FEDERAL AID
FINAL PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

COOPERATIVE ENDANGERED SPECIES CONSERVATION FUND

PROJECT TITLE: Satellite Tracking of Tule White-fronted Geese to Delineate and Detect Shifts in Seasonal Ranges

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COOPERATORS: California Department of Fish and Game and Oregon Department of Fish and Wildlife

GRANT AND SEGMENT NR: E-4-3

PROJECT NUMBER: 1

WORK LOCATION: Capture and marking in Central California; data collection in Anchorage; field surveys in south-central and interior Alaska

REPORT PERIOD: 25 September 2006 – 24 September 2007

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Tule white-fronted geese (*Anser albifrons gambeli*) are considered vulnerable because they are one of the smallest goose populations in North America (5,000-7,000 birds), and their range (incompletely known) and winter range are restricted. Consequently, several pressing needs for management information have been identified: (1) determine seasonal distribution to assess and implement habitat protection; (2) document distribution through fall and winter to better target surveys for population estimates in California and Oregon; and (3) determine whether Tule geese are making significant shifts in their breeding and molting ranges in Alaska. Satellite telemetry provides a unique opportunity to contribute to the understanding of these management goals.

Currently, there is no reliable method to assess Tule goose abundance. Pacific Flyway states (AK, WA, OR, CA) and the USFWS have set a top priority to obtain an accurate estimate of population size during fall through a telemetry assisted mark-recapture effort. During 2003-2007, VHF radio collars were deployed on 200 Tule geese in southern Oregon during fall and central California during winter. Satellite tracking as described in this project can be used to locate groups of birds that are outside of VHF search areas and traditional ground survey routes, thus allowing more accurate delineation of survey areas for more complete and accurate population estimates.

The breeding grounds of Tule geese were unknown until 1979 when birds were discovered nesting and molting in Redoubt Bay and on Susitna Flats (Cook Inlet, AK). Between the early 1980s and early 1990s, Tule geese in these known breeding areas of Cook Inlet declined by 90%, perhaps related to the 1986 eruption of Mount Redoubt, which altered nesting, brood rearing, and molting habitats. In the mid-1990s, VHF radio telemetry work indicated that a majority of Tules nested and molted in the Lower Susitna

and Kahiltna River drainages, and the Alexander Lake area. In addition, telemetry showed that about 1/3 of the population migrated across the Alaska Range to molt in the Innoko River drainage.

The VHF radio-mark in fall 2003 afforded another opportunity to assess the current summer distribution of Tule geese and locate nests in Alaska. In August 2004, 45 of 70 VHF Tules were located by telemetry in Alaska, but most were heard only once during spring migration in Cook Inlet. In late May and June, only 19 radios were found through intensive surveys of the primary breeding range in the Kahiltna and Lower Susitna Valleys; and by early July, no signals were heard in this area. On July 14, over 20 radios were discovered in an area northwest of Marshall (Muddy Lakes) where Tule geese had not been observed; this documented a new molt area besides Innoko River.

Past and current summer observations suggest that Tule geese may make dramatic shifts in their breeding and molting ranges: (1) they likely abandoned Redoubt Bay and moved north to the Susitna drainage in the late 1980s; (2) since the late 1990s, observations of breeding and molting Tule geese have declined in the Lower Susitna region, and an increasing proportion may be molting north of the Alaska Range; (3) during summer, fewer than expected VHF birds are detected during the nesting period in the Lower Susitna, and few marked birds are seen at traditional molt sites—a new molt area was discovered at Muddy Lakes. Because it is vitally important to reduce risks and ensure habitat security for this small population, we need satellite telemetry to re-evaluate the summer distribution of Tule geese and perhaps locate unknown nesting and molting areas.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

OBJECTIVE 1: Establish a representative sample of Tule geese marked with satellite platform terminal transmitters (PTTs).

