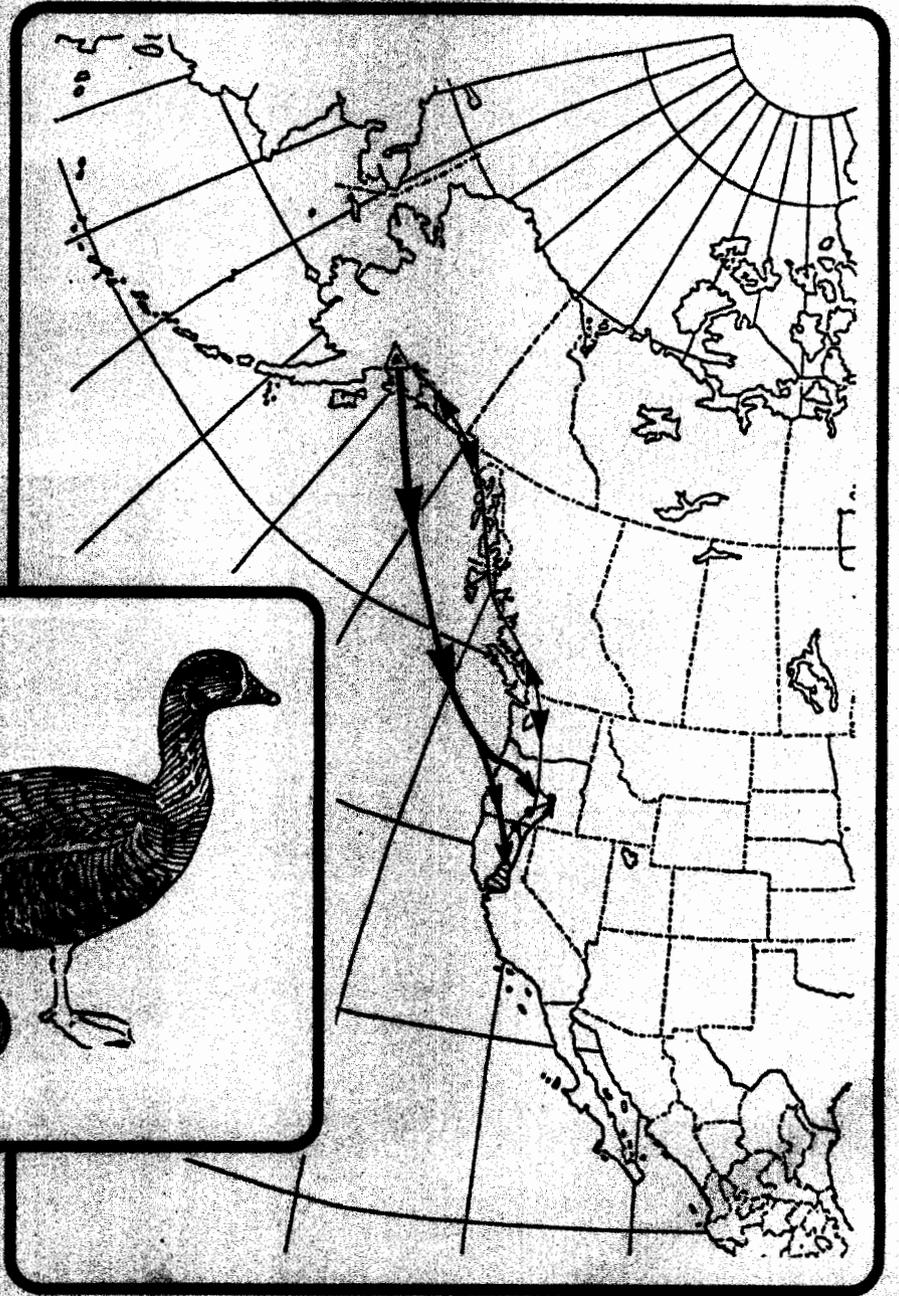
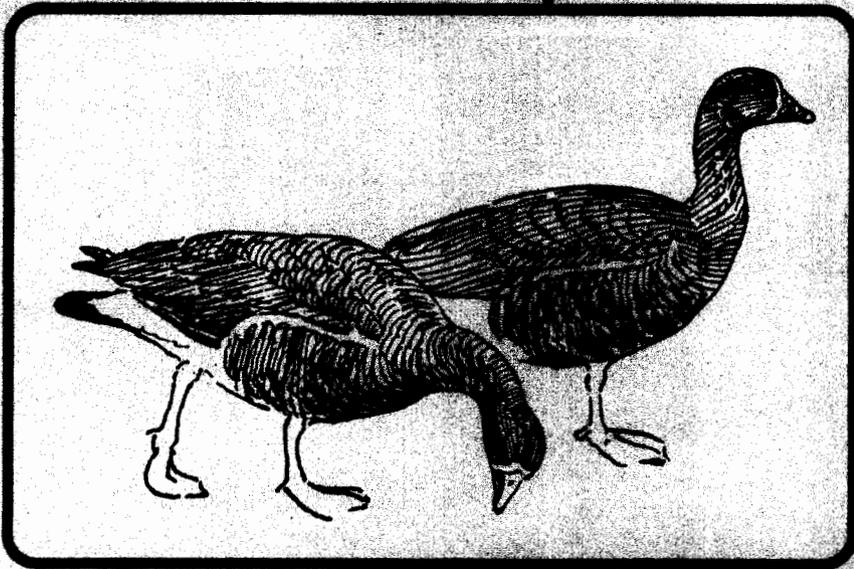


