ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

STATE OF ALASKA
Bill Sheffield, Governor

DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner

DIVISION OF GAME
Robert A. Hinman, Acting Director

# ANNUAL REPORT OF SURVEY-INVENTORY ACTIVITIES

## PART IV. WATERFOWL

by
Bruce H. Campbell
and
Daniel E. Timm

Volume XIII

Federal Aid in Wildlife Restoration

Project W-22-1, Job 11.0



(Printed April 1983)

CONTENTS

## 1981-1982 ALASKA WATERFOWL REGULATIONS SUMMARY - SEASONS AND LIMITS

| AREA | NORTHERN | GULF COAST | SOUTHEAST | KODIAK & ALEUTIANS |
|---|---|---|---|---|
| State Game Management Units | 11-13 & 17-26 | 5-7, 9, 14-16 & Unimak Island | 1-4 | 8 & 10 (except Unimak Island |
| Open Seasons | Sept. 1-Dec. 16 | Sept. 1-Dec. 16 | Sept. 1-Dec. 16 | Oct. 8-Jan. 22 |

| | LIMIT BAG | POSS. | LIMIT BAG | POSS. | LIMIT BAG | POSS. | LIMIT BAG | POSS. |
|---|---|---|---|---|---|---|---|---|
| Ducks | 10 | 30 | 8 | 24 | 7 | 21 | 7 | 21 |
| Sea Ducks* & Mergansers | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 |
| Geese** | 6 | 12 | 6 | 12 | 6 | 12*** | 6 | 12**** |
| Emperor Geese | 6 | 12 | 6 | 12 | 6 | 12 | 6 | 12 |
| Brant | 4 | 8 | 4 | 8 | 4 | 8 | 4 | 8 |
| Snipe | 8 | 16 | 8 | 16 | 8 | 16 | 8 | 16 |
| Crane | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 |

* Sea Ducks: Eiders, Scoters, Old Squaw, Harlequin.
** No more than 4 daily, 8 in possession may be Canada and/or white-fronted geese.
*** Provided that Unit 1C is closed to the taking of snow geese.
**** The taking of Canada geese in the Aleutian Islands, except on Unimak, is illegal. (To protect the Aleutian Canada goose).

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

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

(c) CONVEYANCES: Hunting is not permitted from an aircraft, motor driven vehicle, air boat, jet boat, or propellor driven boat, which the motor of such has not been completely shut off and its progress therefrom has ceased.

(d) POSSESSION: No person may receive or possess any migratory game bird belonging to another unless such birds have a tag attached with the signature of the hunter, his address, the date, and total number and kinds of birds taken.

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

(f) SHOOTING HOURS: One half hour before sunrise to sunset.

(g) 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) on his person.

### SUMMARY OF FEDERAL REGULATIONS

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

Restriction. 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 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.

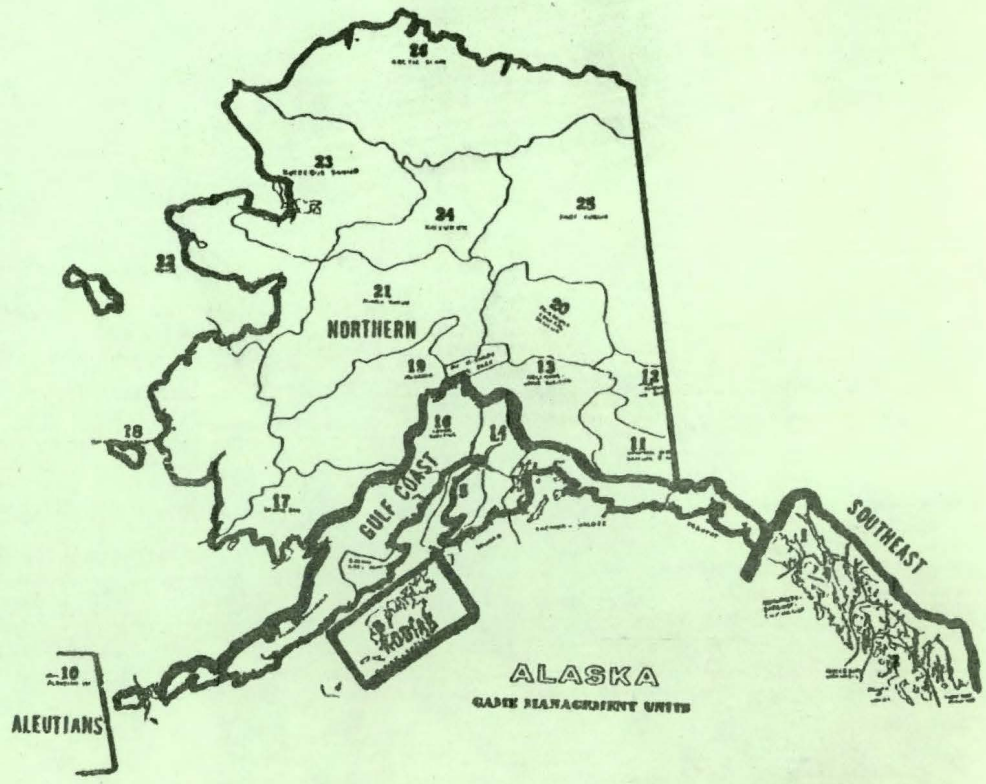
Field Possession Limit. No person shall possess more than one daily bag limit while in the field, or while returning from the field to one's car, hunting camp, etc.

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

Importation. 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. Importation of doves and waterfowl from 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.

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 Rd., Anchorage, AK 99503. Telephone (907)276-3800.



# WATERFOWL HARVEST AND HUNTER ACTIVITY

This was the 5th year that the Department has utilized the U. S. Fish and Wildlife Service (FWS) mail questionnaire and parts collection surveys to estimate harvest and hunter activity. Timm (1978) described the progression of events which led to discontinuation of the State waterfowl hunters survey. Data in this report are from Carney et al. (1982).

The FWS categorized data from their parts collection according to codes listed in Table 1. Data are coded to either specific locations within 11 harvest areas (Fig. 1), or, if birds were not taken at the specific locations listed in Table 1, then the general harvest area code is assigned. For example, a duck shot at Palmer Hay Flats would be coded 1123; a duck shot on the Kasilof Flats would be coded 1103. Timm (1978) provided a more detailed description of the coding system.

## Results

### Hunter Activity:

There were 15,885 duck stamps sold in Alaska during 1981. After corrections for people buying 2 stamps, 15,496 potential hunters were projected in Alaska. During the 1981-82 season, 10,862 people (70.1%) hunted waterfowl, compared to 12,425 active hunters a year ago (Table 2). The FWS survey does not allow for a breakdown of hunting effort by area.

### Duck Harvest:

#### Magnitude of the Harvest.

Hunters reported taking an average of 5.2 ducks each (7.7 in 1980-81), after corrections for reporting bias were made (Table 2). Reported average daily bag was 1.2 ducks. The projected total statewide harvest was 78,209 ducks, of which 2,968 (3.8%) were sea ducks and mergansers.

#### Location of Harvest.

According to the FWS survey, about 62% of the kill occurred in the Cook Inlet area (Table 3), while no birds were shot on the Seward Peninsula and Aleutian Chain. These aberrant data are the result of small or no samples from these areas. For comparative purposes, the 3-year (1974-76) average distribution of harvest data, as obtained from State mail surveys, are also presented in Table 3. These data are believed to more accurately portray harvest by location than does the Federal survey.

Species Composition of Harvest.

As in previous years, mallards, pintails, green-winged teal, and wigeons composed the bulk of the harvest (82.6%) (Table 4). Dabblers made up 88% of the total kill, divers 9.6% and sea ducks and mergansers, 2.5%. Mallards composed a large portion of the harvest in the Southeast and Cook Inlet areas, while pintails were common on the Alaska Peninsula and in Cook Inlet. Relatively uncommon ducks (blue-winged teal, ring-necked ducks, and redheads) occurred in scattered locations of the Central, Cook Inlet, and Gulf Coast areas.

Goose Harvest:

A breakdown by species and area of the 1981-82 statewide goose harvest of 10,203 birds is provided in Table 5. This represented a 21.7% decrease in harvest from last year. Canada, emperor, brant, and white-fronted geese composed 86.6%, 6.8%, 5.0%, and 1.5%, respectively, of the Statewide kill. The Fish and Wildlife Service survey reported no snow geese killed in Alaska. According to the Federal survey, over 60% of the harvest occurred on the Alaska Peninsula, while no geese were killed on the North Slope, Yukon valley, Seward Peninsula, Aleutian Chain, Y-K Delta, or Kodiak Island. Only a few were shot along the Gulf Coast and in the Central region (2.5% and 1.0%, respectively). These aberrant data resulted from the same biases described for the duck harvest. We believe that a more accurate picture of the goose harvest is portrayed by 3-year average data obtained from past State mail surveys (Table 6). However, recent harvest data are desirable.

Crane Harvest:

A retrieved take of 553 cranes (1,049 in 1980) was calculated by Sorensen et al. (1982) for the 1981-82 season in Alaska. The location of crane harvest and the number of successful hunters were not obtained from the FWS survey.

Discussion

The FWS samples more hunters in their mail questionnaire survey than were sampled by State mail surveys. Compared to most other states in the Pacific Flyway, sample size is proportionately greater in Alaska. However, a major weakness of the parts collection survey is that species composition of the harvest (particularly for geese) and harvest by area are not accurately reflected. For example, perhaps 10 people from the Gulf Coast reported taking 25 geese in the mail questionnaire survey. However, if only 1 person from the Gulf Coast sent in 1 goose tail (which happened in 1980), a calculated 6.5 geese were taken during the 1980-81 season.

When the State survey was dropped, the chief loss was annual estimates of harvest and hunter days by specific location (Timm 1978). However, it was believed that 3-year average estimates of these data, based on State surveys made during 1974-76, would be adequate until a need for more precise data arose. Requests for current and specific data continue to increase, and a State survey is planned for the 1982-83 season.

## STUDIES ON THE COPPER RIVER DELTA (CRD)

### Dusky Canada Goose (Branta canadensis occidentalis) Studies

Production Studies:

Although weather during the springs of 1981 and 1982 was favorable for nesting birds, goose production was poor. Results of a limited nest survey in 1981 (Table 7) indicated a 60% decline in nests from 1980 and a 70% decline from the 1975-80 average (a period when the population was steady or increasing). Intensive nest surveys in 1982 indicated nest densities were 68% greater than in 1981 but still 43% below the 1975-80 average (Table 7). Predators, primarily bears, coyotes, and gulls destroyed 49% of the 1982 nests, while 49% of the nests hatched at least 1 egg (Table 7). This compares to a 14-year hatching success of 71.7%. Clutch sizes were also down from the previous 15-year mean of 5.0 (range 3.6-5.8) with clutch sizes of 4.9 ($\underline{N}$ = 28) in 1981 and 4.8 ($\underline{N}$ = 135) in 1982 (Table 7).

The production surveys conducted during July 1981 and July 1982 reflected the low nest densities and small clutch size. Based on aerial observation of 8,740 geese in 1981 and 8,473 geese in 1982, young composed 17.9% and 23.7% of the population in 1981 and 1982, respectively. These data compare to a 26.5% average from the preceding 11 years (1971-1982).

Breeding population surveys were not flown in 1981 or 1982 because of unknown air/ground visibility rates and higher priority work on tule geese. However, Bob Jarvis of Oregon State University has developed an aerial photographic technique to determine subspecies of geese. The results of his photography and ground estimates of subspecies composition, combined with aerial population surveys, indicated a 1981 postseason population of 23,000 duskys on the wintering grounds in Western Oregon (unpubl. rep. to Pacific Flyway Waterfowl Study Committee). That population and 17.9% young resulted in a calculated fall 1981 flight of 27,000 birds. The spring 1982 population was an estimated 17,750 geese (B. Jarvis, unpubl. rep.), indicating mortality of 9,250 geese during the 1981-82 waterfowl season (Table 8). An estimated 17,000 breeding population and 23.7% young resulted in a calculated fall 1982 flight of 21,000 birds (Table 8).

