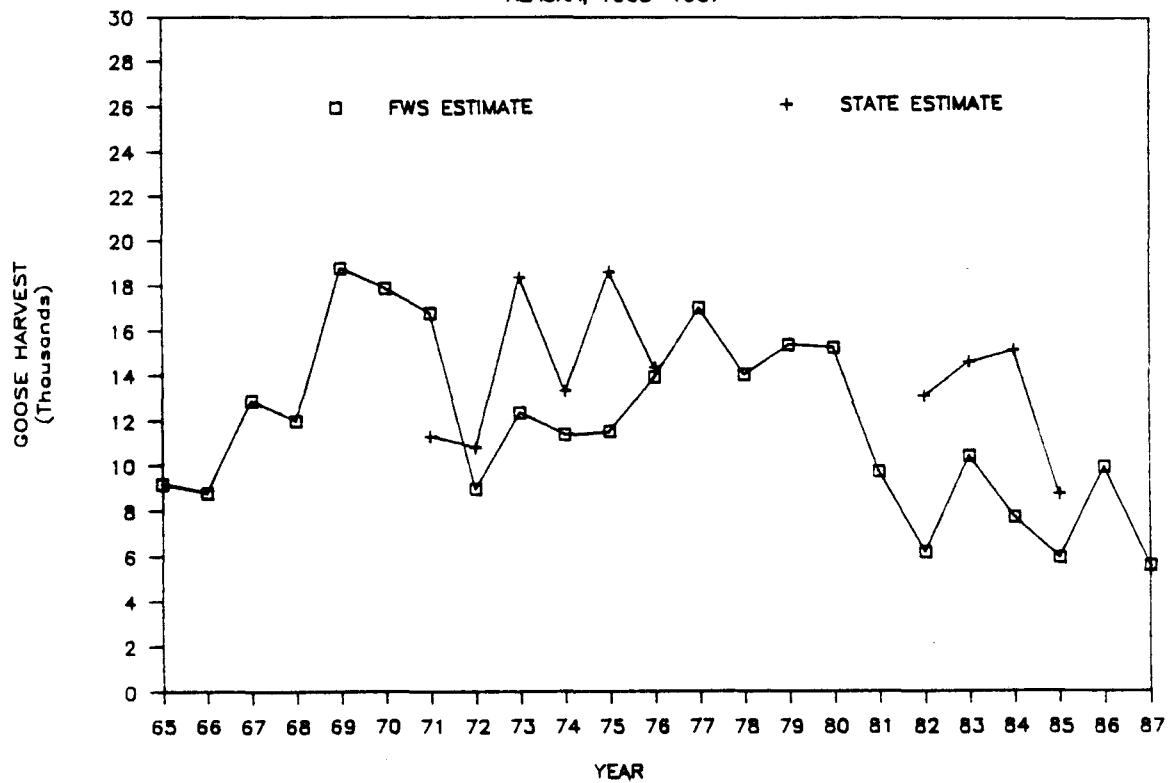


Fig. 6. Fish and Wildlife Service and State calculated geese harvested per hunter and annual goose harvest in Alaska, 1965-1987.

Table 8. Distribution (%) of the fall goose harvest by species and harvest region, 1987-88.

Region	Canada	White-fronts	Pacific brant	Snow	Emperor	Total
North Slope	0.1	0.0	0.0	0.0	100.0	0.2
Seward Peninsula	0.7	1.0	0.0	0.0	0.0	0.6
Upper Yukon Valley	0.6	5.0	0.0	0.0	0.0	0.8
Lower Yukon Valley	0.3	0.0	0.0	0.0	0.0	0.2
Central	12.8	49.5	3.4	5.1	0.0	14.6
Yukon Delta	0.7	7.9	4.5	51.3	0.0	2.8
Cook Inlet	31.6	25.7	13.6	28.2	0.0	29.9
Gulf Coast	3.7	4.0	0.0	2.6	0.0	3.4
Southeast	23.6	3.0	2.3	10.3	0.0	20.4
Kodiak	0.0	0.0	0.0	0.0	0.0	0.0
Alaska Peninsula	25.6	4.0	73.9	2.6	0.0	26.3
Aleutian Chain	0.3	0.0	2.3	0.0	0.0	0.1
unknown	0.2	0.0	0.0	0.0	0.0	0.1
Total	100.2	100.1	100.0	100.1	100.0	99.4

Table 9. Calculated goose harvest and proportion of the state total for specific locations in Alaska where more than 0.2% of the harvest occurred in 1987-88.

Location	<u>N</u>	% of state of total
Cold Bay	1,323	24.6
Susitna Flats	760	14.1
Delta	410	7.6
Chickaloon Flats	287	5.3
Palmer Hay Flats	183	3.4
Kachemak Bay	171	3.2
Minto Flats	171	3.2
Duncan Canal	160	3.0
Ketchikan area	112	2.1
Blind Slough	108	2.0
Copper River Delta	104	1.9
Prince of Wales Is.	104	1.9
Tanana Flats	86	1.6
Healy Lake	82	1.5
Stikine River	63	1.2
Prince William Sound	52	1.0
Mendenhall	52	1.0
Rocky Pass	37	0.7
Trading Bay	34	0.6
Farragut Bay	26	0.5
Potters Marsh	22	0.4
Icy Strait	22	0.4
Unimak	22	0.4
Petersburg area	19	0.3
Redoubt Bay	15	0.3
Yakutat	11	0.2
Portage	11	0.2
Safety Lagoon	11	0.2
Subtotals	4,461	82.8
Statewide Totals	5,389	100.0

1988). The FWS 1971-86 average harvest is 780 cranes, and the 1971-76 and 1982-85 average state survey estimate is 1221 cranes (Table 10). Regional data (Table 4) indicate that 178 (17.6%) cranes in the 1987 harvest were likely Pacific Flyway lesser sandhills; the remainder were from the midcontinent populations.

Snipe Harvest:

An average of 0.4 snipe (Capella gallinago) was harvested per active hunter in 1987; the calculated statewide harvest was 2,654 birds (Table 3). No state estimate of the 1986 harvest was made, but an average of 0.2 snipe was harvested per active hunter in 1985, representing a calculated harvest of 1,597 birds. The 1971-76 and 1982-85 average annual snipe harvest was 3,544 (Table 10).