Tule Greater White-fronted Goose



PACIFIC FLYWAY MANAGEMENT PLAN
FOR THE
TULE GREATER WHITE-FRONTED GOOSE

This plan was prepared by the Subcommittee on the Pacific Flyway Population of White-fronted Geese of the Pacific Flyway Study Committee. Principal author is Greg Mensik, wildlife biologist, Sacramento National Wildlife Refuge.

Approved by:



Chairman, Pacific Flyway Council



Date

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PACIFIC FLYWAY MANAGEMENT PLAN
FOR THE
TULE GREATER WHITE-FRONTED GOOSE

Prepared for the:

Pacific Flyway Council
U.S. Fish and Wildlife Service
Canadian Wildlife Service

July 1991

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PACIFIC FLYWAY MANAGEMENT PLAN FOR
TULE GREATER WHITE-FRONTED GEESE

I. INTRODUCTION

This plan establishes guidelines for cooperative management of the tule greater white-fronted goose (Anser albifrons gambelli) in the Pacific Flyway. Though this subspecies has been documented in the Central Flyway, its status there is uncertain and will not be addressed in this plan.

The nomenclature of this subspecies has become complicated over the years. The tule greater white-fronted goose (TW) was first classified from a specimen collected in Texas by Hartlaub in 1852 and later described as one of two subspecies of greater white-fronted geese that breed in Alaska and winter primarily in California (Swarth and Bryant, 1917). The other subspecies, the Pacific greater white-fronted goose (A. a. frontalis), is far more numerous (240,000). In 1975, Delecour and Ripley separated the Texas birds described by Hartlaub and those wintering in California. They classified the California birds as A. a. elgasi (Bauer, 1979). However, the American Ornithologists Union Check-List of North American Birds first listed the TW in 1931 as A. a. gambelli and it has remained the same to date. The two subspecies have been differentiated by size and color, TW being larger and darker than the Pacific greater white-fronted goose (PW). A separate management plan has been prepared for PW.

Nesting of TW is known to occur only at Redoubt Bay, in Cook Inlet, Alaska. This group of approximately 1,500 birds was first discovered in 1979 (Timm et al. 1982) (Fig. 1). Other suspected production or summering areas in Alaska include Susitna Flats, Tuxedni and Chinitna bays, and Innoko National Wildlife Refuge (NWR) (Timm et al. 1982). Old Crow Flats, Yukon is also reputed to summer these geese. Migration stopover areas for TW include southeastern Oregon and Klamath Basin in southeastern Oregon and northcentral California. The first migrants arrive at these locations during the last few days of August and again during late February.

Though some birds are present on the wintering areas of Sacramento and Delevan NWRs in early September, a major influx occurs into these areas later in the month. Additional movements result in increasing numbers using the Suisun Marsh, Solano County by late November. Most birds leave the wintering areas by late February. Winter population estimates during the late 1970s ranged from 2,100 in 1978-79 (Wege 1984) to 2,500 in 1979-80 (Bauer 1979). During the early 1980s, estimates increased to 4,800 in 1980-81 and 5,000 birds in 1981-82 (Wege 1984). Surveys in 1988-89 and 1989-90 yielded estimates of 6,600 and 6,900 birds (G. Mensik, 1988 & 1989, U.S. Fish and Wildlife Service unpubl. reports).