The Future of Dusky Geese:

Habitat on the Copper River Delta has been steadily changing since the 1964 "Good Friday" earthquake. In 1974, a low (12-32 inch) shrub habitat characterized by Myrica gale composed 2.5% of the vegetation on the delta. Dusky canada geese strongly preferred this type of vegetation for nesting (Bromley 1976). Limited vegetation analysis in 1982 indicated that brush cover on the delta had increased to at least 11% and is now characterized primarily by 8-10 ft alders and willows.

This habitat change has not only directly affected the geese by limiting visibility and predator detection, but the brush also provides cover for mammalian predators. Secondarily, an increase in brush cover and growth indicates drier conditions which also favors mammalian predators.

It was generally assumed that siltation and sedge growth on pre-earthquake submerged land would keep pace with brush growth on the upper delta, resulting in the amount of nesting habitat remaining constant. This has not been the case. It will be many years before the outer, uplifted mud flats become suitable nesting habitat unless manipulated by man.

While changes in nesting habitat have adversely affected dusky production, 1981-82 production survey results are cause for some optimism. Geese are nesting in greater numbers in other parts of the delta, particularly on Castle Island in the Copper River, on Egg Island in the southwest corner of the delta, and on the far west delta in the Eyak River-Government Slough area. Based on aerial counts, production was 32% and 43.7% young in these areas during 1981 and 1982, respectively.

Harvest levels in Oregon may also be influencing the dusky population. Postseason numbers remained fairly stable between 1978 and 1981 despite poor production, primarily due to a relatively low harvest (Table 8). This low harvest was attributed to an abundance of other Canada goose subspecies on the wintering area.

In 1973, there were about 3,000 lesser Canada geese (B. c. taverneri and B. c. parvipes) postseason in dusky goose wintering areas; in 1982, there were 56,700 (R. Jarvis, unpubl. reps.). The growing number of lessers was likely buffering the harvest of duskys until 1981 when, assuming errors in survey techniques were minimal, dusky harvest increased. In 1981, 9,250 duskys were taken during the 1981-82 season, even though lesser Canada goose numbers continued to increase. In addition, the breeding stock was apparently hard hit, with >60% of the harvest comprised of adult birds.

Because of declining dusky goose numbers, new and innovative management techniques are being explored. These include habitat

manipulation and predator control on the delta, as well as modification of hunting regulations on the wintering areas. The potential of these techniques presents an optimistic future for the dusky Canada goose.

Band Recoveries:

In accordance with the revised flyway management plan, duskys were banded in 1982 to monitor distribution and timing of harvest. Distribution of bands reported from previously banded birds that were shot or found dead since the 1975 hunting season, by area, is given in Table 9.

We can currently offer no explanation for the apparent relative decline of harvest in Alaska and increase in Oregon during the 1980-81 and 1981-82 hunting seasons.

## Fall Duck Survey and Duck Food Habits

In response to public concern over an apparent decline in duck use of the Copper River Delta during fall, the U. S. Forest Service (USFS) held a meeting on April 29, 1980 to discuss past and present conditions on the Delta. As a result of that meeting, the ADF&G, with financial support from the FWS, agreed to conduct aerial surveys of the west Copper River Delta from late August through October 1980 and 1981. The objectives of the fall duck surveys were to: 1) document migration timing, 2) identify autumn habitat use by time period, and 3) locate major concentration areas for future evaluation.

ADF&G also volunteered to assess duck food habits and to conduct a hunter survey (this work was accomplished by J. Reynolds, D. Sellers, and M. Jackson). All tasks were to provide base data for a duck study, which never materialized, to be contracted by the USFS in 1981.

Aerial Surveys:

Campbell et al. (1982) presented results of 1980 and 1981 autumn aerial surveys. These results are summarized below.

Procedures:

Surveys were flown along predetermined transects totaling 116 linear miles and were designed to sample habitats from barrier islands inland to shrub communities south of the Copper River Highway. Flight lines were broken into 34 segments, according to habitat type and physiographic features.

Five segments totaling approximately 20 mi were along the water/mud interface, 2 segments (14 mi) were over unvegetated intertidal flats between Egg Island and Eyak River, and the remaining 27 segments (82 mi) were over supratidal habitats, except where

they crossed tidal sloughs and rivers. The same plane, pilot, and 2 observers were used for all surveys, except the 1st survey when a 3rd observer was used. Altitude was maintained between 100 and 150 ft and air speed at 90 MPH. The front seat observer (J. Reynolds) helped with navigation and plotted waterfowl concentrations on the right side as either small (15-50 ducks) or large (>50 ducks) on 1 inch = 1 mi topographical maps. The other observer (M. Jackson) recorded all birds within 220 yd of the aircraft on the right side, according to transect segment, habitat type (pond, slough/river, mud flats, tide line, meadow, or other), and when possible by species.

Results:

A total of 33,399 ducks, excluding flock size data, was counted during the study (14,920 in the fall of 1980 and 18,479 in 1981). In 1980, the number of birds observed/survey increased through late August, peaked in mid-September, and, with the exception of early October, declined throughout the remainder of the fall. The early October increase in duck abundance is common for the Gulf Coast region of Alaska and probably results from migration of birds prompted by freeze-up in Interior Alaska. The 1981 counts were similar to 1980 since September was the month of highest counts. However, the October secondary peak in duck numbers was much smaller in 1981 than 1980. Duck species composition during these counts was not determined due to inconsistencies in the data.

A strong habitat preference was noted during the study period (Fig. 2). Over 75% of the ducks observed were on the intertidal zone. In 1980, 67.3% of the birds seen were on the tideflats, tide guts, and Egg Island complex, while 86.1% of the birds occurred in these areas in 1981. This preference changed during the fall of both years. During August and early September, ducks showed a strong preference for the intertidal areas over inland ponds and marshes; however, as fall progressed, the frequency of ducks inland increased.

Duck flock size and location data also indicate a strong preference for the intertidal zone (Table 10). In 1980, the smaller flocks of ducks (15-50) apparently had near-equal preference for the tide flats and inland marshes while 83% of the larger flocks (>50) preferred the open intertidal zone. Duck distribution in 1981 illustrated a much stronger preference for the intertidal zone, with over 73% of the small groups and nearly 90% of the large flocks seen there.

Relationships between flock size, habitat use, and time of year were observed. Throughout fall 1980, groups larger than 50 ducks were most often seen in the intertidal zone (Fig. 3). In fact, this was the only place large groups were observed during the last half of October. In contrast, groups comprised of less than

50 birds were most commonly seen on the intertidal zone from August until late September, but they occurred more frequently on inland ponds and marshes after that time. In 1981 (Fig. 4), use patterns differed from 1980 in that both flock sizes were more frequently seen on the intertidal zone throughout fall.

Minor autumn duck concentrations occurred on Castle Island (7.8 ducks/mi), Gus Stevens Slough (5.4 ducks/mi) and on land between the Eyak River and Government Slough (5.5 ducks/mi).

All major concentrations were observed on the intertidal zone. Concentrations ranged from over 70 birds/mi on Egg Island and mud flats between Eyak River and Government Slough to 15 birds/mi along the mud flats between Alaganik Slough and Glacier River. Concentrations of ducks were observed along the mud flats between Gus Stevens and Pete Dahl Sloughs, Pete Dahl and Alaganik Sloughs, and Government Slough to Eyak River during all survey flights.

Several areas had consistently low or no duck concentrations. These included the marsh/tide flats interface between Gus Stevens and Walhalla Sloughs (0 birds/mi), Upper Government Slough (0 birds/mi), and segments 19 and 21 bisecting upper Alaganik Slough (0.2 and 0.1/mi, respectively).

Discussion:

An obvious conclusion is that ducks had a very strong habitat preference during fall 1980 and 1981, with the intertidal zone much preferred over inland marshes and rivers. Over 75% of the ducks observed and 78% of the total flocks were in the intertidal zone. This imbalance in distribution is partially due to increased sightability of ducks on the mud flats than on small ponds. However, ground observations by J. Reynolds and hunter complaints substantiate the lack of ducks inland.

Temporal changes in both flock distribution and total duck observations were similar both years, although the magnitude of these changes was more pronounced in 1980. Ducks were observed over 15 times more frequently in the intertidal zone than the inland zone from the middle of August until mid-September. After mid-September, the number of birds on inland ponds and rivers generally increased but was never greater than a ratio of 1:13 inland to intertidal sightings (Oct. 1, 1980).

Large flocks of ducks (>50) were most common on the intertidal zone throughout both fall seasons. The distribution of smaller flocks (15-50) changed during fall both years. They occurred 4 times more frequently on the intertidal zone than inland marshes until mid-September when their frequency of occurrence on the inland zone increased. By the 1st part of October 1980, small flocks occurred more frequently inland than on the intertidal area.

The shift in habitat preference during falls 1980 and 1981 (Fig. 2), although not major, was from the intertidal zone to the inland zone. Similar shifts are common in upper Cook Inlet. The relative abundance of species preferring inland marshes, such as mallards, increases as the total number of birds in an area declines, resulting in an apparent shift in duck habitat preference from intertidal to inland marshes. However, greater food availability inland vs. intertidal as the season progresses cannot be discounted.

Certain parts of the intertidal zone appear more important to waterfowl than others. Egg Island, the areas between the mouths of the Eyak and Glacier Rivers, and Alaganik and Gus Stevens Sloughs consistently supported large number of ducks, contrasted to intertidal zones between Alaganik Slough and Glacier River, and the Copper River and Gus Stevens Slough. These areas, which appear similar to the other intertidal areas, supported far fewer ducks.

The only inland marsh areas surveyed that were fairly consistently used by ducks during fall 1980 and 1981 were Castle Island, Gus Stevens Slough, and the marshes, ponds, and sloughs between Eyak River and Government Slough.

If these surveys are representative of present fall distribution of ducks (and they apparently are), it is evident why duck hunting has "deteriorated" on the Copper River Delta. Although long-term population and distribution data are unavailable, we speculate that the "deterioration" is not so much the result of declining populations on the delta as it is of shifts in areas of heavy duck use. Shepard (1965) reported that a 20-$mi^2$ area of intertidal mud flats adjacent to the shoreline of the Copper River Delta was raised and exposed by the 1964 earthquake. Work presently being conducted by the USFS, Pacific Northwest Range and Experimental Station personnel indicates that new plant communities are evolving on these uplifted areas. Major concentrations of ducks in fall have apparently shifted from inland habitats to these new areas.

Recommendations:

1. Fall surveys should continue for at least 2 more years to determine areas of the west Copper River Delta used consistently by fall ducks over an extended period. Future surveys should include the collection of duck species composition data.

2. Upper tracts of ducks collected in 1980 and 1981 will be analyzed for food habitats. However, no ducks were collected on intertidal areas. Future collections should be made there, as well as on supratidal habitats.

Unfortunately, due to budgetary restrictions, the ADF&G cannot continue fall duck surveys unless they are conducted in conjunction with a research effort by the USFS or FWS, to determine fall duck distribution.

Food Habits:

Results of the 1980 autumn duck diet study have been reported (Timm 1982). A total of 109 ducks was collected on the west delta during fall 1981, 97 from the supratidal and 12 from the innertidal zones. Sixty of the 109 birds were collected between Sept. 29 and Oct. 3, 1981.

Esophagi and gizzards (collectively referred to as gullet) were removed as soon as possible and preserved by freezing. Because sport hunters cooperated in the collection, the samples were not handled identically, and fixing of some samples occurred several hours after collection. Postmortem digestion rendered many of these samples unusable for content analysis and undoubtedly inflated the occurrence of seeds in others (Swanson and Bartonek 1970). In consideration of this potential bias, only a refined ocular estimate of gullet content volume was made.

Since analysis of gizzard contents inflates the importance of seeds in the diet (Swanson and Bartonek 1970), only esophageal contents were analyzed. Sixty-two esophagi contained items relatively undigested and in suitable condition for analysis. The contents of these esophagi were segregated and identified. Invertebrates were identified at least to family by Pennak (1978). Vegetation and seeds were identified to genus, using Hotchkiss (1970), Prescott (1969), and Fassett (1969). Segregated items were placed on a piece of plateglass with 1 cm x 1 cm and 0.5 x 0.5 cm grids, and volumes were estimated ocularly. Data were summarized by percent occurrence and aggregate percent volume.

Results.

While both dabbling and diving ducks were collected, 98% of the samples analyzed were dabblers. Pintails composed 33% of the total sample, mallards (27%), wigeon (26%), green-winged teal (9%), gadwall (3%), and goldeneye (2%).