Discussion

Federal duck stamp sales and hunter participation in Alaska have followed national trends downward since 1980, when Alaska stamp sales reached an all-time high of 20,110. By 1987 sales had fallen 28% to the lowest level since 1971. The apparent single-year increase of 26% indicated by federal survey data in 1986 remains unexplained. Many factors have influenced the number of active Alaska waterfowlers, but the most important are the economic downturn and emigration of people from the state after 1980, coinciding with the phenomenon of reduced hunter activity in years of poor fall flight forecasts and restrictive regulations.

Trends in the duck harvests are difficult to discern, given the unknown accuracy of active hunter estimates used to calculate total duck harvest. In general, declines in hunter participation and North American duck populations contributed to an average 24% reduction in Alaska's duck harvests between the 1976-80 and 1981-87 periods. Along with lower duck harvests, bag composition has changed; e.g., pintails ranked fourth and composed their lowest proportion ever in the harvests for both 1986 and 1987. During these two years, wigeons rose to second rank in proportions (18%) that have not been recorded since the early 1970's. Although it is difficult to assess the effects of the 2-pintail bag limit imposed for the past 2 years, the 1987 Alaska pintail harvest was the lowest since the late 1960's, regardless of the rising state breeding population indices in both 1986 and 1987.

Lesser and Taverner's Canada geese continue to be the mainstay of the state's goose harvest, especially with standing harvest restrictions on western Alaska geese, dusky Canadas, and Kodiak transplant birds. Goose harvests have been relatively stable in the prime Cold Bay area in recent years, but they have dropped by as much as 75% in the Delta Junction area. The latter is probably a result of the decline of barley cultivation in the state-sponsored agricultural zone, where the viability of many farms is threatened and more land is being enrolled in federal set-aside programs.

Table 10. FWS and state estimated crane and snipe harvest in Alaska, 1971-87.

Year	Crane		Snipe	
	FWS	State	FWS	State
1971	--	502	--	3,087
1972	--	765	--	3,498
1973	--	602	--	1,661
1974	--	640	--	2,205
1975	288	1,642	--	4,318
1976	1,082	873	--	7,003
1977	619	--	--	--
1978	312	--	--	--
1979	675	--	--	--
1980	1,049	--	--	--
1981	553	--	--	--
1982	948	1,746	--	4,833
1983	903	1,805	--	3,476
1984	1,552	2,376	--	3,564
1985	642	1,270	--	1,597
1986	731	--	--	--
$\bar{x}$	780	1,221	--	3,544
SD	± 353.4	± 608.0	--	$\pm 1,364$
1987	1,206	1,014	--	2,654

Among harvests of other goose species, the statewide brant harvest has dropped by more than 50% since 1985. No reliable data are available for 1986, but the decline is probably a continuing effect of the 2-brant daily limit that has been in place since 1984. The federal framework change that reduced the brant season to 50 days in 1987 had little impact on harvest opportunities during the late-September to October hunting period. Alaska's brant harvest was 46% lower than Washington's, where brant harvest had been reopened, and 42% below the California harvest. Alaska's harvest of Pacific white-fronted geese remained low (168) under restrictive regulations, and the indicated trace harvest of emperor geese, closed to hunting since 1986, stems from possibly erroneous reports (North Slope only).

The 1988 state harvest survey is being conducted like the 1987 survey; the method seems to provide a much improved data base over previous state and federal efforts, as far as total harvest estimates, localized data, and geographic coverage are concerned. The 1987 state survey reached 84% more potential hunters than the federal mail questionnaire and yielded responses from approximately 18% of them. At present, federal data on duck species composition in the bag (parts collection survey) and total hunters (stamp sales) are not measured with the state survey. During the next 2 years an attempt will be made to improve coverage, response rates, and variety of data requested; also a detailed analysis of historical federal and state data will be conducted. These efforts will be aimed at developing improvements in survey methods, addressing problems of measuring harvest in rural Alaska, and maintaining responsiveness in the hunting public.

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DUSKY CANADA GOOSE STUDIES

GAME MANAGEMENT UNIT: 6

GEOGRAPHIC DESCRIPTION: Copper River Delta

PERIOD COVER: 1 July 1987-30 June 1988

Introduction

Dusky Canada geese (Brant canadensis occidentalis) are known to nest only on the Copper River Delta of Alaska and to winter primarily in southwestern Washington and the Willamette Valley of Oregon. Until the late 1970's population size, which has ranged from a midwinter index of 7,500-8,000 in 1953 to 28,000 in 1960, was limited by hunting on the wintering grounds. Hunting was responsible for nearly all (95%) of the 45% annual population mortality (Chapman et al. 1969). Band recoveries indicated that about 70% of this harvest occurred in Oregon; the remaining 30% was about equally split between Washington, British Columbia, and Alaska. Production was typically good, and during the mid-1970's the population increased, despite a heavy annual harvest. Around 1979 production dropped off considerably; the population began to decline. Failure of the population to respond to harvest restrictions during the period from 1983 to 1986 indicates that conditions influencing production in Alaska are now limiting the population.

The Dusky Canada Goose Subcommittee of the Pacific Flyway Study Committee was formed to set objectives and coordinate management. This subcommittee has developed a council-endorsed management plan for the dusky goose that establishes a population objective of 20,000 based on the midwinter population index, and it recommends guidelines for achieving and maintaining that objective. The recommended management procedures in the plan that involve ADF&G are as follows:

1. Monitor and describe changes in nest site selection and nest success as related to changes in vegetation.
2. Monitor annual nest density and success.
3. Conduct annual production surveys and develop fall flight forecasts.
4. Mark and band geese annually to monitor population age structure, survival rates, harvest distribution, and support studies on the wintering grounds.
5. Describe and evaluate interactions between habitat change, predator ecology, and production.

In addition to these procedures, in 1986 the Pacific Flyway Council

endorsed a subcommittee recommendation that ADF&G develop and implement appropriate, biologically sound strategies to reduce predation on dusky geese by brown bears and coyotes. The following is a summary of ADF&G projects or actions addressing the above recommendations.

Study Area

The Copper River Delta is an approximately 650-km² deltaic plain at the mouth of the Copper River on the Gulf of Alaska (Fig. 1). It is bounded on the west, north, and east by the Chugach Mountain Range and by the Gulf of Alaska on the south. The area has a typical maritime climate: cool summers, mild winters, and abundant precipitation. Annual precipitation averages 205 centimeters, including 319 centimeters of snowfall and annual temperatures averaging 3.4 C, ranging from averages of -5 C in January to 12 C in July.