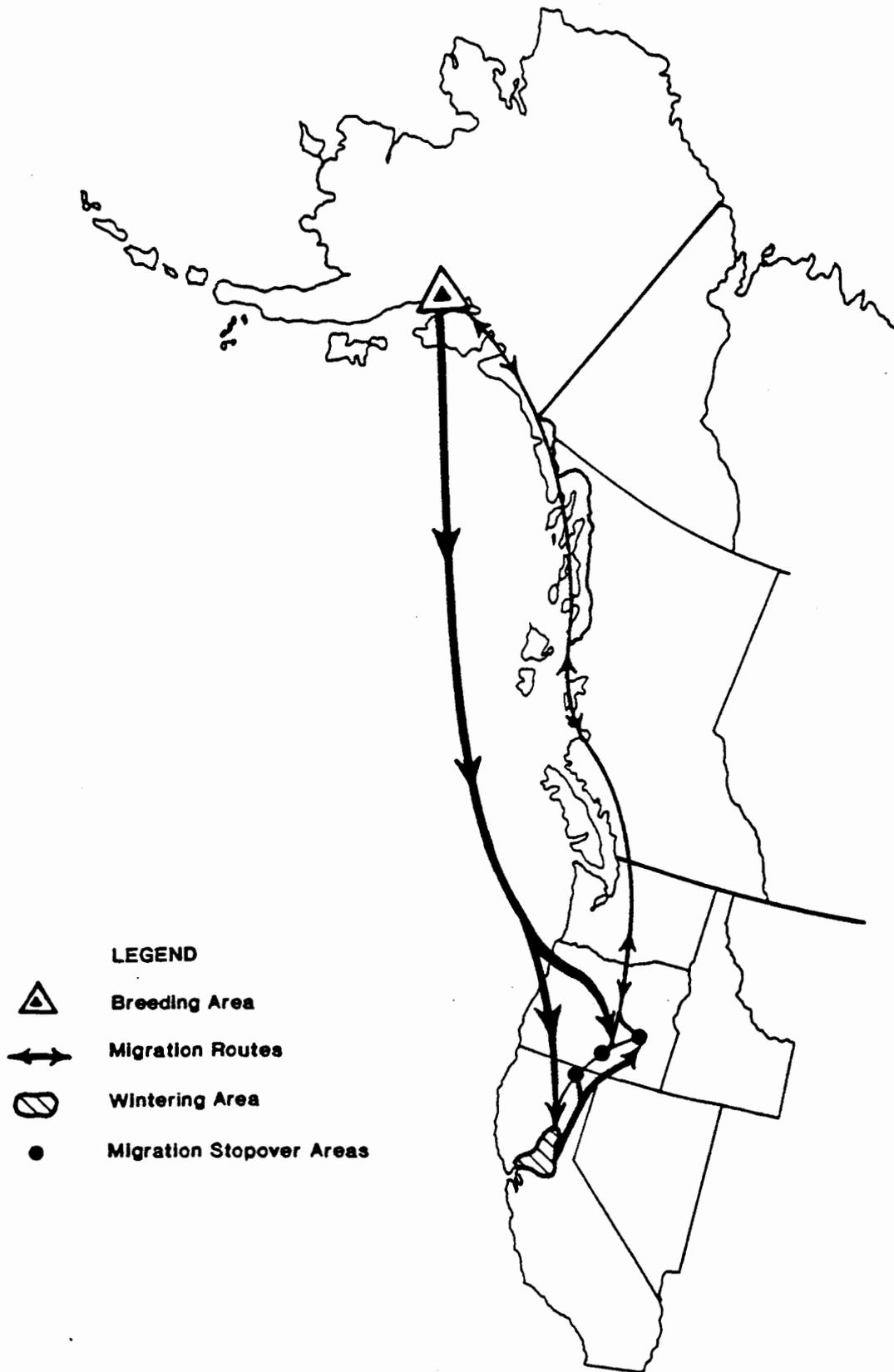


Figure 1. Known distribution of the Pacific Flyway population of tule greater white-fronted geese.

II. GOALS AND OBJECTIVES

The goal of this plan is to identify the information needs, management actions, and agency responsibilities necessary to cooperatively manage the numbers and distribution of TW.

Objectives of the plan are to:

- A. Identify current population distribution and abundance.
- B. Build and maintain a population index of 10,000 birds as measured by coordinated surveys on southern staging and wintering areas.
- C. Maintain nesting, migration, and wintering habitats of sufficient quantity and quality to meet the population objective.
- D. Increase winter use in the Suisun and Napa marshes.
- E. Provide educational, scientific, and sport hunting opportunities that are compatible and consistent with stated objectives.