Fifteen items in aggregate volume composed 1% or more of the diet (Table 11). Vegetation (foliage, roots, and tubers), seeds, and animal matter were all about equally represented in the diet, with vegetation composing 36% of the volume, seeds (33)%, and animal matter (29%).

The diets of the 4 species of dabbling ducks (mallard, pintail, green-winged teal, and wigeon) indicate species food preferences (Table 12). Pintails consumed the most animal matter and seeds,

while wigeon consumed the greatest amount of vegetation and no animal matter. Mallards and green-winged teal were intermediate, with mallards consuming more animal and seeds than teal, which tended to be vegetarian.

Because habitat varied between collection sites, differences in species dietary preferences may have occurred. However, sample size from collection sites was insufficient to positively determine location dependent variations in species preferences. Some differences were suggested, however (Table 13). The diet of 16 wigeon collected along Eyak River, Copper River, and Eyak Lake was 88% water buttercup (Ranunculus sp.) and pondweed (Potamogeton sp.), and 2% unidentified grass and unidentified seed. The 21 pintail samples, which were collected from Castle Island, Egg Island, and Eyak River, suggested that, with the exception of Egg Island, this species consumes considerable amounts of animal matter. Diptera, trichoptera larva, pelecypods, gastropods, and stickleback made up a major portion of the diet volume. In contrast, nearly 66% of the volume of material from 7 pintails collected on Egg Island was rush (Eleocharis sp. and Scirpus sp.) and sedge (Carex sp.) seeds. Pelecypods, gastropods, and diptera larva composed most of the remainder.

Mallards tended to be vegetarian on all parts of the Copper River Delta. The esophagi from mallards collected on Castle Island and along the Copper River Highway contained 70% and 90% vegetation, respectively. This vegetation was primarily an unidentified grass with lesser amounts of pondweed and water buttercup. Over 50% of the diet of mallards collected from Eyak River was seed, including rush, sedge, and water mare's tail (Hippuris sp.) seeds, and an unidentified seed.

Only 6 green-winged teal were collected, and the diet varied between locations: 66%-100% animal matter on Castle Island and Copper River Highway, compared to 100% seeds on the Eyak River.

Discussion.

Seeds are probably an important part of fall duck diets in Alaska because their high carbohydrate content helps to provide the energy necessary for migration. Fall dabbling duck diet in Alaska has been reported to contain from about 30% seeds along upper Cook Inlet (Timm and Sellers 1979) to 70% seed in southeastern Alaska (Hughes and Young 1982). In contrast, seeds composed only a minor portion (20%) of the 1980 autumn dabbling duck diet on the west Copper River Delta (Timm 1982). Speculation was that this was a result of changing conditions on the delta, due to the 1964 Good Friday earthquake. These changes may have lowered plant vigor and reproduction, resulting in low seed availability (studies quantifying availability have not been done).

The above results are different from those reported for 1980. Autumn 1981 dabbling duck diets composition was similar to that reported for Cook Inlet, since 33% of the material ingested was seeds. The difference between 1980 and 1981 could be attributed to several factors: seeds may have been more abundant in the environment in 1981; birds may have selected seeds while foraging in 1981; or samples were collected from different areas during the 2 fall seasons. Since seed availability on the west Copper River Delta was not ascertained and a major shift in foraging selectivity among all species of dabbling ducks on the delta in the span of 1 year is not likely, the 3rd factor seems more likely. The proportion of the sample from Eyak River, Copper River Highway, Castle Island, and Eyak Lake was similar during both 1980 and 1981. The portion of esophagi contents comprised of seed was also similar at 20% and 19%, respectively. However, the addition of Egg Island birds to the sample in 1981 changes overall duck diet composition significantly. Eighty-two percent of the esophagi contents from Egg Island (an innertidal area) was seed.

Diet composition differences between birds collected from the supratidal zone and Egg Island are very important in light of autumn duck distributions. Over 75% of the ducks using the Copper River Delta between mid-August and late October in 1980 and 1981 were in the intertidal zone (Campbell et al. 1982). While the sample size for Egg Island was small, the difference between the portion of duck diets comprised of seeds there and on the mainland suggests that seed availability and/or use on the intertidal zone influences autumn duck distribution on the west Copper River Delta.

## Summary and Recommendations

The 1981 autumn diet of 4 species of dabbling ducks (pintail, mallard, green-winged teal, and wigeon) was comprised of 36% vegetation, 33% seeds, and 29% animal matter. Seeds were nearly 10% more abundant in 1981 diets than 1980 diets. Pintails consumed the greatest amount of seed as well as animal matter, followed by mallards and green-winged teal. Wigeon consumed the least amount of seed and animal matter, but the most vegetation.

Major differences during of the 2-year diet study were differences between duck and sampling area distributions. During both 1980 and 1981, over 75% of the birds observed during aerial surveys were on the intertidal zone (Campbell et al. 1982), while only 12% of the diet sample came from this area (Egg Island). Collection of ducks from the intertidal zone is very difficult. However, if a true representation of the diet of a major portion of the ducks on the west Copper River Delta is to be achieved, additional collection from the intertidal habitat will be necessary. Additionally, food availability assessments, intertidal and supratidal, are necessary to further examine the reasons for duck distribution on the Copper River Delta. Time-budget observations in different habitats are also desirable.

## LESSER CANADA GOOSE STUDIES

### Cook Inlet Area

The U. S. Army requested a Canada goose transplant to Otter Lake on Fort Richardson after extensive waterfowl habitat improvements were made in early 1979 and 1980.

During July of 1981 and 1982, a crew of Army and ADF&G personnel captured 7 and 100 Canada geese, respectively, on the Palmer Hay Flats, using an Army helicopter. Five goslings and 2 adults were transplanted to Otter Lake in 1981; 66 goslings and 3 adults were transplanted to McVeigh Marsh on Fort Richardson in 1982. The resulting total of 1979-82 transplanted birds was 162 goslings and 21 adults. Sixty-one of the goslings transplanted in 1982 were fitted with red neck collars.

As of July 31, 1982, there have been 12 recoveries (7.4%) of transplanted locals and 1 recovery (4.8%) of a transplanted adult. For banded and released locals and adults in 1979, 1980, and 1981, total recovery rates have been 5.3, 8.1, and 28.6%, respectively.

Although the Otter Lake project is now 3 years old and goslings transplanted in 1979 are now of breeding age, no banded birds were observed nesting on the lake in 1982. Three pairs of unmarked geese nested on the lake, but all nests were lost before hatching.

### Alaska Peninsula

Canada geese were banded at Cold Bay by FWS personnel in 1981 without assistance from ADF&G. Timm and Sellers (1979) and Timm (1982) reported 36 recoveries from banding in 1977, 1978, and 1980 (no birds were banded in 1979). As of the July 31, 1982 FWS recovery listing, there have been 45 hunting season recoveries from birds banded at Cold Bay, plus sightings of 5 dyed birds in the Willamette Valley. The distribution of recoveries is as follows: Oregon - 18 (36.0%); Alaska - 19 (38.0%); California - 9 (18.0%); and Washington - 4 (8%). The recoveries in Alaska were at Cold Bay (12), Nunivak (1), and on the Yukon-Kuskokwim (Y-K) Delta (4). An additional bird was recaptured on the Y-K Delta during summer banding operations.

## TULE GOOSE STUDIES

Since first described on their California wintering grounds in 1917, the existence of tule white-fronted geese (*Anser albifrons gambelli*) as a bona fide subspecies has been debated. Location of the nesting grounds was necessary to ascertain the relationship with *A. a. frontalis*. In 1979, nesting grounds were located by Bob Elgas, Warren Hancock, and Dan Timm in Redoubt Bay, across

Cook Inlet from Kenai. Because of the wide concern for and attention given to these birds in recent years, ADF&G assumed leadership in an investigation of the status of white-fronts on State-owned marshes in Cook Inlet.

## 1981-82 Progress Report

Study objectives for 1981 and 1982 were the following:

1. Locate and describe nesting habitat in the upriver regions of Big River.

2. Determine whether nesting and brood rearing occurs, and the suitability of nesting habitat in the northern portions of Redoubt Bay.

3. Locate and describe nesting habitat on Susitna Flats.

4. Determine the suitability of Trading Bay as nesting habitat for tule geese.

5. Determine spring arrival dates and use areas in Cook Inlet.

6. Capture, neck-collar, and measure tule geese on Susitna Flats and Redoubt Bay.

7. Conduct comprehensive aerial surveys of tule geese in Cook Inlet during mid-July.

8. Further define the fall departure pattern of tule geese from Cook Inlet.

### Objective 1 - Locate and Describe Nesting Habitat on Upper Big River:

During spring and early summer of 1981 and 1982, 11 $mi^2$ of Redoubt Bay were searched on foot for tule nests bringing the total area searched since 1980 to about 18 $mi^2$ (Fig 5). In 1981, approximately 1.3 $mi^2$ of shrub-bog habitat, and 7.6 $mi^2$ of fresh marsh and sedge grass flats (see Timm 1982 for definition of habitat types) were searched unsuccessfully for nests.

Four nests were located in 3.1 $mi^2$ of fresh marsh on lower Big River (1.3 nests/$mi^2$), while no nests were found in the Johnson Slough-Kustatan River area. The 1981 nest density of 1.3 nests/$mi^2$ on lower Big River was similar to 1980 (Timm 1982).

Three of the 4 nests were located on elevated (about 2 ft) slough berms, and the fourth was in an elevated clump of sedge (Carex Lyngbaei) in a shallow pond. Table 14 describes the 4 nests.

Approximately 3.36 $mi^2$ of habitat were surveyed in 1982 (1.43 $mi^2$ of shrub-bog, 1.15 $mi^2$ fresh marsh, and 0.78 $mi^2$ saline sedge-grass flats). One nest was found in a clump of sedge on a pond in the fresh marsh (Table 14).

Although over 3 $mi^2$ of shrub-bog have been searched since 1980 with negative results, brood observations suggest that nesting occurs in this habitat. Six and 8 broods were seen on Big River tributaries in this habitat in 1980 and 1981, respectively. Another possibility is that broods move into this habitat type after hatching somewhere else.

Objective 2 - Determine if Nesting Occurs and Evaluate Nesting Habitat in Northern Redoubt Bay:

A total of 6.3 $mi^2$ of potential nesting habitat in the Johnson Slough-Kustatan River area was searched for nests in June 1981 (Fig. 5). While no nests were found, the habitat appears similar to that on Big River. The only visible differences are slightly smaller fresh marsh ponds and occasional areas where the fresh marsh is absent and saline sedge-grass flats extend to shrub-bog. Plant communities in the saline sedge-grass, fresh marsh, and shrub-bog are similar to those described for the Big River area (Timm 1982).

During the July 1982 aerial survey, 6 adult and 15 young white fronts were seen along Johnson Slough; none were seen there in 1980 and 1981. The quantity and quality of habitat north of Big River indicates that a large amount of unusual nesting habitat exists.

Objective 3 - Locate and Describe Nesting Habitat on Susitna Flats:

During aerial surveys in 1980 and 1981, young white-fronts were observed between the Theodore and Beluga Rivers. In 1981, an area between intertidal mud and poorly drained sweet gale (Myrica gale) was searched for nests. In 1982, because of reports of nesting geese in sweet gale (Charles Brauch, pers. commun.), the search was extended into this habitat.

Habitat Description.

Habitat progressing inland from the coast between the Beluga and Theodore Rivers is characterized by a transition from intertidal mud, to saline sedge-grass flats, freshwater marsh, poorly drained sweet gale, alder-willow thickets, and spruce-birch forest. Slightly elevated berms along rivers and major sloughs support a dry grass-sedge-drift habitat in sedge-grass habitat. The habitat searched for nests was categorized by the 4 habitat types used by Timm (1982): intertidal mud flats, saline sedge-grass flats, fresh water marsh, and shrub-bog.

Saline sedge-grass flats extend from 0.15 to 0.25 mi inland of the tidal flats and are characterized by occasional small, shallow (<3 ft) brackish ponds. A slightly elevated driftline divides this habitat from the fresh marsh along much of the coast. Saline sedge-grass flats are flooded by tides higher than approximately 32.5 ft.