The major dusky goose nesting area is the approximately 450-km² west Copper River Delta. This area is interlaced with tidal sloughs, glacial streams, and numerous small, shallow, freshwater ponds between drainages. Plant communities are evolving as a result of the uplifting of the area by as much as 2 meters during the 1964 Good Friday earthquake (Potyondy et al. 1975). Currently, coastal communities are dominated by freshwater sedge meadows (Carex spp.) interspersed with dense tall shrub (Alnus crispa and Salix spp.) stringers along drainages. Stands of tall shrub and shrub-bog (Myrica gale, Carex spp., and Menyanthes trifoliata) increase in frequency inland from the coast; an alder (Alnus crispa), Sitka spruce (Picea sitchensis), and Western hemlock (Tsuga heterophylla) community becomes dominant 7-11 kilometers from the coast.

Projects

Monitor and Describe Changes in Nest Site Availability and Selection:

This project was completed in 1988. A final report entitled "Habitat Availability, Utilization, and Nesting Success of Dusky Canada Geese on the Copper River Delta, Alaska" has been written (Campbell 1988), and a manuscript has been submitted for publication.

Describe and Evaluate Interactions Between Habitat Change, Predator Ecology, and Production:

This project was inactive in 1988. Field work has been completed, and results have been partly reported through the above-mentioned report. A final report and manuscript are in preparation for a 3-year investigation of the activity of brown bears on the Copper River Delta and their impacts on nesting geese.

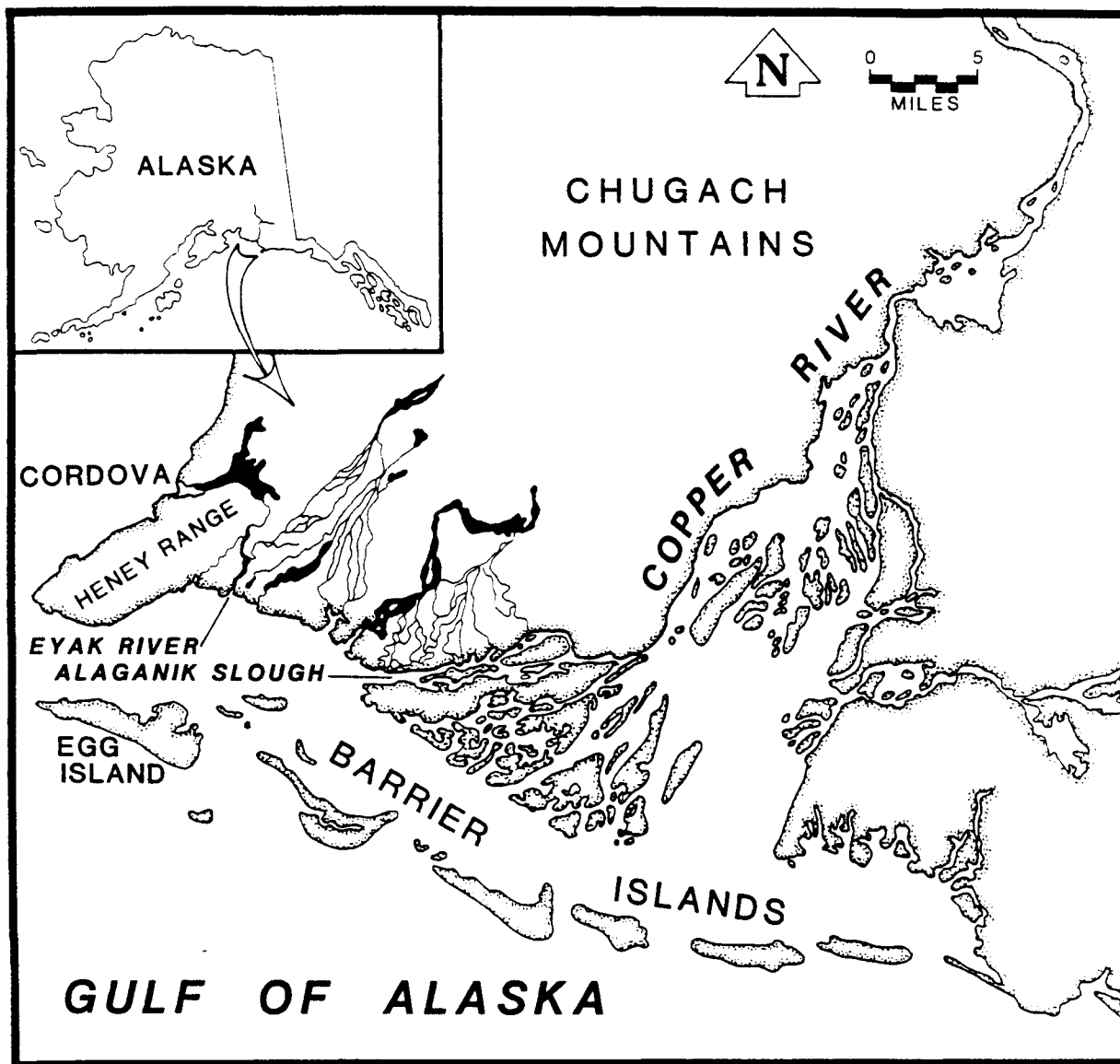


Fig. 1. Location of the Copper River Delta, Alaska.

Monitor Nest Densities and Fate:

Methods. Ten sample plots ranging from 0.23 to 0.88 km² have been established on the west Copper River Delta (Fig. 2). Eight of these plots were established in 1974, and with the exception of 1980 and 1981, they have been sampled annually through 1987. Additional plots at the mouth of Eyak River and on Egg Island were established in 1982, in response to apparent increases in the density of nesting geese in the areas.

To reduce costs and streamline the production-monitoring project, the number of nesting study plots sampled was reduced in 1988. The Egg Island and Eyak River plots were sampled as usual, but only plots 1-3 and 6-7 were sampled in the Alaganik Slough area. This reduction was based on the results of an analysis of 1982-87 nest density, nest success, and nest destruction data that indicated a strong correlation between long-term trends and information collected from the abbreviated sample area.