We met our objective of deploying 15 and 7 PTTs in Tule white-fronted geese captured on the Sacramento and Delevan National Wildlife Refuges, CA during February in 2005 and 2006, respectively (Table 1). Geese were captured with rocket nets while they foraged for grit along levee banks. Females comprised 64% of the marked sample. In addition to the satellite transmitters, geese were marked with blue neck collars (white alphanumeric code) for identification in the field. United States Fish and Wildlife Service metal leg-bands were also applied to identify recovered birds harvested during the hunting season. PTTs weighed approximately 60 grams and were equipped with a sensor that recorded the internal temperature of the bird and a sensor that recorded battery voltage. If an ambient temperature reading was received, it indicated that the bird had died. PTTs were programmed to transmit at specified duty cycles (e.g., 6 hours on, 72 hours off) depending on the need to record seasonal activity of the birds (migration, nesting). Batteries were expected to last for 1,500 transmission hours. PTTs were surgically implanted in the abdominal cavity of birds by an experienced veterinarian. The stainless steel antenna exited the body cavity dorsally near the base of the tail. Capture, handling and surgical procedures were reviewed and approved by the AK Dept Fish and Game, Division of Wildlife Conservation, Animal Care and Use Committee (ACUC # 04-017). No birds died during surgery. Capture and marking efforts were efficient and

successful through exceptional cooperation and support from California Department of Fish and Game (CDFG).

PTTs transmit data to polar orbiting satellites in 32-byte messages. Message data were interpreted by Service Argos which subsequently provided us with location and sensor information every four days via email. We used a filtering algorithm (David Douglas, USGS-BRD) based on signal quality, travel distance, travel rate, and redundancy from previous or subsequent locations to remove auto-correlated and aberrant locations. Filtered locations were compiled in Microsoft Excel spreadsheets, and maps illustrating movements for individual birds were created using ArcView GIS software.

To date we have received over 24,000 locations for Tule geese throughout their range (Fig. 1). Some PTTs far exceeded their anticipated life expectancy (> 2,200 hours). Consequently four PTTs deployed in 2005 and two PTTs deployed in 2006 are currently active and providing location data. We have acquired locations during three complete migration cycles for currently active PTTs deployed in 2005.

OBJECTIVE 2: Document migration routes, breeding range, post-breeding movements, and molting areas of Tule geese.

Tule geese began their northerly migration from wintering areas on the Sacramento National Wildlife Refuge Complex, CA during February (average date of departure 21 Feb). Three spring staging areas were identified: Summer Lake Wildlife Area, OR, Lower Klamath National Wildlife Refuge, CA, and Chewaucan Marsh, OR (Fig. 1). Tule geese remained at these locations for 60 days, on average, departing in late April (24 April average departure). For the most part, Tule geese followed the coast during their migration north to Alaska stopping infrequently along their route. Three geese, however, were located up to 1,400km off-shore (Fig. 1) during spring migration in 2005. Two of these geese died in the northern Pacific suggesting that violent weather may have caused them to veer from course and they ultimately succumbed, possibly to exhaustion. Four other geese traveled further inland during migration than expected.

Tule geese arrived in the upper Cook Inlet Basin (UCIB), AK in late April-early May (3 May on average), an average of 9 days after departing spring staging areas. Susitna Flats, Palmer Hay Flats, and Alexander Lake were frequently used as initial stopping areas upon arrival. Shortly after arrival, Tule geese dispersed to nesting areas in the Lower Susitna Valley. Potential nesting locations were identified and included areas near Trapper Lake, Kashwitna, Shulin Lake and the Kahiltna and Tokositna drainages, to name the more frequently used areas.

Locations of PTT birds were used to aid in our aerial telemetry efforts on the breeding grounds to detect Tule geese that were VHF radio-marked by CDFG at Summer Lake, OR and Sacramento Valley, CA. Twenty-two, 37, and 57 VHF radio-marked geese were detected during our telemetry flights in UCIB during 2005, 2006 and 2007, respectively.

After the nesting period, most geese departed the UCIB and traveled west to either the Innoko or Yukon Delta National Wildlife Refuges where they underwent the molt (Fig. 1). Average date of departure to molt sites was 12 June, indicating that these birds were not successful in raising a brood in the UCIB. Several geese, however, molted in the

UCIB. That so many birds left the UCIB to molt elsewhere was surprising, given that the UCIB was historically the primary molt site. Frequent use of the Muddy Lakes area on Yukon Delta National Wildlife Refuge by satellite and VHF-marked birds highlights the importance of this newly discovered molt location. Fidelity to molt sites varied among geese, as some used the same location each year, while others switched molt locations annually. Geese spent an average of 48 days at NWR molt sites before returning to UCIB (average return 5 August). On average, geese departed UCIB and began migrating south on 7 September.