Prominent vegetation on Susitna Flats includes the following: creeping alkali grass (Puccinellia phryganodes), seaside arrowgrass (Triglochin maritimum), marsh arrowgrass (T. palustris), goose-tongue (Plantago maritima), Ramenski sedge (Carex Ramenskii), Lyngbei sedge (Carex Lyngbyaei), and Pacific silverweed (Potentilla Egedii). Beach rye (Elymus arenarius), blue grass (Poa eminens), Arctic daisy (Chrysanthemum arcticum), and beach lovage (Ligusticum scoticum and Saussurea nuda) occur along the slightly elevated driftline.

Within a month after snowmelt, large expanses of standing sheet water shrink to numerous, small permanent ponds of brackish water. These ponds are shallow, have sharply defined shorelines, relatively little emergent vegetation, and unvegetated bottoms. Pondweeds (Potamogeton sp. and Zanichellia palustris) and mare's tail (Hippuris tetraphylla) are sometimes present.

Fresh marshes form a 0.5-0.25 mi wide band inland of the saline sedge-grass flats, and are characterized by numerous large (up to 50 acres) freshwater ponds with indefinite shorelines of emergents. Sedges (Carex Lyngbyaei and C. Mackenziei), dock (Rumex spp.), and marsh five-finger (Potentilla palustris) are common plants. Drainage of this habitat is by sloughs to either the Beluga or Theodore Rivers. Berms along sloughs are covered by drift and are vegetated by prostrate willow and blue joint grass (Calamagrostis spp.).

Shrub-bog begins inland of fresh marsh and consists mostly of sweet gale, red fescue (Festuca rubra), and sedges (Carex spp.). Drier sites support occasional dwarf birch (Betula nana) and willow (Salix spp.), while wetter sites also support buckbean (Menyanthes trifoliata). The edge between shrub-bog and fresh marsh is precise, except at Seeley Lake where a transition of scattered brush-covered islands occurs. No discernible drainage pattern exists in the shrub-bog.

Nest Site Characteristics.

Due to an early spring and higher priorities at Redoubt Bay, a search for nests did not occur until late June in 1981. During 42 man-hours of searching along edges of fresh marsh, river and slough berms, driftline, and the edge of shrub-bog habitat, no nests were found. However, 8 goslings were seen in fresh marsh. One nest was found in 112 man-hours of searching in 1982. Because of the extensive coverage, we believe that little nesting occurs seaward of shrub-bog habitat between the Beluga and Theodore Rivers.

The nest found in 1982 was within 3 ft of a shallow freshwater pond, in the driftline between saline sedge-grass marsh and fresh marsh habitat. The nest characteristics (Table 14) may not be representative because this was probably the 1st nest attempt for these birds. A pair observed near the nest during 2 visits were both 3 years old (neck collared as goslings at Redoubt Bay in 1980). The pair acted very "broody." When the nest was first located the eggs were warm, but the nest bowl contained approximately ½-inch of water. The next day the pair of tules was still near the nest, but the eggs were cold and 1+ inch of water filled the nest.

Nesting, and probably most production, occurs farther inland at Susitna Flats. A cabin owner (Charles Brauch, per. commun.) reported seeing broods on beaver ponds and marshy lakes along the edge of the spruce-birch forest and shrub-bog habitat. We observed numerous adults moving between the saline sedge-grass flats, fresh marsh, and more interior habitats during the nesting period. Several "broody" acting tules were flushed from the shrub-bog habitat during nest searches. Reports of family groups coming down the Theodore and Beluga Rivers from interior regions (Charles Brauch, pers. commun.) may account for the occurrence of young birds in fresh marshes during late July and August.

Objective 4 - Evaluate Trading Bay for Nesting Habitat:

On August 18-21, 1981, the McArthur River area of Trading Bay was evaluated to ascertain suitability of habitat for goose nesting. Habitat in this area can be characterized by the same 4 habitat types used in Redoubt Bay and Susitna Flats. However, the saline sedge-grass flats are narrower than at Susitna Flats or Redoubt Bay.

Plants common on the saline sedge-grass flats are sedge (Carex Mackenziei and C. Ramenskii), poa, seaside and marsh arrowgrass, marsh five-finger, and Arctic daisy. Mare's tail is common in the numerous ponds. The relatively few berms are vegetated by beach lovage, vetch, marsh five-finger, sweet gale, and prostrate willow.

Fresh marsh habitat is similar in width to Redoubt Bay and Susitna Flats but differs from these areas by an absence of high ground and drift. Much of the fresh marsh is a continuous expanse of tall, dense Ramenski sedge. This habitat was not considered good for goose nesting because of poor visibility and little dry ground. Common vegetation in the fresh marsh area includes sedges (Carex Lyngbyaei, C. pluriflora and C. Mackenziei), marsh arrowgrass, bedstraw (Galium sp.), and (Atriplex sp.). Ponds support pondweed (Zanichellia palustris) and water milfoil (Myriophyllum sp.). The few elevated areas support beach poa, squirrel tail grass, water hemlock (Cicuta mackenzieana), silverweed, and beach rye.

There are fewer tidal guts and sloughs in the McArthur River area of Trading Bay than in Redoubt Bay; thus, berm nesting sites are far less available. A lack of high ground in fresh marsh habitat in the McArthur River area further limits potential nesting sites. Brood rearing--if it occurs--would probably be on intertidal flats or along McArthur River because suitable lakes are scarce. In summary, limited nesting habitat exists in Trading Bay on the sedge-grass flats; suitable habitat may occur inland, but additional study is needed to evaluate this possibility.

During mid-August 1981, approximately 600 white-fronted geese (<50 tules) were observed, mostly on mud flats and saline sedge-grass flats. These birds were feeding on Carex Mackenziei and C. Lyngbyaei foliage and rhizomes as well as Triglochin palustris and T. maritimum.

Objective 5 - Determine Spring Arrival Dates and Use Areas In Cook Inlet:

In 1981, spring thaw occurred 7 to 10 days "early." When investigators arrived at Redoubt Bay on April 26, the area was about 75% snow and ice free; over 300 white-fronts (both subspecies) were present. Geese loafed by melt ponds and ice free saline sedge-grass flats and fresh marsh habitats. Major food items were sedge and arrowgrass roots. As spring progressed, feeding shifted to new sedge shoots.

Breakup occurred 2-3 weeks later in 1982; between April 25-30, only 162 white-fronts were seen at Redoubt Bay. Less than 5% of the area was snow and ice free on May 1. Geese were not abundant until May 10, after large areas had thawed.

A series of ground and aerial observations by ADF&G, USFWS, and others allowed reconstruction of tule migration in 1982. White-fronted geese arrived on Klamath Basin refuges earlier than usual but stayed later. On April 19, several thousand still remained on the refuges. Between April 24-May 1, several hundred white-fronts (primarily tules) were observed feeding and loafing on snow free riverbanks on Susitna Flats. Between May 2-11, over 1,000 observations of white-fronts, primarily in fresh marsh and secondarily saline sedge-grass flats were made on Susitna Flats. Between May 8-12, numbers of geese declined on Susitna Flats while birds increased at Redoubt Bay. The majority of observations at both locations were on saline sedge-grass flats and fresh marsh. Apparently, geese followed breakup down Cook Inlet, moving to new areas as saline sedge-grass flats and fresh marsh areas opened.

Objective 6 - Capture and Neck-Collar Geese on Susitna Flats and Redoubt Bay:

Neck collaring and banding of geese on wintering grounds in California and summering grounds in Alaska have enabled investigators to identify major use areas, timing and route of migrations, pair association, production, and survival rates. Measurements of randomly selected adult birds were also taken to increase the morphological characteristics data base. These data are used to define morphological differences between the Pacific and tule white-fronted goose. Types of measurements and analysis of morphological characteristics were reported by Timm (1982).

Fifty-four and 136 tules were collared in Alaska in 1981 and 1982, respectively (Table 15). Twenty tules were also outfitted with radio transmitters in 1981. A total of 475 tules have been collared in Alaska since 1979.

Marking efforts were expanded in 1981 to include Susitna Flats and the Holitna-Hoholitna River drainages in Interior Alaska, where "tule-like" geese had been reported (Rae Baxter, pers. commun.). Only 3 white-fronts (2 locals, 1 2nd year female) were captured on the Holitna River; 15 tules were captured on Susitna Flats. Birds were captured and marked only in Redoubt Bay in 1982. The Second year (SY) Holitna bird was a frontalis, as were other adults with young where subspecies classification was made visually.

Observation of Marked Birds.

Based on post 1980-81 waterfowl season observations of collared geese in California and Oregon, at least 142 of 292 Alaska collared tules could have migrated north in 1981. During spring and summer, 50 of these were positively identified (45 in Redoubt Bay and 5 on Susitna Flats). Another 77 collared tules were seen, 64 in Redoubt Bay, and 13 on Susitna Flats; however, collars were unreadable due to weather, terrain, and birds' habits.

During April 20-May 3, May 19-June 6, and June 17-19, 1,258 tules (678 adults, 352 yearlings, and 228 unknown age) were checked for collars at Redoubt Bay. During June 9-12, 490 geese (74 adults, 115 yearlings, and 301 unknown age) were checked on Susitna Flats. Two hundred twelve (12.1%) of all geese checked were collared. Age ratio of known-age birds was similar at Redoubt Bay and Susitna Flats (68.7% adults and 31.3% yearlings). The 1980-81 winter population of tule geese was estimated to have had 35% young.

Based on post 1981-82 waterfowl season observations of collared geese, at least 53 of 342 geese collared in Alaska since 1980 could have migrated north in 1982. This number is likely low as only limited observations were made south of Alaska during spring migration. During spring and summer, 32 tules were positively

identified (23 in Redoubt Bay and 9 on Susitna Flats). Another 85 collared tules were seen (49 in Redoubt Bay and 36 on Susitna Flats), but collars were unreadable due to weather, terrain, and birds' habitats.

During April 25-30, May 5-12 and June 3-13, 578 tules (322 adults, 156 yearlings, and 100 unknown age) were checked for collars at Redoubt Bay. During April 24-May 11 and June 1-9, 2,650 geese (1,688 adults, 723 yearlings, and 239 unknown age) were checked for collars on Susitna Flats. The age ratio of known-age birds was similar at both locations (69.6% adults and 30.4% yearlings). This compares with 74.2% adults and 25.8% young in 1980 and 68.7% adults and 31.3% young in 1981. The 1981-82 wintering population of tule geese was estimated to have had 35% young.

Objective 7 - Conduct Aerial Surveys of Geese in Cook Inlet:

Areas surveyed and survey emphasis varied between 1981 and 1982. All species of geese were counted in upper Cook Inlet in 1981, while the west side of lower and middle Cook Inlet were surveyed for tules only in 1982.

Table 16 summarizes Cook Inlet goose surveys since 1980. Besides areas listed in Table 16, McNeil River, Bruin Bay, Ursus Cove, Cottonwood Bay, Iliamna Bay, Iniskin Bay, Chitnitna Bay, Shelter Creek, and Johnson River were surveyed in 1982. No geese were seen.

The 1,217 Canada geese counted in 1981 compares with 2,029 in 1980, representing a 40% decrease. However, Canada goose numbers were still 50% higher than during the 1970's. The number of white-fronts observed declined in both 1981 (1,146) and 1982 (964) from the 1980 count (1,537). It is likely that substantial numbers of white-fronts were not seen because flocks comprised of family groups are often small and frequent flooded brush during molt. White-fronts may also inhabit areas not surveyed as they have been reported nesting inland (see Objective 3). Most of the adults without young were probably seen because they congregate in large, easily observed flocks.

Objective 8 - Define Fall Departure Pattern of Tule Geese:

Departure patterns of tule geese were ascertained in 1981 and 1982 by radio tracking, observations of collared birds, and analysis of harvest data.

Twenty radio transmitters furnished by the USFWS were placed on tules in 1981 (14 in Redoubt Bay and 6 at Susitna Flats). During August and September, 4 radio-tracking flights were made over Cook Inlet, and 15 of the radios were heard at least once (Table 17). All birds remained in the geographical area where they were

captured but dispersed coastward to the saline sedge-grass flats. Sixty-five percent and 69% of the radio relocations were in saline sedge-grass flats in Redoubt Bay and Susitna Flats, respectively.