Plots were extensively sampled once immediately after the peak of incubation and again after the peak of hatch. Peak of incubation was estimated by monitoring nests along the Copper River Highway; the peak of hatch was determined by adding the appropriate number of days (based on egg floatation data) to the mean age of clutches on the study plots to complete the average of 28-day incubation period. During the first search, the number of eggs and stage of development for active nests were recorded. To facilitate relocation, all nests were also marked with wands and their locations plotted on large-scale (1:330-1:700) maps. Wands were placed at least 50 feet from the nests to minimize the possibility of attracting predators.

During the second visit, the fate of both previously located nests and newly discovered nests was determined. Nests in which one or more eggs had hatched were considered successful. Attended nests were considered to be incubating, and nests that were unattended and where egg development had ceased were classified as abandoned. Nest destruction was classified as avian, unknown mammal, canid, or bear, when sufficient evidence allowed, using published characteristics of predation (Darrow 1938, Sooter 1946, Rearden 1951) and techniques applicable to the local area that were developed during the study.

Areas adjacent to the study plots that had similar habitat types were searched after the peak of hatch. Nest fate information from these areas was used as a control to determine if the presence of field crews had influenced nest success on the study plots.

This project was a cooperative venture; assistance was provided by the Oregon Department of Fish and Wildlife, Washington Department of Wildlife, Fish and Wildlife Service (Region 1), U. S. Forest Service, and nongovernmental groups from Oregon and Montana.

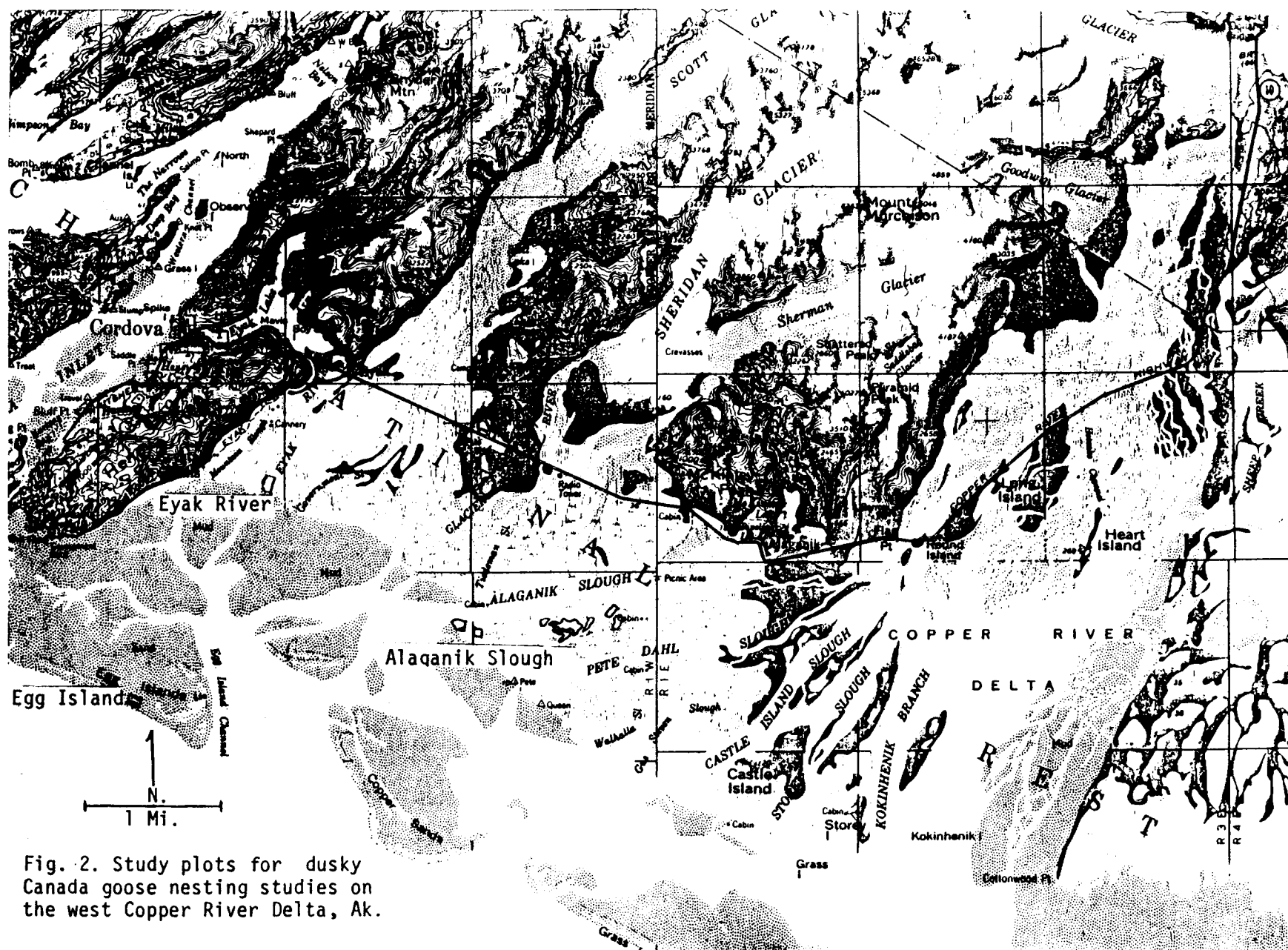


Fig. 2. Study plots for dusky Canada goose nesting studies on the west Copper River Delta, Ak.

Results. The arrival of dusky geese on the Copper River Delta was not well documented in 1988, but based on departure dates from the wintering grounds and reports of marked birds along the migration routes, timing of the spring migration was about average to slightly later than normal. Observations along the Copper River Highway suggested that spring conditions on the Delta were poor for nesting. Temperatures in April and early May were cool, precipitation was heavier than normal, and spring thaw and leaf emergence were retarded (Table 1). However, an earlier-than-normal peak in nest initiation, high frequency of nests in shrub habitats, and large average clutch size suggested that conditions were more favorable for nesting on the coastal areas than indicated along the highway.

Peak nest initiation ($N = 111$) was bimodal; a primary peak occurred between 8 and 14 May, and a secondary peak occurred between 25 and 29 May. The earliest recorded nest initiation was around 27 April, and the latest was a newly laid clutch found on 15 June. Mean clutch size was 5.5 ± 1.3 eggs ($N = 52$), well above the 1959-87 average of 5.0 eggs (Table 2). The calculated density of nests, based on the abbreviated sample area was $116/\text{mi}^2$, identical to that in 1987 (Table 2).