OBJECTIVE 3: Document fall and winter distribution to aid VHF inventory surveys.

Tule geese spent little time migrating from Alaska to the Pacific Northwest (6 days on average) arriving in mid-September (average 13 September) at the same staging areas used during the spring (Fig. 1). Geese spent considerably less time at fall staging areas (8 days on average) compared to the spring before returning to the Sacramento National Wildlife Refuge Complex (23 September average arrival date; Fig. 1). Tule geese spent most of the winter on the natural marsh habitats provided by the refuge complex while making brief forays to adjoining agricultural fields.

California Department of Fish and Game used locations of PTT-marked birds to focus ground and air survey areas for a VHF mark-recapture study. The purpose of the study is to estimate the fall and winter population of Tule geese. As such it is important to know the distribution of the marked population. Our locations for satellite birds coincided with VHF-marked birds, thereby reaffirming their distribution and increasing confidence in the winter survey methodology.

IV. MANAGEMENT IMPLICATIONS

For small populations, managers require regular and accurate information on abundance, as well as details of seasonal distribution, important habitats, and the chronology of movements. By using satellite transmitters we were able to acquire locations for Tule geese year-round throughout their range and, for some, over several years. We identified specific nesting, molting and stopping/staging areas in Alaska that are critical to the maintenance of this goose population. This updated range information allows the department to ensure that Tule goose habitat values are recognized and considered in assessing effects of resource development proposals (e.g., oil and gas, timber, recreation) and other activities that could affect the small Tule goose population.

Until Tule goose abundance can be reliably assessed to detect changes, and focused management actions are developed, more intensive surveys and research will be needed. Deployment of more satellite transmitters, perhaps during spring or fall staging on the Summer Lake Wildlife Area, OR may ensure marking a cross-section of the population. Also, Tule geese have exhibited behavior atypical of other goose populations. Contrary to typical strong site fidelity, Tule geese shifted their breeding range nearly completely over 200 miles. Their migration routes, especially in the spring, are less direct than expected and do not follow a specific route. In addition, molt site selection can vary annually regardless of reproductive success. Continued marking and monitoring is the only tool available to determine whether shifts in seasonal range and distribution occur in the future.

Tracking Tule geese by satellite in this project contributed substantially to reaffirming knowledge of fall and winter ranges. Moreover, the satellite data helped focus the new critical ground and VHF inventory projects that are top priorities for management. During late fall and winter, Tule geese cannot easily be distinguished from over 500,000 Pacific white-fronted geese with which they share a winter range. Using a combination of data from satellite and VHF transmitters managers in Oregon and California can more accurately assess how to design hunting programs to minimize harvest of Tule geese while taking advantage of overabundant Pacific white-fronts. Most recently, we monitored the locations of our satellite birds to determine if they were vulnerable to harvest during an early spring crop depredation hunt in the Oregon portion of Klamath Basic. Satellite data and aerial telemetry flights demonstrated that Tule geese used natural marshes east and outside of the agricultural hunt zone, assuring agencies that the new hunt did not put Tule geese at increased risk.

V. SUMMARY OF WORK COMPLETED ON JOBS FOR LAST SEGMENT PERIOD ONLY (25 September 2006 – 24 September 2007)

JOB/ACTIVITY 1A: Capture groups of wintering Tule geese with rocket nets at the end of the hunting season in the Sacramento Valley (CA). Use a veterinarian to implant PTTs in large-bodied adults.

No activity during this reporting period. Captures of Tule geese occurred during February 2005 and 2006.

JOB/ACTIVITY 1B: Initiate a system to access satellite data from Argos Data Collection and Location Systems (Service Argos), filter location data based on quality, and compile goose locations with database and GIS programs.

Location data has been received from Service Argos since the beginning of the study in February 2005. Federal Aid funds have been used to acquire location data through the end of the reporting period. Because transmitter life has exceeded expectation, several transmitters have remained active beyond the contract date. Consequently, current costs for location data have been paid through state budget sources.