The decline in number of radioed birds relocated between August 31 (10) and September 9 (3), along with sightings of collared birds in Washington on September 21, 1982 and Klamath Basin on August 24, 1981, indicate tules leave Cook Inlet early in fall. This fits well with reported mid-October peaks in white-front numbers in the Klamath Basin (Ely and Raveling 1981).

## Plans for 1983

1. Further determine spring arrival dates and use areas in Cook Inlet.

2. Continue to locate and describe nesting habitat at Redoubt Bay and Susitna Flats.

3. Capture, band, and neck-collar tule geese on Redoubt Bay.

4. Conduct comprehensive aerial surveys of Cook Inlet for tule geese.

5. Further define fall departure pattern of tule geese from Cook Inlet.

## ALEUTIAN CANADA GOOSE (*Branta canadensis leucopareia*) RECOVERY TEAM

One Recovery Team meeting was attended in 1981. The population continues to increase (2,700 birds in 1981); captive-reared and wild-caught birds from Buldir Island, released on Agattu Island in previous years, were seen on Agattu in 1982.

## LITERATURE CITED

Bromley, R. G. H. 1976. Nesting and habitat studies of the dusky Canada goose (*Branta canadensis occidentalis*) on the Copper River Delta, Alaska. M.S. Thesis (unpubl.). Univ. Alaska, Fairbanks. 81pp.

Campbell, B., J. Reynolds, and D. Sellers. 1982. Distribution of ducks on the west Copper River Delta during the fall of 1980 and 1981. Unpubl. Rep. Alaska Dep. Fish and Game. On file Migratory Bird Office, U.S. Fish and Wildl. Serv., Anchorage. 17pp.

Carney, S. M., M. F. Sorensen, and F. M. Martin. 1982. Waterfowl harvest and hunter activity in the United States during the 1981 hunting season. U.S. Fish and Wildl. Serv. Admin. Rep. June 8, 1982. 27pp.

Chapman, J. A., C. J. Henny, and H. M. Wight. 1969. The status population dynamics and harvest of the dusky Canada goose. Wildl. Monogr. No. 18. 44pp.

Ely, C. R., and D. G. Raveling. 1981. Winter ecology of white-fronted geese. Prog. Rep. Calif. Fish and Game. 7pp.

Fassett, N. C. 1969. A manual of aquatic plants. McGraw-Hill, New York. 382pp.

Hotchkiss, N. 1970. Common marsh plants of the United States and Canada. Dover Publ., New York. 124pp.

Hughes, J. H., and E. L. Young. 1982. Autumn foods of dabbling ducks in southeastern Alaska. J. Wildl. Manage. 46:259-263.

Pennak, R. W. 1978. Fresh-water invertebrates of the United States. Ronald Press, N. Y. 769pp.

Prescott, G. W. 1969. How to know the aquatic plants. Brown Pub. Co., Dubuque, Iowa. 158pp.

Sorensen, M. F., S. M. Carney, and E. M. Martin. 1982. Age and sex composition of ducks and geese harvested in the 1981 hunting season in comparison with prior years. U.S. Fish and Wildl. Serv. Admin. Rep. June 9, 1982. 40pp.

Shepard, P. K. 1965. A preliminary evaluation of earthquake damage to waterfowl habitat in Southcentral Alaska. Ann. Conf. West. Assoc. State Game and Fish Comm. 9pp.

Swanson, G. A., and J. C. Bartonek. 1970. Bias associated with food analysis in gizzards of blue-winged teal. J. Wild. Manage. 34:739-746.

Timm, D. E. 1978. Annual report of survey-inventory activities. Vol IX, Waterfowl. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-17-10, Job 10.0. Juneau. 27pp.

_____. 1982. Annual report of survey-inventory activities. Vol XII, Waterfowl. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-19-2, Job 11.0. Juneau. 48pp.

_____, and R. Sellers. 1979. Annual report of survey-inventory activities. Vol. X, Waterfowl. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-17-11, Job 10.0. Juneau. 29pp.

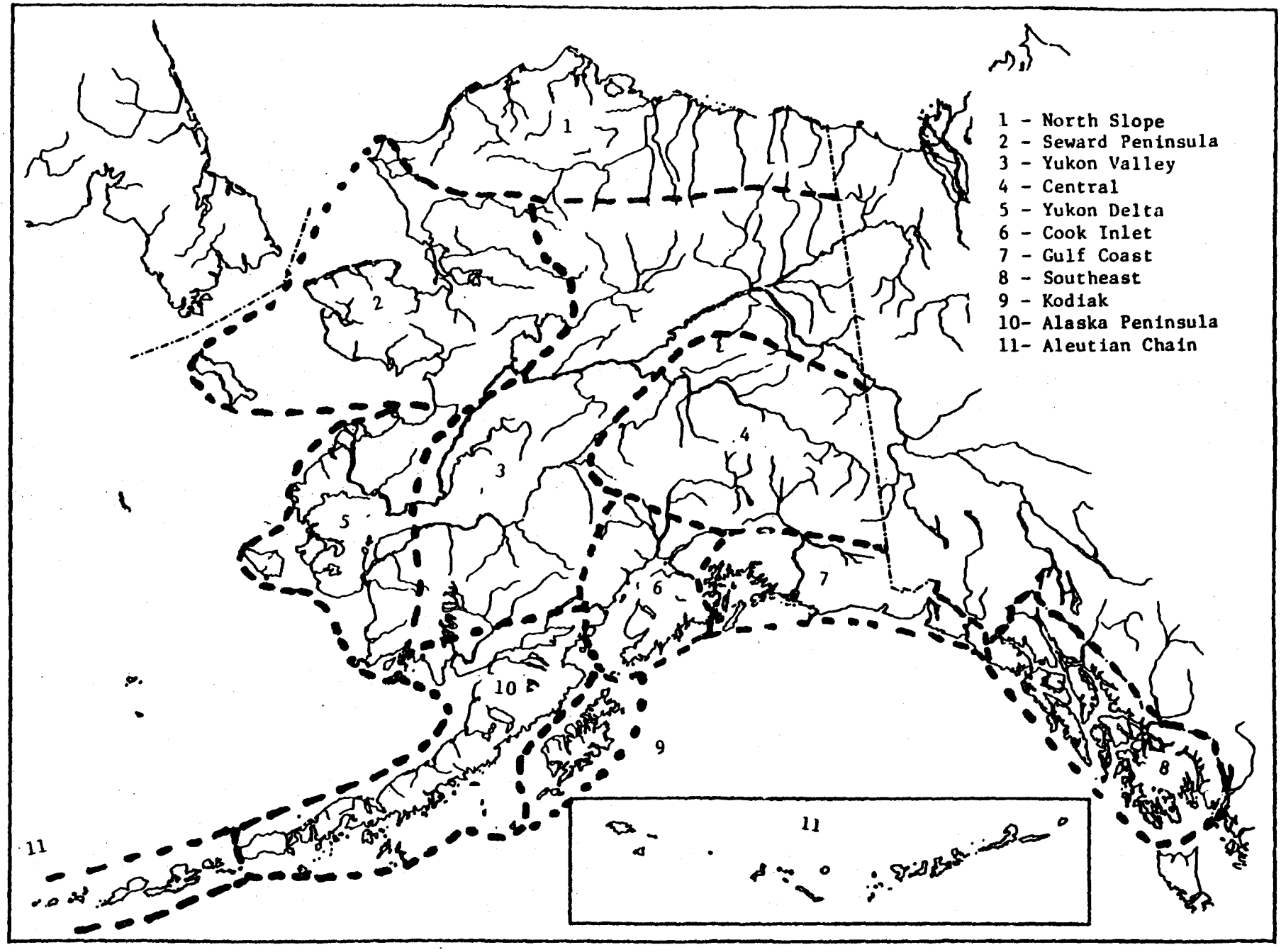



Fig. 1. Harvest areas used in data analysis.

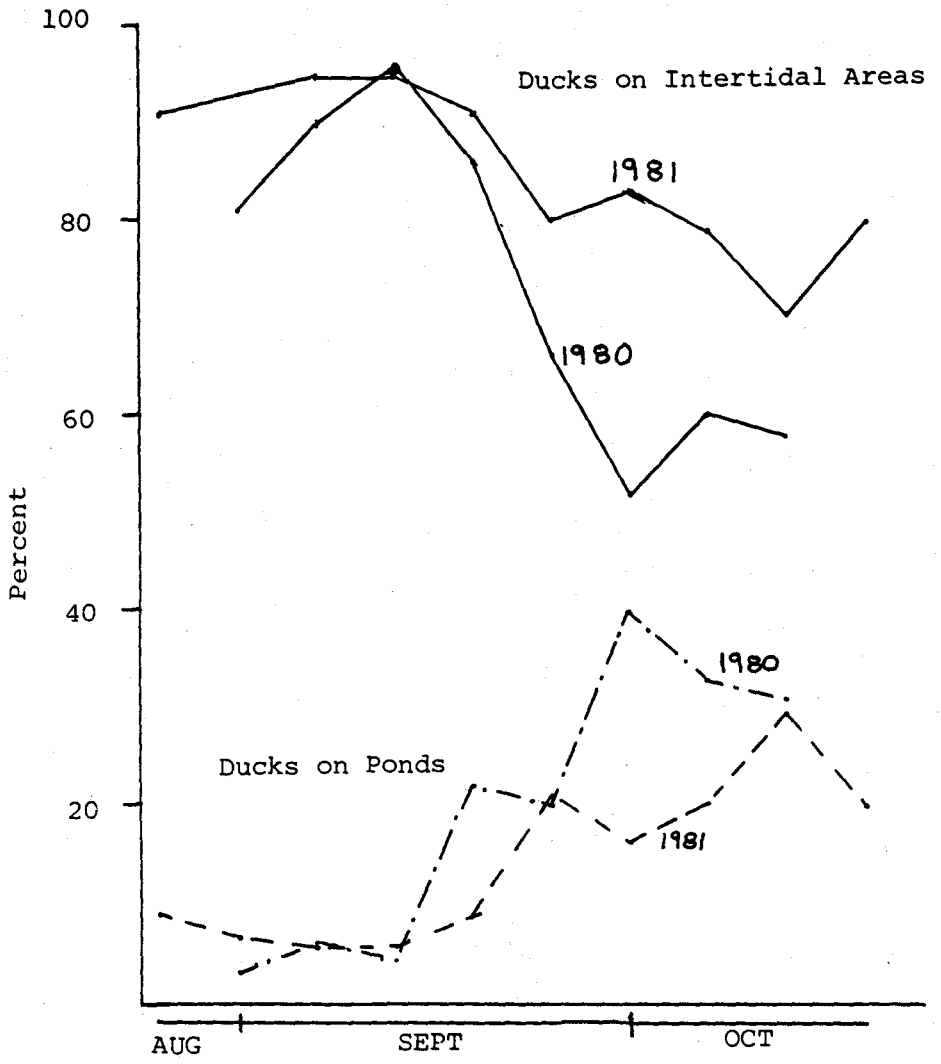



Figure 2. Distribution of ducks during 1980-81 Copper River Delta fall duck surveys.