Similar to the last couple of years, the number of nests observed during the second sampling of plots was appreciably higher than the first one. There was a 52% increase in the number of nests located between May and June in 1988. Because the visibility was excellent and coverage of the plots was thorough in May, the increase was probably due to the initiation of additional nests after the May sampling period, rather than an incomplete sampling of the plots in May. Even though mean clutch size for the late initiated nests was larger than expected for renests ($\bar{x} = 5.7 \pm 0.8$, $N = 17$), evidence suggests that the observed secondary peak in nest initiation represented renesting. Several of the late nests were in bowls that contained destroyed clutches in May and, on the Eyak River plot where nest survival was high (92%), only one new nest was found in June.

Nest success was not well documented in 1988. In mid-June about 17% of the nests on the study plots had hatched (Table 2), well below the 44% success predicted necessary for a stable population (Campbell and Griese 1987). About 62% and 4% of the nests had been destroyed or abandoned, respectively (Table 3). The fate of over 17% of the nests that had been initiated late and were still incubating is unknown. Because these nests typically have a higher success rate (Alaska Department of Fish and Game unpubl. data), overall nest success could have approached 34%.

Predation on nests and geese was high again in 1988. Most of the failed nests were destroyed by mammalian and avian predators (Table 3). In addition, 27 goose carcasses or kill sites per square mile were calculated for the study area (Table 4). Some of this predation was probably due to a shortage of alternative prey. Only one small mammal was captured on the Alaganik Slough assessment

Table 1. Weather indices developed for the spring months of April, May, and June, according to Bromley (1976) for the Copper River Delta, 1950-88.

Year	Temperature deviation from normal (C)	Snow depth on ground (cm)	Precipitation deviation from normal (cm)	Weather index
1950	-2.1	21.8	+19.7	-130.8
1951	-2.5	21.1	+7.5	-71.1
1952	-4.8	14.8	+1.4	-45.8
1953	+2.6	1.3	-13.8	+80.7
1954	-2.4	4.3	-30.0	+133.7
1955	-5.2	44.7	-13.3	-4.2
1956	-4.8	155.4	+3.1	-194.9
1957	+2.9	6.6	-30.8	+161.9
1958	+3.0	0.0	-6.0	+45.0
1959	+3.1	62.2	-9.7	+1.8
1960	+1.6	56.6	-18.4	+43.4
1961	+0.6	41.9	+12.5	-101.4
1962	-0.8	0.0	-2.5	+8.5
1963	-1.76	4.7	+12.6	-136.2
1964	-1.78	0.5	+3.7	-107.5
1965	-5.7	110.4	+32.0	-298.9
1966	-3.0	23.3	-5.9	-8.8
1967	+0.9	0.3	-12.2	+65.2
1968	+1.6	93.7	+10.3	-137.2
1969	+5.3	0.0	-10.5	+79.0
1970	+0.6	85.6	+15.2	-158.6
1971	+0.7	71.1	+51.9	-327.3
1972	-7.1	297.2	+2.1	-343.3
1973	-1.6	27.9	+16.6	-118.9
1974	+1.9	5.1	-8.8	+48.4
1975	-1.7	66.0	+7.3	-110.0
1976	-1.6	73.1	+9.2	-90.3
1977	+3.9	42.4	+3.2	-26.1
1978	+2.3	4.6	-0.4	+7.4
1979	+0.1	2.8	-10.1	+7.6
1980	+5.2	3.6	+11.6	+10.9
1981	+5.8	4.3	-3.3	+28.1
1982	-1.9	5.8	-3.5	+2.2
1983	+4.5	2.5	-6.2	+51.1
1984	+4.8	2.5	-17.7	+110.0
1985	-5.4	71.1	+7.1	-133.6
1986	-1.2	10.2	-16.6	+66.8
1987	+1.5	3.1	+22.5	-107.8
1988	+4.3	49.0	+14.1	-98.0
$\bar{x}$	+0.5	43.1	2.7	-51.1

Table 2. Dusky Canada goose nest densities, hatching success, and average clutch size on the west Copper River Delta study area, 1959-88.

Year	<u>Nest Density</u> nests/mi ²	<u>Nest success</u>		<u>Clutch size</u>	
		<u>N</u>	<u>%</u>	<u>N</u>	<u>X</u>
1959	105	222	89.2	194	5.6
1964	--	102	82.4	114	4.3
1965	--	221	62.9	140	5.8
1966	--	100	97.0	100	4.8
1967	111	--	--	--	--
1968	--	38	86.8	75	5.1
1970	--	164	88.2	146	5.4
1971	--	100	76.0	113	3.6
1972	--	116	81.0	92	4.4
1973	--	--	--	48	4.9
1974	--	81	82.7	--	--
1975	179	215	31.6	215	4.8
1976	156	168	--	168	4.8
1977	175	229	79.0	181	5.4
1978	183	390	56.2	--	--
1979	133	409	18.8	338	5.7
1980	108	152	--	152	5.4
1981	--	--	--	28	4.9
1982	102	158	49.2	135	4.8
1983	91	162	51.9	87	5.5
1984	95	161	75.8	123	5.6
1985	97	168	8.9	64	4.4
1986	119	201	11.4	78	4.9
1987	116	196	23.7	121	5.2
1959-87 <u>X</u>	108~50		60.7~28.9		5.0~0.5
1988	116	110	17.3	52	5.5

Table 3. Fate of dusky Canada goose nests on the west Copper River Delta study area, 1959, 1974-75, and 1982-88.

Year	No. nests	% Successful	% Abandoned	% Fate unknown	% Destroyed	Type destruction			
						% Mammal	% Avian	% Flooded	% Unknown
1959 ^a	1,162 ^b	79.6	1.8	2.0	6.0	0	11.4	88.6	0
1974 ^c	81	82.7	2.5	ND ^d	14.8	ND ^d	-- ^e	0	ND ^d
1975 ^c	215	31.6	3.7	ND ^d	64.6	ND ^d	-- ^e	0	ND ^d
1982	158	49.2	1.8	ND ^d	49.0	45.0	33.8	0	21.8
1983	162	51.9	3.7	8.0	35.2	64.8	5.6	0	29.6
1984	161	75.8	3.1	6.2	14.9	62.4	37.6	0	4.0
1985	258	7.0	1.9	10.9	81.0	78.8	18.4	0	2.8
1986	201	11.4	9.0	12.5	67.2	83.7	5.2	0	11.1
1987	213	23.9	14.1	1.0	61.0	45.6	47.3	7.0	0.2
1988	110	17.3	3.6	17.3	61.8	53.3	40.0	6.7	0.1

a Trainer 1959

b Eggs rather than nests

c Bromley 1976

d Not reported.

e Percentages not given, but majority of losses attributed to avian predators.