III. DISTRIBUTION

Breeding Areas

Nesting TW were first located in 1979 in the Redoubt Bay and Susitna Flats areas of Cook Inlet, Alaska (Timm et al. 1982) (Fig. 2). Banding in 1980 and 1981 confirmed that these birds wintered in the Sacramento Valley. While young were observed at both locations, nests were found only in the lower Big River area near Redoubt Bay (Timm et al. 1982). It is likely that TW nest elsewhere, based on the disparity between breeding ground and wintering ground counts. Adults reportedly took young downstream for brood rearing near the mouth of Big River. Cook Inlet population estimates ranged from 1,146 to 1,537 birds. The suspected nesting range in Alaska is identified in Figure 2.

Fall Migration

Fall migration begins in mid-August and only a few hundred birds remain in the Cook Inlet at the end of the month. Key stopover locations in southeastern Oregon include The Summer Lake Wildlife Management Area (WMA) and the Malheur NWR (Appendix B). In recent years, approximately 50 percent of the population has been present in early September. However, no marked birds have been observed at Malheur. In addition, TW are present in the Klamath Basin during this time period (Wege 1984). Approximately 1,000 to 2,000 birds may remain in these areas until late October.

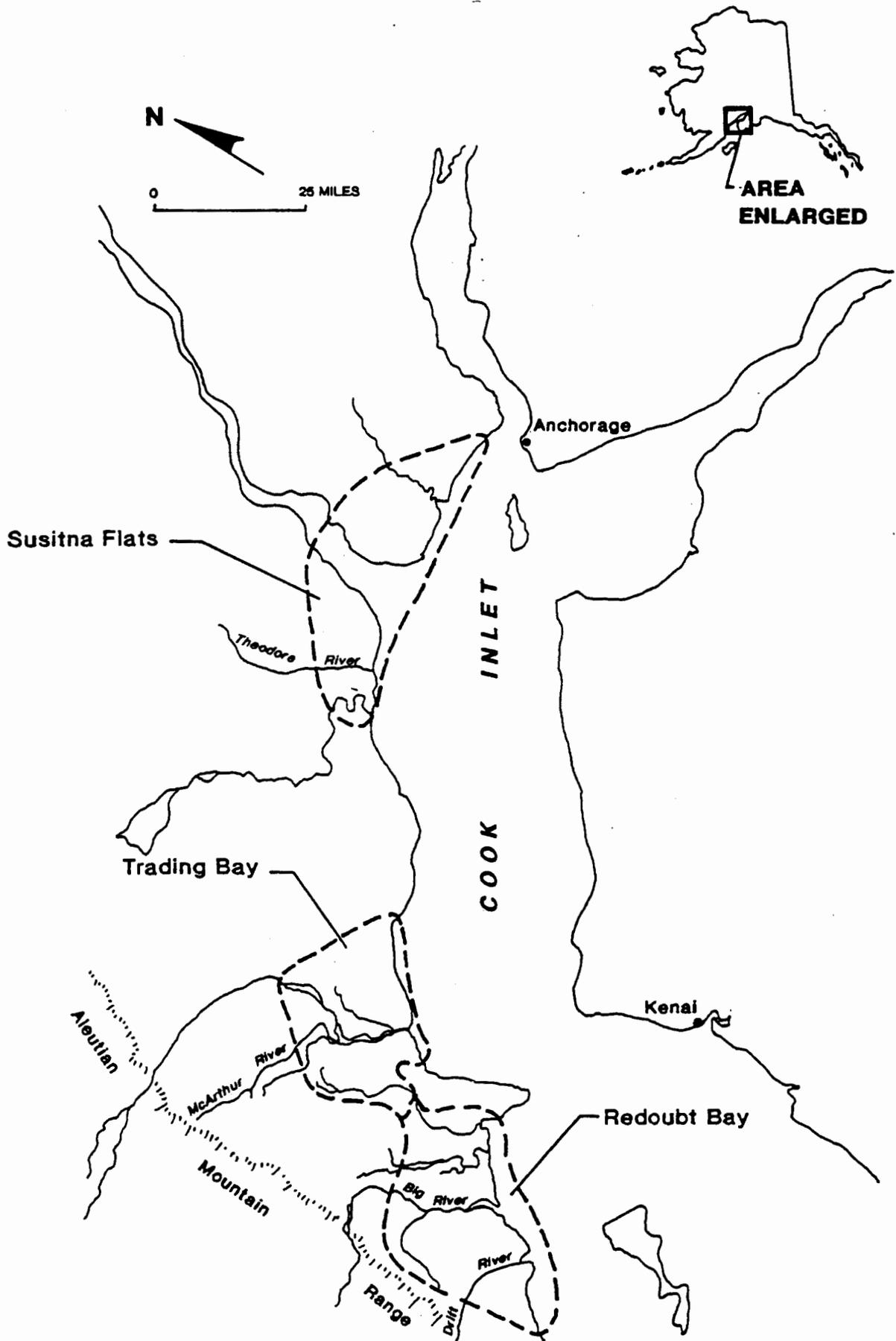


Figure 2. Breeding areas for the Pacific Flyway population of tundra greater white-fronted geese.