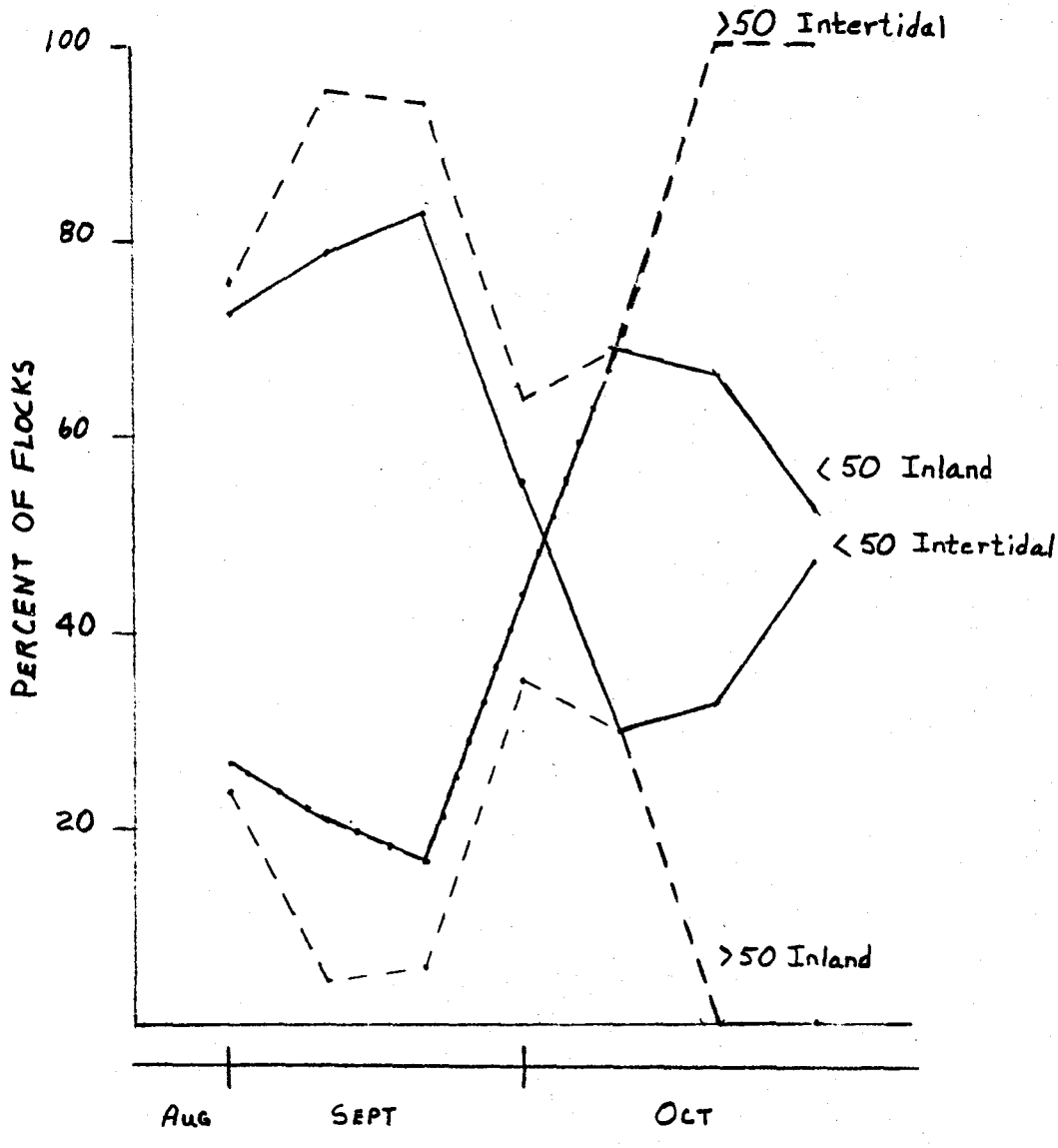



Figure 3. Distribution of flocks of ducks greater than and less than 50 birds during the 1980 Copper River Delta fall duck surveys.

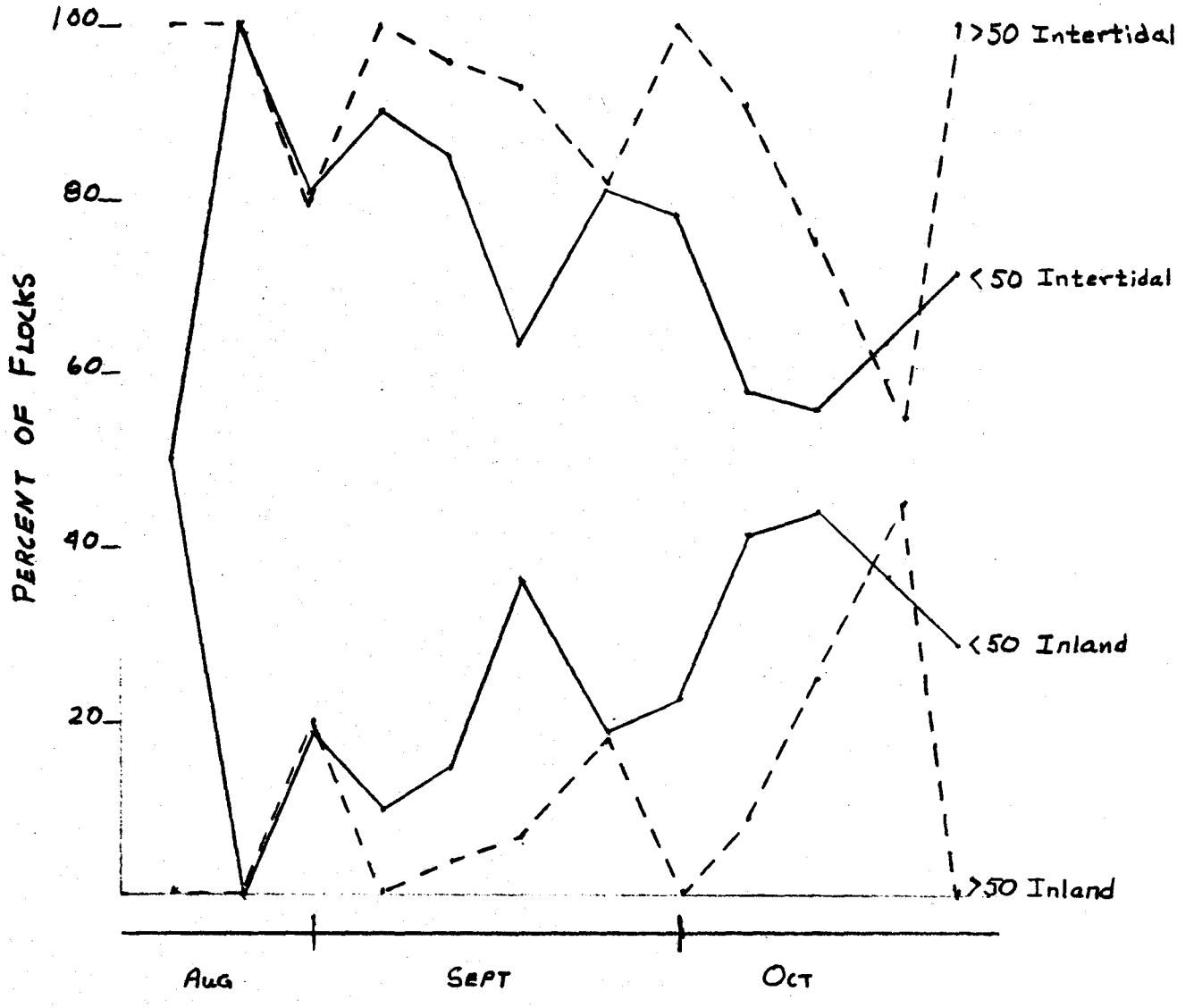



Figure 4. Distribution of flocks of ducks greater than and less than 50 birds during the 1981 Copper River Delta fall duck surveys.

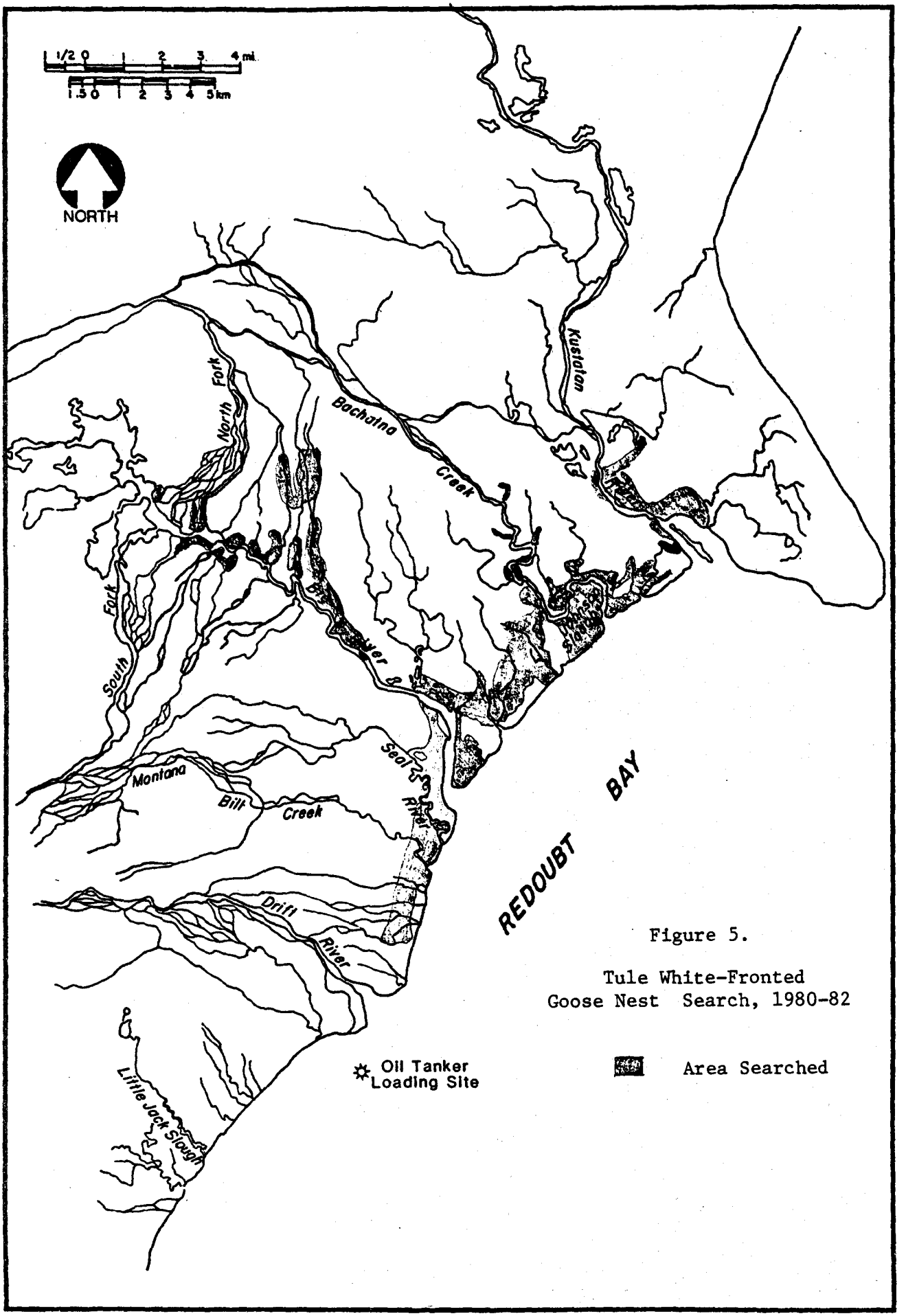



Figure 5.

Tule White-Fronted Goose Nest Search, 1980-82

Table 1. Summary of FWS codes used to assign harvest locations in Alaska.

| Old code | New code | ADF&G survey region (R) and place names | Original FWS "county" name | Harvest zone |
|---|---|---|---|---|
| 0001 | 0000 | Unknown | Unknown | Unknown |
| 0011 | 0101 | North Slope (R) | Arctic Slope | NW |
| 0031 | 0301 | Seward Peninsula (R) | Seward Peninsula | |
| 0051 | 0502 | Yukon valley (R) | Upper Yukon-Kuskokwim | Central |
| 0051 | 0512 | Yukon Flats | " | |
| 0071 | 0702 | Central (R) | Fairbanks-Minto | " |
| 0071 | 0712 | Minto Flats | " | " |
| 0071 | 0722 | Eielson AFB | " | " |
| 0071 | 0732 | Salchaket Slough | " | " |
| 0071 | 0742 | Healy Lake | " | " |
| 0071 | 0752 | Delta area | " | " |
| 0071 | 0762 | Tok-Northway | | |
| 0091 | 0901 | Yukon Delta (R) | Yukon-Kuskokwim Delta | NW |
| 0111 | 1103 | Cook Inlet (R) | Anchorage-Kenai | SE |
| 0111 | 1113 | Susitna Flats | " | " |
| 0111 | 1123 | Palmer-Hay Flats | " | " |
| 0111 | 1133 | Goose Bay | " | " |
| 0111 | 1143 | Potter Marsh | " | " |
| 0111 | 1153 | Chickaloon Flats | " | " |
| 0111 | 1163 | Portage | " | " |
| 0111 | 1173 | Trading Bay | " | " |
| 0111 | 1183 | Redoubt Bay | " | " |
| 0111 | 1193 | Kachemak Bay | " | " |
| 0131 | 1303 | Gulf Coast (R) | Cordova-Copper River | " |
| 0131 | 1313 | Copper River Delta | " | " |
| 0131 | 1323 | Yakutat area | " | " |
| 0131 | 1333 | Prince William Sound | " | " |
| 0151 | 1503 | Southeast Coast (R) | Juneau-Sitka | " |
| 0151 | 1513 | Chilkat River | " | " |
| 0151 | 1523 | Blind Slough | " | " |
| 0151 | 1533 | Rocky Pass | " | " |
| 0151 | 1543 | Duncan Canal | " | " |
| 0151 | 1553 | St. James Bay | " | " |
| 0151 | 1563 | Mendenhall Wetlands | " | " |
| 0151 | 1573 | Farragut Bay | " | " |
| 0151 | 1583 | Stikine River Delta | " | " |
| 0171 | 1704 | Kodiak (R) | Kodiak Island | SW |
| 0171 | 1714 | Kalsin Bay | " | " |
| 0191 | 1904 | AK Peninsula (R) | Cold Bay-AK Peninsula | " |
| 0191 | 1914 | Cold Bay | " | " |
| 0191 | 1924 | Pilot Point | " | " |
| 0191 | 1934 | Port Moller | " | " |
| 0191 | 1944 | Port Heiden | " | " |
| 0211 | 2104 | Aleutian Chain (R) | Aleutians-Pribilofs | " |