Table 4. Alternative prey abundance and dusky goose carcass indices for the west Copper River Delta study plots, 1983-88.

Year	Trap hours	Small mammals captured	Abundance index ^a	Goose Carcasses and kill sites	Carcasses/mi ²
1983	2,304	31	13.46	3	1.7
1984	1,849	25	13.52	4	2.3
1985	3,000	4	1.33	17	9.8
1986	3,125	2	0.64	34	20.1
1987	1,621	26	16.04	15	8.9
1988	3,015	1	0.33	26	27.1

^a Number of small mammals captured divided by trap-hours multiplied by 100.

lines during 3,015 trap-hours (Table 4). Flooding of nests by beavers was again documented in 1988.

For only the second time since 1983, the fate of control nests differed significantly ($\chi^2 = 17.639$, $df = 3$, $P < 0.01$) from those on the study plots. Success and abandonment rates were very similar, as were the types and distribution of nest predation between major predators; however, more nests were destroyed on the study plots, while more nests were still under incubation in control areas. These differences were due to differences in detection rates for control nests and study plot nests, rather than differences in fate. Control nests, which are sampled to ascertain the influence of visits by field crews on the fate of study plot nests, were sampled only after the peak of hatch in June. By this time, foliage had fully emerged and ground cover had reached maturity. In years such as 1988 when much of the nest destruction occurred early in the nesting cycle, many of the destroyed nests become overgrown with vegetation and were very difficult to locate by June. In addition, the attention of field personnel was drawn to incubating nests by the flushing goose. As a result destroyed nests were underrepresented in the control, while incubating nests were overrepresented. If data on incubating nests are removed from the analysis to partially compensate for this bias, there is no significant difference ($\chi^2 = 2.784$, $df = 2$, $P > 0.05$) in the fate of nests between study and control areas.

Production Survey:

Methods. A production survey was conducted on 27 July 1988. Parallel transects at 0.25- to 0.5-mile intervals were flown in a Cessna 185 between saltwater and shrub-bog habitat, including the barrier islands on the west Copper River Delta. Two observers and a pilot were used; the pilot and front-seat observer searched for flocks and navigated. The 2nd observer, seated behind the front passenger seat, assisted with the search until geese were spotted. At that time, passes or circles were flown so that the 2 observers on the right-hand side of the aircraft had an unrestricted view of the geese. The front observer counted and periodically photographed flocks, while the rear observer counted young geese and recorded data. Searches were conducted at an altitude of 500 to 800 feet and at approximately 100 mph.

Once geese were spotted, airspeed and altitude were reduced to allow adequate counts and classification. Photographs of flocks were taken periodically to facilitate development of weighted regressions that provide estimates of total geese and number of young in the population. Statistical support for this inventory was provided by Earl Becker (ADF&G Biometrician, Anchorage).

Results. Survey conditions were poor in 1988. The weather was fair, with high overcast, scattered showers, good visibility, mild temperatures, and gusty 12-15 mph cross winds; but the visibility of geese was poor. A majority of the birds were in small groups dispersed throughout sedge and shrub communities inland from the

coast; therefore, the molting population was only sampled to estimate production. No attempt at an extensive survey and midsummer population index was made. A visual estimate of 5,135 geese (4,560 adults and 1,150 goslings) was made during 3.5 hours of flying. Incorporation of this estimate and counts from photographs into weighted regressions resulted in an adjusted estimate of 6,920 geese. This total comprised $5,360 \pm 172$ adult geese and $1,560 \pm 192$ young, resulting in a production estimate of 22.5% young.

Goose Banding and Collaring:

Methods. Flightless geese (i.e., molting and brooding flocks) were captured by driving them into portable drive traps with a Hughes 500 helicopter. All unmarked geese were banded with FWS leg bands, and 506 geese were fitted with red plastic collars supporting white characters. Previously marked birds were released after their identity had been determined and recorded. Assistance for this project was provided by the Washington Department of Game and U. S. Forest Service.

Results. A total of 1,027 geese were captured at 5 locations on the Delta between 26-28 July (Fig. 3); 226 of these were recaptures and 801, including 151 goslings, were unmarked geese. Seven hundred sixty-eight geese were banded; 506 were also collared. In addition, 11 goslings were taken for genetics studies, 14 goslings were injured or killed during capture, and 8 goslings were too small to band or carry a collar. To minimize potentially severe gosling losses because of trampling by siblings and adults in the holding pens, most of the goslings were quickly marked and released without sexing. The location, numbers, age, sex, and status of captured birds are summarized in Table 5.

One hundred and sixty-four geese collared between 1984-87 were recaptured in 1988, bringing the 4-year total for recaptures of previously collared geese to 438. While sample size is inadequate for geese marked as goslings, retention rates for birds marked as adults can be estimated. The average annual retention rates for combined sexes was 0.742 ± 0.16 . Females had an average annual rate of 0.918 ± 0.02 , while males retained their collars at an average rate of 0.547 ± 0.39 annually. These rates compare to a combined rate of 0.577 for Canada geese at Seney National Refuge (Fjetland 1973) and a 51-month rate of 0.904 computed from Zicus and Pace (1986) for Canada geese at Crex Meadows, Wisconsin.

A total of 3,985 dusky geese have been collared since 1984, in support of projects to define their winter distribution, movement, and habitat use on the wintering grounds. As of the spring of 1988, over 31,500 collar observations had been made in northwestern Oregon and southwestern Washington (Cornely et al. 1988). In the absence of adequate FWS leg band recovery data due to harvest restrictions, the feasibility of using collar observation data to estimate survival probabilities is currently being explored.