Surveys during the fall of 1988 indicated a similar pattern, though fewer birds were recorded in the Klamath Basin, while increased numbers were reported in the Malheur NWR area (Appendix B). Most TW had departed all staging areas by late October.

Surveys indicate that approximately 50 percent of all TW over-fly the fall staging areas, arriving at Sacramento NWR in early September (Timm et al. 1982; G. Mensik 1988, U.S. Fish and Wildlife Service unpubl. report).

Wintering Areas

Primary wintering areas in California are the Sacramento Valley and Suisun Marsh (Fig. 3). Use in the Sacramento Valley is concentrated on Delevan and Sacramento (and to a lesser extent Colusa) NWRs and surrounding rice fields. Highest use occurs in seasonally flooded alkali and tuberous bulrush (Scripus robustus and S. tuberosus) marshes. Similar habitats are used in the Suisun (Grizzly Island Wildlife Area [W.A.]) and nearby Napa marshes.

During October and November, approximately 90 percent of the known TW population occurs in these areas. In addition, 200-300 birds used the Butte Sink in the late 1970s (Wege 1984), and an unknown number may winter as far south as the state of Sinaloa, Mexico (Ely and Takekawa 1990; G. Kramer, U.S. Fish and Wildlife Service unpubl. data).

Spring Migration

TW begin leaving central California in February. Numbers peak in the Klamath Basin, their primary spring staging area, in late March (Appendices A and B). In addition, Malheur NWR and adjacent private lands receive some use.

Major departures from the Klamath Basin occurred on April 8, 15-16, and 28-29, 1980 and April 10 and 20-22, 1981. Several hundred TW had arrived at Redoubt Bay by April 23 and April 20 in 1980 and 1981 (Timm et al. 1982). Three marked individuals traveled the distance (3,050 km) in a maximum of four days (Timm et al. 1982).

Leg-Band and Neck-Collar Recovery Distribution

During 1979-81, 544 TW were both leg-banded and neck-collared, 200 with yellow collars at Sacramento and Delevan NWRs and 344 with blue collars on Alaskan breeding areas (Wege 1984). Direct band recovery rates for 78 local, 98 yearling, and 115 adult geese neck-collared in Alaska were 11.5%, 12.2%, and 12.2% respectively (Timm et al. 1982). Direct hunting recoveries (35) were from California (74%), Alaska (20%), and Texas (6%). Overall survival was 80% the first year after banding.