Table 2. Summary of waterfowl hunter success and activity, 1981-82 season (after Carney et al. 1982).

| | |
|---|---|
| Number of duck stamps sold | 15,885 (15,496 potential hunters) |
| Number of mail questionnaires | 1,041 |
| Number of duck wings received | 1,483 |
| Number of goose tails | 202 |
| Number of active hunters | 10,862 (70.1%) |

Calculated statewide harvests:

Ducks: 75,241; sea ducks and mergansers 2,968; Total 78,209

Geese: Canada 8,846; emperor 700; white-fronted 152; brant 505; Total 10,203

Ducks/active adult hunter 5.2

% successful hunters 53.9 (shot 1 or more duck)

Cranes: 1,049 (Sorensen et al. 1982)

Calculated total hunter days 71,538 [a]

Days/active adult hunter 4.3

[a] Includes about 5,680 juvenile hunter days (hunters under 16 years of age).

Table 3. A comparison between reported duck harvest from 1978-81 USFWS parts collection surveys and the ADF&G mail survey, 1974-76 3-year average.

| | % statewide harvest | | | | | |
|---|---|---|---|---|---|---|
| | ADF&G | USFWS | | | | |
| Harvest area | 1974-76 | 1978 | 1979 | 1980 | 1981 | 1978-81 avg. |
| North Slope | 0.2 | 0 | 0 | 0 | 0.1 | 0 |
| Seward Peninsula | 1.4 | 0 | 0 | 0.8 | 0 | 0.2 |
| Yukon valley | 2.5 | 0 | 0 | 0 | 0.1 | 0 |
| Central | 18.0 | 14.6 | 25.0 | 15.3 | 18.0 | 18.2 |
| Y-K Delta | 1.4 | 1.5 | 1.2 | 0.6 | 0.6 | 1.0 |
| Cook Inlet | 39.2 | 50.1 | 49.4 | 46.1 | 62.6 | 52.0 |
| Gulf Coast | 8.4 | 6.6 | 2.9 | 2.5 | 0.4 | 3.1 |
| Southeast | 20.6 | 14.6 | 11.5 | 25.1 | 8.8 | 15.0 |
| Kodiak | 2.7 | 3.6 | 7.3 | 4.7 | 1.3 | 4.2 |
| Alaska Peninsula | 5.1 | 9.0 | 2.7 | 4.9 | 8.2 | 6.2 |
| Aleutian Chain | 0.5 | 0 | 0 | 0 | 0 | 0 |
| Totals | 100.0 | 100.0 | 100.0 | 100.0 | 100.1 | 99.9 |

Table 4[a] Species composition of duck harvest, 1981-82 waterfowl season.

| Species | % total harvest by area | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Central | Y-K[b] Delta | Cook Inlet | Gulf Coast | South-east | Kodiak | Alaska Penin-sula | % total statewide[c] |
| Mallard | 29.5 | | 27.0 | 20.0 | 50.8 | 50.0 | 13.9 | 28.0 |
| G-W teal | 8.0 | | 15.2 | 20.0 | 19.5 | 7.1 | 20.9 | 15.0 |
| Am. wigeon | 15.3 | | 14.5 | -- | 5.5 | -- | 10.4 | 14.0 |
| Pintail | 16.5 | | 29.2 | -- | 18.8 | -- | 33.0 | 25.7 |
| Shoveler | 3.1 | | 3.3 | 60.0 | 2.3 | -- | 2.6 | 3.5 |
| Gadwall | -- | | 0.6 | -- | 0.8 | -- | 13.0 | 1.5 |
| B-W teal | -- | | 0.1 | -- | -- | -- | -- | Trace |
| Total dabblers | 72.4 | | 89.9 | 100.0 | 97.7 | 57.1 | 93.8 | 87.7 |
| Lesser scaup | 9.6 | | 1.3 | -- | -- | -- | -- | 2.5 |
| Common goldeneye | 2.3 | | 2.2 | -- | -- | 7.1 | 0.9 | 1.9 |
| Greater scaup | 1.9 | | 1.1 | -- | -- | -- | 4.3 | 1.4 |
| Barrow's goldeneye | 1.1 | | 1.2 | -- | -- | 28.5 | -- | 1.2 |
| Buffle-head | 3.8 | | 1.0 | -- | 1.6 | 7.1 | -- | 1.5 |
| Redhead | -- | | 1.1 | -- | -- | -- | -- | 0.7 |
| Canvas-back | 1.2 | | 0.3 | -- | -- | -- | -- | 0.4 |
| Ringneck | 1.2 | | 0.2 | -- | -- | -- | -- | 0.3 |
| Total divers | 21.1 | | 8.4 | 0 | 1.6 | 42.7 | 5.2 | 9.9 |
| W-W scoter | 3.8 | | 0.8 | -- | -- | -- | -- | 1.2 |
| Surf scoter | -- | | 0.1 | -- | -- | -- | 0.9 | 0.2 |
| Mergansers | 0.4 | | 0.4 | -- | 0.8 | -- | -- | 0.4 |
| Oldsquaw | 2.3 | | 0.1 | -- | -- | -- | -- | 0.5 |
| Total sea ducks/ mergansers | 6.5 | | 1.4 | 0 | 0.8 | 0 | 0.9 | 2.3 |
| Sample size | 261 | 0 | 889 | 5 | 128 | 14 | 115 | |

[a] Computed from USFWS parts collection survey.
[b] No duck harvest reported by USFWS parts collection survey.
[c] Includes birds harvested in unknown locations.

Table 5. Species composition of the goose harvest, 1981-82 waterfowl season.

| Species | % total harvest by area | | | | | | |
|---|---|---|---|---|---|---|---|
| | Central | Y-K Delta | Cook Inlet | Gulf Coast | South-east | Alaska Peninsula | % total statewide |
| Canada | 100 | -- | 100 | 60 | 95.2 | 86.3 | 86.6 |
| Emperor | -- | -- | -- | -- | -- | 12.7 | 6.8 |
| Brant | -- | -- | -- | -- | -- | 9.0 | 5.0 |
| White-fronted | -- | -- | -- | 40 | 4.8 | -- | 1.5 |
| Snow | -- | -- | -- | -- | -- | -- | -- |
| Sample size | 2 | 0 | 52 | 5 | 21 | 119 | 199 |

Table 6. A comparison between reported retrieved goose harvest from 1979-81 USFWS parts collection surveys and ADF&G mail surveys, 1974-76 3-year average.

| Harvest area | % statewide harvest | | | |
|---|---|---|---|---|
| | ADF&G | USFWS | | |
| | 1974-76 | 1979 | 1980 | 1981 |
| North Slope | 0.4 | 0.0 | 0.0 | 0.0 |
| Seward Peninsula | 4.4 | 0.0 | 2.4 | 0.0 |
| Yukon valley | 4.4 | 0.0 | 0.0 | 0.0 |
| Central | 8.1 | 7.7 | 1.4 | 1.0 |
| Y-K Delta | 7.3 | 1.9 | 2.9 | 0.0 |
| Cook Inlet | 10.1 | 35.6 | 22.5 | 26.1 |
| Gulf Coast | 13.6 | 0.0 | 0.5 | 2.5 |
| Southeast | 13.1 | 23.1 | 22.0 | 11.1 |
| Kodiak | 0.2 | 0.0 | 0.0 | 0.0 |
| Alaska Peninsula | 38.2 | 31.7 | 48.3 | 59.8 |
| Aleutian Chain | 0.1 | 0.0 | 0.0 | 0.0 |
| Totals | 99.9 | 100.0 | 100.0 | 100.5 |

Table 7. Dusky Canada goose nest densities, hatching success, and average clutch size on the west Copper River Delta, 1959-82.

| Year | $\bar{X}$ nest density/mi$^2$ | % nest hatching success (N) | $\bar{X}$ clutch size (N) |
|---|---|---|---|
| 1959-74 | -- | 82.9 | 5.0 |
| 1975 | 179 | 31.6 (215) | 4.8 (215) |
| 1976 | 156 | -- | 4.8 (168) |
| 1977 | 175 | 79.0 (229) | 5.4 (181) |
| 1978 | 183 | 56.2 (390) | -- |
| 1979 | 133 | 18.8 (409) | 5.7 (338) |
| 1980 | 108 | [a] | 5.4 (152) |
| 1981[b] | 45 | -- | 4.9 (28) |
| 1982 | 130 | 49.3 (151) | 4.8 (135) |

[a] 35% nest destruction observed 10 days into incubation.
[b] Incomplete survey.

Table 8. Summary of population data for dusky Canada geese, 1971-82.

| Year | Mid-winter | Breeding populations[a] | % yng. | % non-prod. ad.[b] | No. yng. produced | Fall flight | Harvest[c] |
|---|---|---|---|---|---|---|---|
| 1971 | 20,850 | 20,065 | 16.2 | 79.7 | 3,880 | 23,945 | 5,995 |
| 1972 | 17,950 | 17,275 | 10.6 | 71.7 | 2,050 | 19,325 | 3,450 |
| 1973 | 15,875[d] | 15,280 | 36.0 | 64.6 | 8,595 | 23,875 | 4,875 |
| 1974 | 19,000[d] | 15,290 | 51.4 | 35.7 | 19,345 | 37,635 | 12,070 |
| 1975 | 26,550[d] | 25,565 | 17.9 | 84.5 | 5,575 | 31,140 | 9,010 |
| 1976 | 22,725[d] | 21,870 | 24.2 | 54.2 | 6,890 | 28,850 | 6,350 |
| 1977 | 22,500[e] | 21,650[e] | 44.3 | 56.9 | 17,225 | 38,875 | 15,100 |
| 1978 | 23,775[e] | 23,000[e] | 24.8 | 71.8 | 7,600 | 30,600 | 5,100 |
| 1979 | 25,500[e] | 24,500[e] | 16.0 | 87.0 | 3,700 | 28,200 | 6,200 |
| 1980 | 22,000[e] | 21,300[e] | 23.7 | 67.4 | 6,600 | 27,900 | 4,900 |
| 1981 | 23,000[e] | 22,200[e] | 17.9 | 92.0 | 4,800[e] | 27,000[e] | 9,250 |
| 1982 | 17,740[e] | 17,000[e] | 23.7 | 50.0 | 4,000[e] | 21,000[e] | |

[a] Calculated from spring breeding grounds survey.
[b] Mid-winter less 0.035 mortality (Chapman et al. 1969).
[c] Percent of total adults seen in flocks with no young.
[d] Fall flight less mid-winter inventory.
[e] Preliminary estimates pending further analyses.