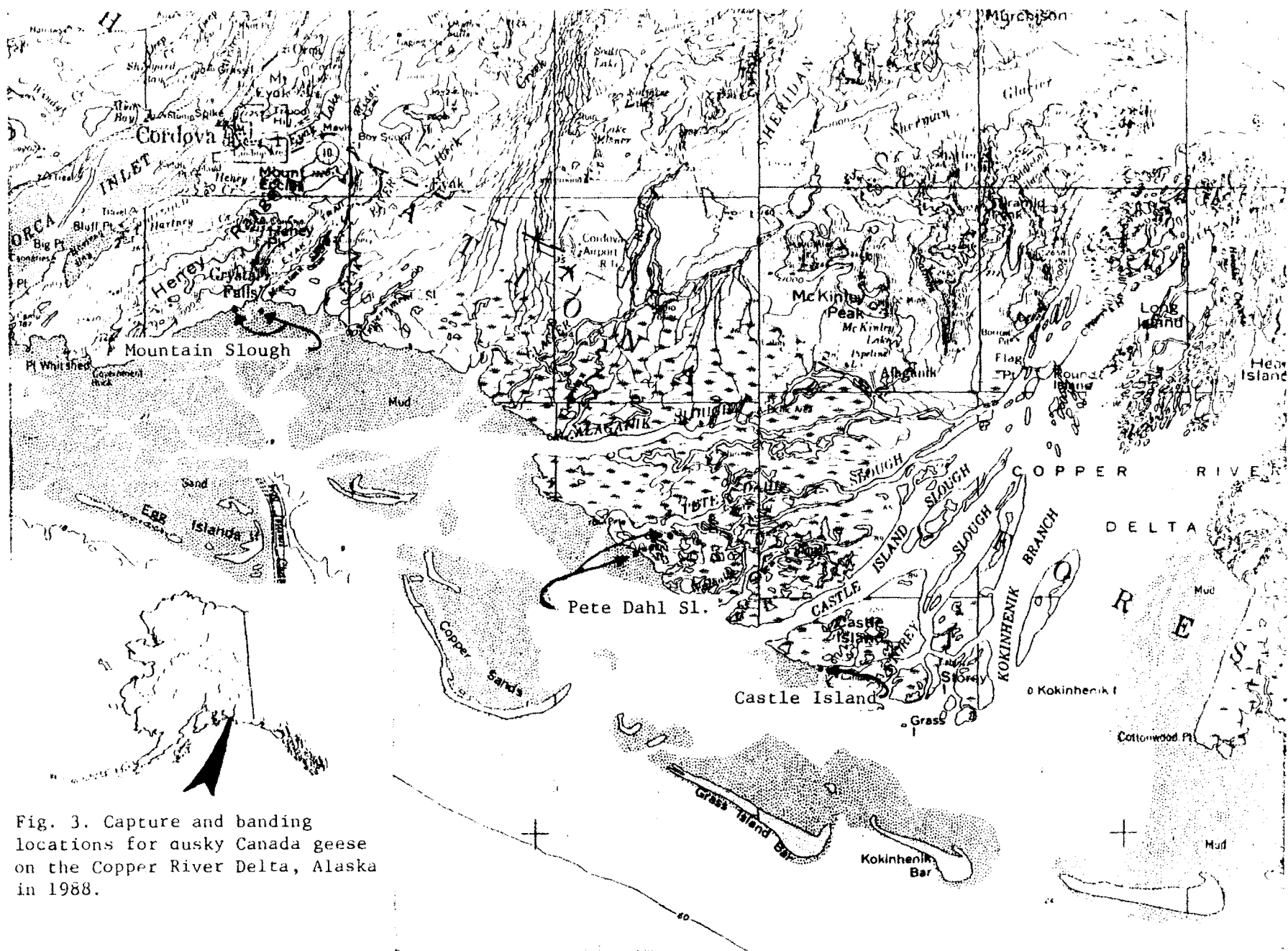


Fig. 3. Capture and banding locations for dusky Canada geese on the Copper River Delta, Alaska in 1988.

Table 5. Summary of dusky Canada geese captured and marked on the Copper River Delta, Alaska in 1988.

Capture location	Total geese captured	Number of recaptures	Number of geese banded						Number of geese collared						Mortalities LU
			AHYM	AHYF	AHYU	LM	LF	LU	AHYM	AHYF	AHYU	LM	LF	LU	
Mountain Slough	420 ^b	128	5	17	0	1	3	62	67	72	2	5	12	22	13
Mountain Slough Middleton Is. ^c	87 ^d	1	0	0	0	14	5	0	0	2	0	20	36	0	1
Pete Dahl Slough	192	60	2	5	1	0	0	0	78	46	0	0	0	0	0
Castle Island	328	37	72	73	2	0	0	0	84	58	2	0	0	0	0
Totals	1027	226	79	95	3	15	8	62	229	178	4	25	48	22	14

^a AHYM = Adult male, AHYF = Adult female, AHYU = Adult of unknown sex, LM = Local male or male gosling, LF = Local female or female gosling, LU = Local or gosling of unknown sex.

^b Includes 11 goslings removed and sent to University of Alaska for genetics studies.

^c Geese captured at Mountain Slough and transplanted to Middleton Island.

^d Includes 1 LM and 7 LF too small to band or collar.

Goose Transplant:

Methods. This was the second year of a proposed 3-year transplant project. Goslings and adult guide birds were captured during the banding operation in July 1988. Birds were placed in cardboard cartons (2 adults or 4 to 5 young per box) and transported by a Hughes 500 helicopter to the U. S. Coast Guard facility at Mile 13 of the Copper River Highway. Geese were held in a cool, shaded area for 4 to 6 hours before being placed on a Coast Guard H3 helicopter for transport to Middleton Island. Upon arrival at the release site, birds were placed in a holding pen constructed of portable drive nets. All birds were banded with FWS leg bands, and goslings large enough to carry a collar were marked with red ones engraved with white alpha-numeric codes. All geese were released as a flock.

This transplant was cooperatively funded by ADF&G and Washington Department of Wildlife; access to private lands was granted by Chugach Alaska Corporation. Aircraft and staging-area support were provided by the U. S. Coast Guard.

Results. A total of 87 geese (3 adult females, 35 male goslings, 48 female goslings, and 1 unknown-sex gosling) were moved to Middleton Island on 26 July 1988 (Table 5). All geese, except 8 goslings too small to band, were marked with FWS leg bands. In addition, 56 young and 3 adult females were collared. An absence of older goslings on the Delta necessitated the relocation of younger goslings, one-third of which were too small to carry a collar. Also, it appears that 2 sets of collars with the codes MMO-MM9 were manufactured and deployed. Unfortunately, one of these M-code sets was placed on birds banded on the mainland Delta. Observations of these collars should not be included in any data analysis unless the leg band number is also obtained. Leg band numbers for the Middleton Island birds are MM0 768-93438, MM1 768-93439, MM2 768-93418, MM3 768-93408, MM4 768-93420, MM5 768-93403, MM6 768-93411, MM7 768-93410, MM8 768-93419, and MM9 768-93402.