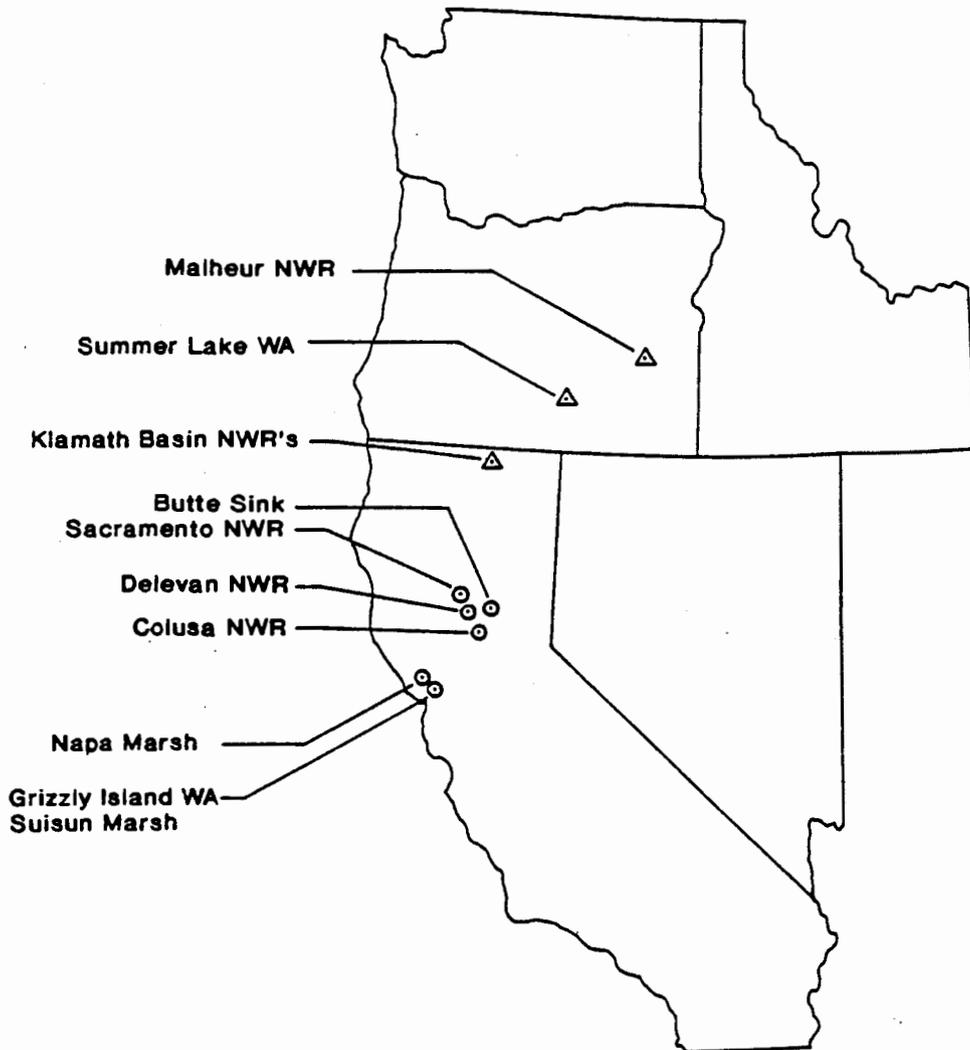
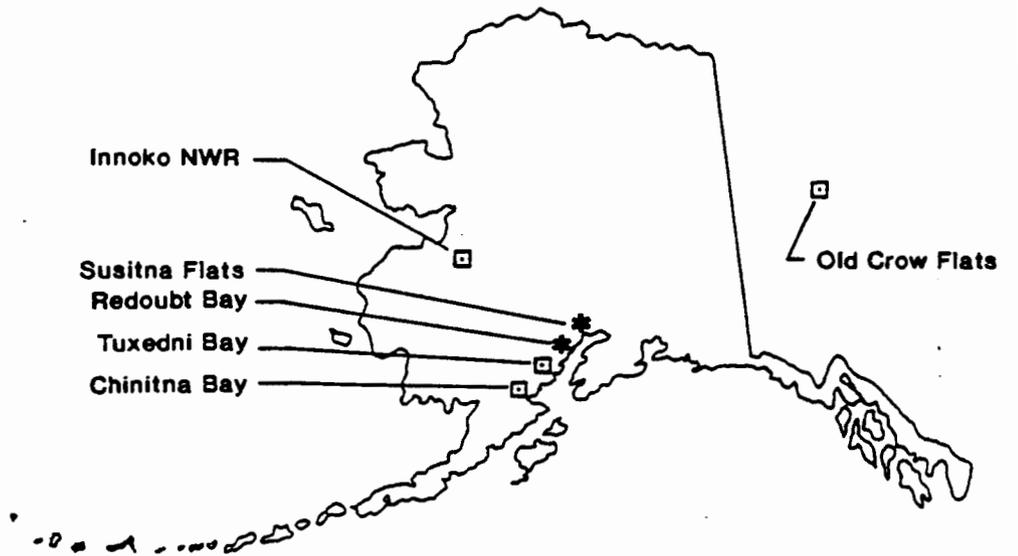


Figure 3. Breeding (*), suspected use (◻), migration stopover (Δ), and wintering (○), areas for tule greater white-fronted geese.

IV. PRODUCTION

Very little has been documented regarding nesting chronology for TW. Nests have only been found in the lower Big River area of Redoubt Bay. Nest sites are reported to be "typical of other white-fronts" as described by Ely (1979). The magnitude of nest loss remains unknown.

Two methods have been used to monitor TW annual production. The most common is to estimate the percent young in a sample of TW present on fall migration or wintering areas. In 1988 and 1989 the percent young was 30 percent and 27 percent, respectively. The second method surveys hunter check stations to determine percent young in the harvest, which was 44 percent in 1989. Sacramento and Delevan NWRs and Grizzly Island W.A. are the primary sources of this information (G. Mensik, U.S. Fish and Wildlife Service unpubl. data).

V. USES AND MANAGEMENT

Hunting

Most Pacific Flyway greater white-fronted goose harvest occurs in California (Appendix C). Despite limited harvest information from band returns or hunter check stations, it appears harvest location for TW is similar to that for FW. Because no subsistence harvest is known to occur, and few TW remain in Alaska and Oregon beyond the opening of sport hunting (September 1 and mid-October, respectively), most TW hunting mortality takes place on California migration/wintering grounds.