JOB/ACTIVITY 2A: Monitor satellite locations of geese from wintering areas through spring migration in April and settlement on breeding sites during May and June. Satellite data will be used to target telemetry for VHF-marked birds and other aerial surveys.

Federal Aid funds were used to conduct aerial surveys of VHF radio-marked geese while on Alaska nesting areas in the upper Cook Inlet Basin. Surveys were targeted, in part, with data obtained in Job 1b above.

JOB/ACTIVITY 2B: Monitor satellite locations from mid-June to mid-July to detect movements to molting areas (south-central and interior Alaska) and duration of molt aggregations. Satellite data will be used to target telemetry for VHF-marked birds and other aerial surveys.

Federal Aid funds were used to conduct aerial surveys of VHF radio-marked geese while at molting areas in Alaska. Satellite data provided cues for timing of surveys and locations.

JOB/ACTIVITY 3A: Monitor satellite locations in Oregon and California during fall/winter**.**

Using Service Argos location data we were able to monitor satellite locations of Tule geese in Oregon and California during fall/winter, which were relayed to CA and OR state agencies to aid in the timing of their fall capture efforts.

JOB/ACTIVITY 3B: Relay fall Tule goose locations to California Department of Fish and Game to help delineate ground and air survey areas for a VHF mark-recapture study.

Locations for satellite marked Tule geese were distributed to California Department of Fish and Game. As a result, additional locations were added to their survey route.

VI. PUBLICATIONS

Annual reports on this project have been presented to the Pacific Flyway Study Committee, including California Department of Fish and Game and Oregon Department of Fish and Wildlife, and U.S. Fish and Wildlife Service Regions 1 and 7. Manuscripts are currently being outlined with cooperators, which we anticipate will be submitted for publication to appropriate journals in the near future.

VII. APPENDIX

Figure 1. Satellite locations for Tule white-fronted geese during 2005, 2006 and 2007.

Table 1. Summary data for Tule white-fronted geese surgically implanted with satellite transmitters (PTTs).

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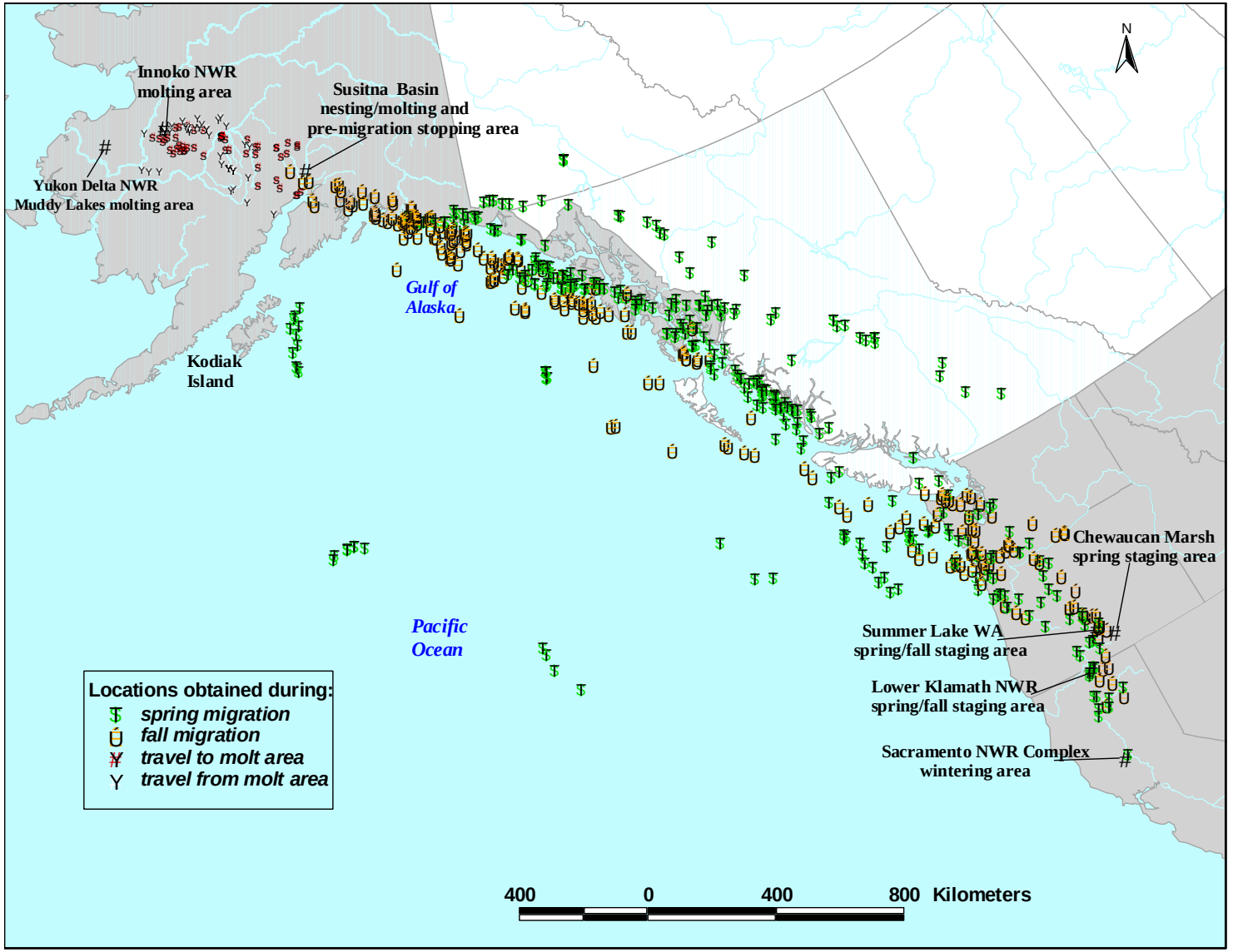