On 7-9 June 1988 Middleton Island was visited to evaluate the results of the initial transplant of dusky Canada geese in 1987. The island was surveyed on foot, with crews working the uplands in the middle of the island from the old FAA site to the far southwest end and then returning to the FAA site through the coastal wetlands (Fig. 4). Weather conditions were favorable for the survey, with a light southwesterly breeze, partly sunny skies, and mild temperatures.

Canada geese were commonly observed during the survey. While exact numbers could not be determined because of constant movement and mingling of geese, a minimum of 80 to 100 after-hatching-year birds were estimated to inhabit the island. In addition, at least 12 broods, ranging in age from only a few days to 3 weeks old were observed (Fig. 4). It is likely that all of these broods were naturally pioneering birds, since all of the geese transplanted in

1987, except for 11 guide birds that probably did not return to Middleton Island, were goslings and would not yet be of breeding age.

Based on sign and direct observation, the upland grass and sedge meadow habitat on the terraces and top of the island are being heavily used by geese. Areas of highest use appear to be at the south end of the island and east of the main runway (Fig. 4). Over 30 geese, mostly in pairs, were observed loafing on one terrace at the south end of the island. Tall forb (Urtica layalli and Heracleum maximum) and salmon berry (Rubus spectabilis) stands at the top of the bluffs also appear to be important to geese as brood escape cover. Eleven of the 12 observed broods were near or in this habitat. When threatened, they moved into dense stands of tall forbs and salmon berry and, if further threatened, dove off the bluffs into stands of tall forb below.

At least 4 dusky geese transplanted onto the island in 1987 were confirmed to have returned. Collars M12, M20, M79, and M? were observed. All of these birds were released as goslings last year. Other waterfowl observed during the survey, in descending order of abundance, were gadwall, northern shoveler, northern pintail, green-winged teal, greater scaup, and harlequin ducks. Predaceous birds appeared to be more common than in 1987. Numerous glaucous-winged gulls were nesting on the uplands of the island. They were observed harassing nesting seabirds as well as goose broods that dove off the bluffs to avoid survey crews. One parasitic jaeger and a pair of nesting bald eagles were also observed. The eagle nest was located in a stunted spruce tree on the northwest side of the island (Fig. 4).

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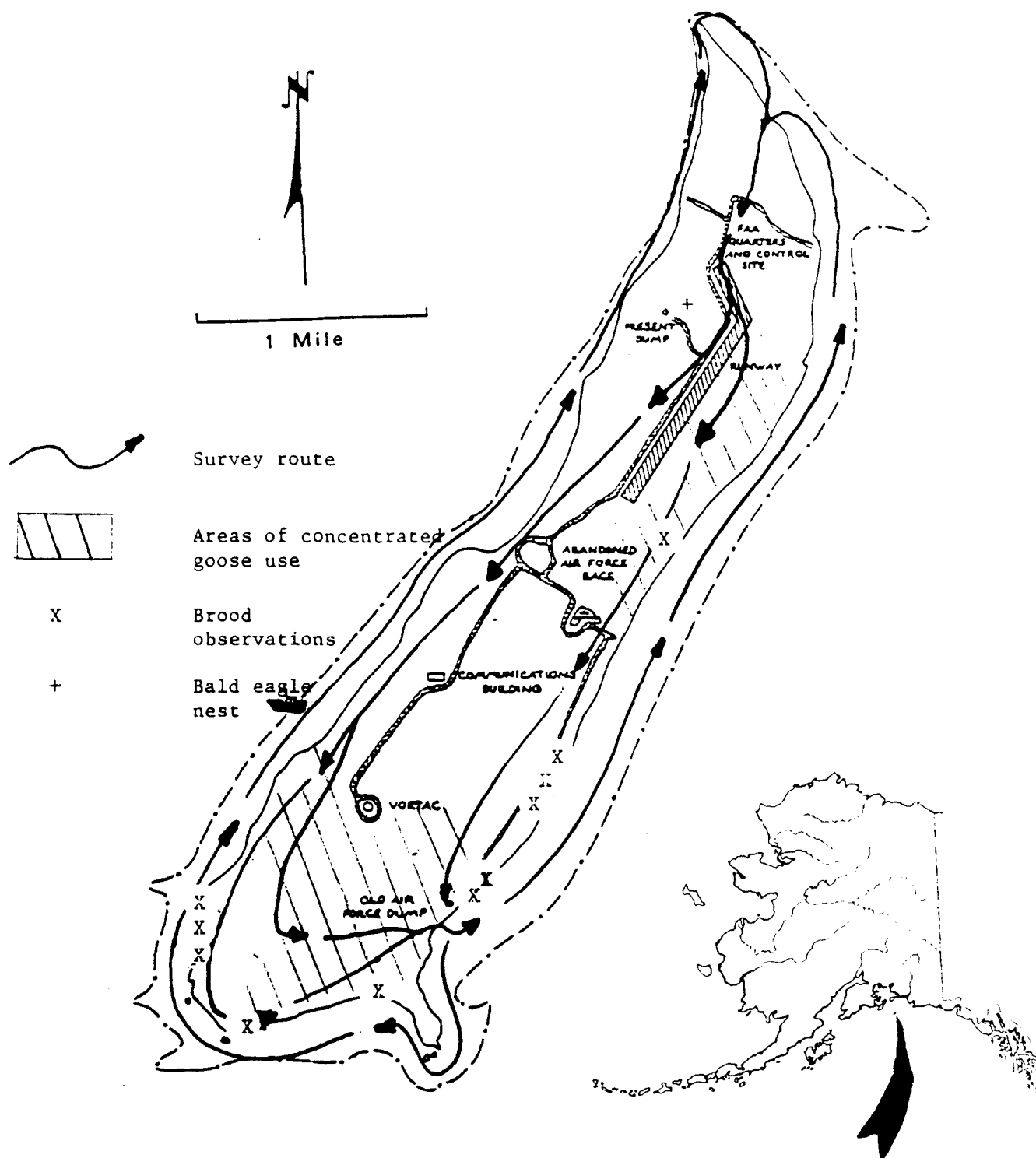


Fig. 4. Survey route, areas of concentrated use, and brood observations for Canada geese on Middleton Island, Alaska, 1988.

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