Declines in the FW population prompted a series of restrictive regulations including bag limit reductions, shortened hunting seasons throughout the flyway (1979), and site specific closures (1986). As a result, white-fronted goose harvest declined by 75 percent between 1981 and 1986 on major use areas in California (Appendix D). Since that time, GW populations and harvest have increased. As was true for the state in general, favorable harvest conditions and population increases in recent years combined to cause the 1989-90 sport harvest on the Sacramento NWR Complex to return to mid-1980s level. Subsistence harvest take was also reduced by voluntary action.

The 1979-1982 and 1987-1989 sport harvest of whitefronts on the Sacramento NWR Complex indicate that: (1) TW comprise a disproportionately high percentage of the harvest (30-60%) when compared to population composition (5-25%); (2) the majority of the harvest comes from Delevan NWR and adjacent areas; (3) harvest age ratios for TW (30%-40% young) more closely reflect those of the population than do those of FW (70%-80% young).

Sport harvest also occurs at Grizzly Island W.A. and Klamath Basin NWR (Appendix D). In addition, kill records indicate 20-30 TW are taken by private duck clubs in the Suisun Marsh and 15-20 by clubs in the Napa Marsh

(B. Smith, Calif. Dept. of Fish and Game unpubl. data). Limited harvest has occurred on Summer Lake WMA and Malheur NWR in Oregon. In addition, 2 TW marked in Alaska were shot in southeastern Texas the first year after banding (Timm et al. 1982).

Estimated hunting mortality appears to represent less than 5 percent of the known total population. This is supported by the comparatively high survival estimates ($\geq 80\%$) the first year after banding (Timm et al. 1982).

Other Public Uses

Though the TW is difficult to identify and largely unknown as a sub-species, a limited public following does exist. Each year requests are granted on the wintering ground refuges for photographic special use permits. In addition, daily feeding flights are observed and appreciated by many of the visitors (78,412 in 1989) to Sacramento Valley refuges. There are also some birds held in captivity by aviculturists.

Research

Comprehensive research occurred during the late 1970s and early 1980s. Work was conducted on wintering, migration stopover, and the newly discovered breeding areas. Activities included leg banding, neck collaring, and outfitting individuals with radio transmitters. Daily and seasonal movements were monitored, sport harvest documented, and social behavior observed (Timm et al. 1982; Wege 1984, unpubl. data).

Management

Current management efforts to benefit white-fronted geese at the Flyway, state, and local levels deal almost exclusively with PW. There are few specific surveys, regulations, or management strategies developed or conducted specifically for TW.

The following information has been gathered for TW on an irregular basis since the late 1960s:

1. Population size and distribution
 - A. Fall and winter counts on NWRs and state-managed wildlife areas.
 - B. Periodic leg banding and color marking
2. Production assessment
 - A. Age composition and family size counts on staging and wintering areas.

3. Mortality assessment and harvest management
 - A. Monitoring harvest on selected public hunting areas.
 - B. Monitoring disease mortality on NWRs and state-managed wildlife areas.

In addition to these population assessment monitoring activities, the following habitat management practices have occurred:

- A. Special protection for TW habitat afforded by land classification as refuge, management area, and critical habitat.
- B. Federal and state laws provide habitat protection through use permits and coastal zone planning for lands important to TW.
- C. Marsh management, grain farming, and controlled burning on some federal, state, and private lands enhances habitat for TW.
- D. The Federal Waterbank Act and Wetland Easement Program provide incentives to retain private wetland habitat important to TW.

Because of their similar appearance and wintering ground distribution, management directed at either PW or TW will affect the other. Management actions for each subspecies must be jointly prioritized so that conflicts can be resolved when actions directed toward one negatively impact the other.

VI. INFORMATIONAL NEEDS

Because of its small population and the physical similarity to the Pacific greater white-fronted goose, several data gaps exist:

1. Population status remains in question without regularly scheduled surveys.
2. Taxonomic separation between PW and TW is not clearly understood.
3. The only confirmed nesting area is Redoubt Bay, Alaska; other nesting areas need to be identified.
4. Estimates of population parameters (production, survival, and the relative importance of specific types of mortality) are incomplete.
5. Results of past research are not completely analyzed and published.
6. Habitat requirements are not fully delineated and effects of some agricultural land use practices are unknown.

7. The magnitude of wintering populations and the amount of harvest outside of California are unknown.

VII. RECOMMENDED MANAGEMENT PROCEDURES

The following management procedures and research needs are consistent with similar plans written for other goose species of the Pacific Flyway. They are recommended even though the degree and timing of their implementation by agencies involved will be influenced by man-power, fiscal, and legislative constraints. Whenever possible, the following recommended management procedures should be coordinated with or incorporated into those recommended for other Pacific Flyway goose populations.