Figure 1. Satellite locations for Tule white-fronted geese during 2005, 2006 and 2007.

Table 1. Summary data for Tule white-fronted geese surgically implanted with satellite transmitters (PTTs).

PTT ID	Capture Date	Capture Location	Sex	Age	Band Number	Collar Code	Number of Locations[a]	Number of Migrations[b] Spring	Fall
10929	2/01/05	Delevan NWR	Female	Adult	0918-25837	9V6	1557	2	2
11369	1/31/05	Delevan NWR	Female	Adult	0918-25830	80V	2051	3	3
11371	2/04/05	Delevan NWR	Male	Adult	0978-74331	9V7	1054	3	2
12752	2/01/05	Delevan NWR	Male	Adult	0978-74326	83V	889	2	2
12753	2/04/05	Delevan NWR	Male	Adult	0978-74327	81V	1451	2	1
12870	1/31/05	Delevan NWR	Female	Adult	0918-25831	79V	1039	3	2
12871	1/31/05	Delevan NWR	Female	Adult	0918-25833	82V	479	1	0
12886	2/01/05	Delevan NWR	Female	Adult	0918-25836	84V	2349	3	3
13063	2/04/05	Delevan NWR	Male	Adult	0978-74330	85V	1463	3	3
13064	1/31/05	Delevan NWR	Female	Adult	0918-25832	89V	35	0	0
13381	2/01/05	Delevan NWR	Female	Adult	0918-25838	88V	101	0	0
13386	2/01/05	Delevan NWR	Male	Adult	0978-74322	86V	134	0	0
13387	1/31/05	Delevan NWR	Female	Adult	0918-25835	9V8	2134	3	3
14019	2/04/05	Delevan NWR	Female	Adult	0918-25840	77V	492	1	1
14020	1/31/05	Delevan NWR	Female	Adult	0918-25829	87V	2067	3	2
11370	2/16/06	Delevan NWR	Male	Adult	0618-05528	W63	781	2	2
12754	2/16/06	Delevan NWR	Female	2nd Year	1008-60706	W60	814	2	2
02242	2/07/06	Sacramento NWR	Male	Adult	1008-60701	W62	433	1	0
02243	2/07/06	Sacramento NWR	Male	Adult	1008-60702	W64	11	0	0
02244	2/10/06	Delevan NWR	Female	Adult	1008-60703	W67	1682	2	2
02245	2/10/06	Delevan NWR	Female	Adult	1008-60704	W65	246	0	0
02246	2/10/06	Delevan NWR	Female	Adult	1727-30966	W61	20	0	0

[a] Number of locations while alive and transmitting.
[b] Complete migrations between Alaska and California.