Table 9. Percent distribution of band recoveries, 1975-81.

| Year | No. recoveries | Oregon | Alaska | Br. Columbia | Washington |
|---|---|---|---|---|---|
| 1975 | 198 | 67.3 | 14.0 | 13.5 | 5.2 |
| 1976 | 241 | 65.5 | 10.0 | 13.3 | 11.2 |
| 1977 | 245 | 71.4 | 17.0 | 4.1 | 7.5 |
| 1978 | 225 | 63.3 | 19.3 | 14.2 | 3.2 |
| 1979 | 84 | 64.2 | 18.5 | 2.5 | 14.8 |
| 1980 | 102 | 82.4 | 2.9 | 8.8 | 5.9 |
| 1981 | 64 | 92.2 | 1.6 | 0 | 6.3 |

Table 10. Fall distribution of duck flocks on the west Copper River, 1980-81.

| Flock size | % intertidal zone | | % inland | |
|---|---|---|---|---|
| | 1980 | 1981 | 1980 | 1981 |
| 15-50 | 52.9 | 73.4 | 47.1 | 26.6 |
| >50 | 83.1 | 89.5 | 16.9 | 10.5 |

Table 11. Diet composition of 62 dabbling ducks on the west Copper River Delta, Sept.-Oct. 1981.

| Item | Aggregate % volume | % occurrence |
|---|---|---|
| Vegetation | | |
| Water buttercup (*Ranunculus* sp.) | 13.6 | 16.9 |
| Pondweed (*Potamogeton* spp.) | 11.6 | 13.8 |
| Unidentified grass CRD #3 | 5.1 | 10.8 |
| Misc. foliage | 5.6 | |
| Seeds | | |
| Sedge (*Carex* spp.) | 12.4 | 38.5 |
| Rushes (*Eleochris* sp. and *Scirpus* sp.) | 8.1 | 16.9 |
| Unidentified seed #7 | 7.1 | 16.9 |
| Marestail (*Hippuris* sp.) | 3.3 | 16.9 |
| Pondweed (*Potamogeton* spp.) | 2.3 | 6.2 |
| Animal | | |
| Diptera larvae (*Chironomidae*, *Ceratopogonidae*, *Tipulidae*) | 13.4 | 29.2 |
| Unidentified invertebrate eggs | 4.2 | 4.6 |
| Trichoptera larvae (*Brachycentridae*, *Limnephilidae*, *Polycentropodidae*) | 3.8 | 23.1 |
| Pelecypods (Sphaeriidae) | 3.1 | 9.2 |
| Gastropods | 2.5 | 15.4 |
| Stickleback (*Gasterosteus aculeatus*) | 1.4 | 3.1 |
| Misc. (Hirudinids, Archinids, Odonatids) | 1.0 | |

Table 12. Proportions of total plant and animal matter in esophagi of dabbling ducks, west Copper River Delta, Alaska.

| Species (N) | % seeds | % vegetation | % animal |
|---|---|---|---|
| Pintail (21) | 52.7 | 5.8 | 41.5 |
| Mallard (17) | 38.1 | 40.4 | 21.5 |
| Green-winged teal (4) | 37.7 | 58.9 | 3.4 |
| Wigeon (16) | 2.1 | 97.9 | -- |

Table 13. Autumn diet composition of dabbling ducks by collection location on the west Copper River Delta, Alaska.

| Location/ species (N) | % seeds | % vegetation | % animal matter |
|---|---|---|---|
| Castle Island | | | |
| Pintail (8) | 28 | 22 | 50 |
| Mallard (1) | 30 | 70 | -- |
| Teal (2) | 35 | -- | 65 |
| Egg Island | | | |
| Pintail (7) | 64 | 4 | 32 |
| Teal (1) | 100 | -- | -- |
| Lower Eyak River | | | |
| Pintail (6) | 34 | 23 | 43 |
| Mallard (8) | 59 | 4 | 37 |
| Wigeon (5) | 7 | 93 | -- |
| Eyak Lake | | | |
| Teal (2) | -- | 55 | 45 |
| Wigeon (4) | -- | 100 | -- |
| Copper River Highway | | | |
| Mallard (8) | 9 | 89 | 2 |
| Teal (1) | -- | -- | 100 |
| Wigeon (7) | -- | 100 | -- |

Table 14. Tule geese nest characteristics in Redoubt Bay and Susitna Flats, 1981-82.

| Character | Redoubt Bay - Nest No. | | | | | Susitna Flats - Nest No. |
|---|---|---|---|---|---|---|
| | 81-1 | 81-2 | 81-3[a] | 81-4 | 82-1 | 82-1 |
| Distance to intertidal mud (ft) | 2,300 | 3,900 | 2,600 | 12,000 | 1,300 | 2,500 |
| Distance inland to *Myrica* | 5,800 | 4,500 | 6,000 | 3,200 | 4,300 | 3,300 |
| Located on[b] | | | | | | |
| small slough | | X | | | | |
| medium slough | X | | | | | |
| large slough | | | X | | | |
| pond/lake | | | | X | X | X |
| Nearest tule nest (ft) | 700 | 1,800 | 700 | 11,300 | -- | -- |
| Initiation date[c] | 5/12-16 | 5/12-15 | 5/29-30 | 5/17-21 | 5/26 | 5/29-30 |
| No. eggs | 4 | 5 | 2 | 4 | 3 | 2 |
| Dominant vegetation within 3 ft of nest | | | | | | |
| *Elymus* sp. | X | X | X | | | |
| *Carex Lyngbaei* | | | | X | X | |
| *Carex Ramenski* | | | | | | X |

[a] Small ≤15 in width; medium 16-30 ft; large >30 ft.
[b] Based on white-front egg floats correlated with known hatching dates (C. Ely, pers. commun.)
[c] Nest contained 2 tule eggs + 2 eider eggs; nest built by tule.

Table 15. Summary of white-fronted geese captured and marked in Alaska by ADF&G and cooperators, 1980-82. Number of radios attached in parenthesis.

| Date | Location | Age[a] and sex | | | | | | Location total |
|---|---|---|---|---|---|---|---|---|
| | | ASYM | ASYF | SYM | SYF | LM | LF | |
| 1980 | | | | | | | | |
| 7/20-22 | Redoubt Bay | | | | | | | 292 |
| 1981 | | | | | | | | |
| 7/8 | Holitna River | | | | 1 | 1 | 1 | 3 |
| 7/16-20 | Susitna Flats | | 1(1) | 1(1) | 1(1) | 8(2) | 4(1) | 15 |
| 7/26-27 | Redoubt Bay | 3(3) | 4(4) | -- | 1(1) | 11(3) | 23(3) | 32 |
| 1982 | | | | | | | | |
| 7/20-22 | Redoubt Bay | 54 | 23 | 27 | 32 | -- | -- | 136 |

[a] ASY = After Second Year, SY = Second Year, L = Young of Year.

Table 16. Geese seen during late July 1980-1982 surveys of Cook Inlet.

| | Tule | | | | | | Canada | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Adult | | | Immature | | | Total | | | Adult | | | Immature | | | Total | | |
| | '80 | '81 | '82 | '80 | '81 | '82 | '80 | '81 | '82 | '80 | '81 | 82 | '80 | '81 | '82 | '80 | '81 | '82 |
| Palmer Hay Flats | -- | -- | NS[a] | -- | -- | NS | -- | -- | NS | 480 | 238 | NS | 45 | 120 | NS | 525 | 390 | NS |
| Goose Bay | -- | -- | NS | -- | -- | NS | -- | -- | NS | 16 | -- | NS | 11 | -- | NS | 27 | -- | NS |
| Potter | -- | -- | NS | -- | -- | NS | -- | -- | NS | 45 | 30 | NS | 60 | 50 | NS | 105 | 80 | NS |
| Chickaloon | -- | -- | NS | -- | -- | NS | -- | -- | NS | 47 | 35 | NS | 68 | -- | NS | 115 | 35 | NS |
| Susitna Flats | 50 | 39 | 25 | 68 | 49 | 58 | 118 | 88 | 83 | 497 | 286 | NS | 676 | 273 | NS | 1,173 | 559 | NS |
| Trading Bay | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | NS | -- | -- | NS | -- | -- | NS |
| Redoubt Bay | 1,273 | 927 | 801 | 146 | 131 | 80 | 1,419 | 1,058 | 881 | 1 | -- | NS | 3 | -- | NS | 4 | -- | NS |
| Kalgin Is. | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | NS | NS | -- | NS | NS | -- | NS | NS |
| Kenai R. delta | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS |
| Kasilof R. delta | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS | -- | -- | NS |
| Tuxedni Bay | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | NS | -- | -- | NS | -- | -- | NS |
| Anchorage area[b] | -- | -- | -- | -- | -- | -- | -- | -- | -- | 40 | 80 | NS | 40 | 105 | NS | 80 | 185 | NS |
| Totals | 1,323 | 966 | 826 | 214 | 180 | 138 | 1,537 | 1,146 | 964 | 1,126 | 669 | NS | 903 | 548 | NS | 2,029 | 1,217 | NS |

[a] NS = Not Surveyed.
[b] Estimated number present in Anchorage city proper, military bases, airport, and airport flats.

Table 17. Location and cohort association of radioed tule geese in Cook Inlet, 1981.

| Collar No. and capture location | Age and sex[a] | Habitat type[b], Location, and cohort association 8/14 | 8/24 | 8/31 | 9/8 | Comments |
|---|---|---|---|---|---|---|
| PX Redoubt Bay | ASYF | | | Redoubt, exact location unk. | | Wintered Sacramento NWR, CA |
| A08 Susitna Flats | LF | Susitna, SSGF w/A03 & A10 | Susitna, SSGF w/54 birds, A07 & A03 | Susitna, exact location unk. Signal received with A03. | | Found dead Springfield, OR |
| PJ Redoubt Bay | LM | Redoubt, SSGF w/14 birds, PP & PK | | Redoubt, exact location unk. Signal received with PX. | | Unknown |
| A10 Susitna Flats | LF | Susitna, SSGF w/A08 & A03 | Susitna, on river w/27 birds, A00 | | | Unknown |
| PC Redoubt Bay | LF | | Redoubt, SSGF w/birds | Redoubt, SSGF w/11 birds, 2 yellow collars | Redoubt, SSGF w/1 bird | Unknown |
| A00 Susitna Flats | SYM | | Susitna on river w/27 birds, A10 | Susitna, River berm in SSGF w/13 birds | | Shot Susitna Flats 9/12/82 |

Table 17. Continued.

| Collar No. and capture location | Age and sex[a] | Location, Habitat type[b], and cohort association 8/14 | 8/24 | 8/31 | 9/8 | Comments |
|---|---|---|---|---|---|---|
| RN Redoubt Bay | LM | | Redoubt, exact loc. unk. | | | Wintered Sacramento NWR, CA |
| PA Redoubt Bay | LF | Redoubt, SSGF w/36 birds | | Redoubt, SSGF w/13 birds, 1 yellow collar | Redoubt, SB w/16 birds | Wintered Sacramento NWR, CA |
| A07 Susitna Flats | LM | Susitna, exact location unk. | Susitna, FM, lone bird | | | Unknown |
| RY Redoubt Bay | SYF | Redoubt, SB w/79 birds | Redoubt, exact location unk. | | | Unknown |
| RH Redoubt Bay | LF | Redoubt, FM w/250 birds | Redoubt, SSGF w/230 birds | Redoubt, SSGF w/24 birds, PK, 1 yellow collar | | Shot Tule Lake, NWR 10/19/81 |

Table 17. Continued.

| Collar No. and capture location | Age and sex[a] | Habitat type[b], Location, and cohort association 8/14 | 8/24 | 8/31 | 9/8 | Comments |
|---|---|---|---|---|---|---|
| PP Redoubt Bay | ASYM | Redoubt, SSGF w/14 birds, PK & PJ | | | | Shot Sauvie Is., OR 11/28/81 |
| PL Redoubt Bay | ASYM | | Redoubt, FM w/24 birds | Redoubt, exact location unk. | Redoubt exact location unk. | Unknown |
| PK Redoubt Bay | ASYF | Redoubt, SSGF w/PJ & PP | | | Redoubt, SSGF with 24 birds, RH, 1 yellow, | Unknown |
| A03 Susitna Flats | SYF | Susitna, SSGF w/ A08 & A10 | Susitna, SSGF w/54 birds, A08 | Susitna, exact location unk., signal w/A08 | | Shot Susitna 9/1/81 |

[a] ASYM = After second year male; ASYF = After second year female; SYM = Second year male; SYF = Second year female; LM = Young of the year male; LF = Young of year female.

[b] SSGF = Saline Sedge-Grass Flats; FM = Fresh Marsh; SB = Shrub Bog. See Objective 3, Habitat Description for definitions.