Habitat

A. Breeding Habitat Protection

Redoubt Bay in Alaska's Cook Inlet is protected under a "critical habitat" legislative act (Senate Bill 184) passed in 1989. As additional breeding locations are discovered, each should be evaluated, based upon ownership, location, and contribution, for suitable protection.

Lead Agency: USFWS (Reg. 7), ADFG
Priority: 1
Schedule: Ongoing

B. Migration/Wintering Habitat Protection

Identify preferred TW use areas in California and Oregon that are not currently under state or federal management. Determine the desirability and feasibility of protecting (fee title acquisition, easement) such lands.

Lead Agencies USFWS (Reg. 1), ODFW, CDFG
Priority: 1
Schedule: Ongoing

C. Migration/Wintering Habitat Management

Continue to practice and encourage those land management strategies resulting in maintenance of habitat types identified as beneficial to migrant and wintering TW. Such efforts should include not only publicly managed areas, but also privately owned duck clubs and farms.

Lead Agency USFWS (Reg. 1), ODFW, CDFG
Priority: 1
Schedule: Ongoing

Population Management and Research

A. Determine Breeding Population Index and Distribution

In addition to Redoubt Bay, several other areas have reported TW activity during late spring and summer months. All sites should be either revisited or surveys initiated to determine the number and status of birds using these areas.

Lead Agency: USFWS (Reg. 7,8), ADFG
Priority: 1
Schedule: Redoubt Bay -1991
Susitna Flats - 1992

B. Determine Migrant Population Distribution

Preliminary data analysis and resulting publications document a number of significant TWFG use areas. However, substantial additional unanalyzed data does exist. It is important to complete this analysis as it may add sites of importance, patterns of use, and habitat preferences. Consideration for additional marking to be given based on identified needs.

Lead Agency: USFWS
Priority: 1
Schedule: Completed by July 1991

C. Coordinated Fall/Winter Surveys

Surveys should be designed to obtain concurrent peak population counts and age ratio samples on all known use areas. Surveys should be timed so as to minimize complications with GWFG. Areas will include:

1. Breeding grounds in Alaska - ADFG - every 3rd year
2. Summer Lake, Oregon - ODFG - yearly
3. Harney Basin, Oregon - USFWS - yearly
4. Klamath Basin, Oregon/Calif. - USFWS - yearly
5. Sacramento Valley, Calif. - USFWS & CDFG - yearly
6. Suisun Marsh, Calif. - CDFG - yearly
7. Mexico - USFWS - every 3rd year

Lead Agency: As listed
Priority: 1
Schedule: Begin 1991 (Calif. and Oregon only)
1992 (complete effort)

D. Determine Winter Habitat Requirements

Acquire data needed to understand habitat requirements. Evaluate and refine management strategies to produce required habitats on both public and private lands.

Lead Agency: USFWS (Reg. 1, NPWRC)
Participating Agencies: ODFW, CDFG
Priority: 2
Schedule: Begin Fall, 1991

E. Establish Parameters for Subspecific Identification

Subsequent to an analysis of existing data, collect and analyze additional data as required to develop techniques for TW identification. Availability of a quantitative procedure will provide improved annual harvest estimates.

Lead Agency: USFWS (Reg. 1, NPWRC)
Participating Agencies: CDFG, ADFG
Priority: 2
Schedule: Ongoing

F. Non-Sport Hunting Mortality

Monitor mortality due to disease, predation, subsistence hunting, and pollution. Develop management procedures to minimize such losses where feasible.

Lead Agency: USFWS, ADFG, CDFG
Priority: 2
Schedule: Ongoing

Tule Whitefront Harvest Strategy

A. Harvest Guidelines

Design and implement a management strategy comparable to that used for Canada geese where restricted winter distribution allows harvest manipulation within defined geographic regions. Harvest regulations should allow for an increasing population up to 10,000 birds. Based on the previous year's population index, the following are recommended as possible alternatives to accomplish necessary adjustments:

1. Population index greater than 10,000; establish regulations that allow for a stable population such as:
 - a. Restrict daily bag limit to one bird on Sacramento and Delevan NWRs and Grizzly Island W.A. throughout the general goose season.

2. Population index between 5,000-10,000; establish restrictive regulations that allow for an annual population increase of 3%-5% such as:

For Sacramento and Delevan NWRs and Grizzly Island W.A.

- a. Restrict daily bag limit to one bird.
 - b. Regulate length and timing of open season pending desired population increase.
3. Population index between 3,200-5,000; establish more restrictive regulations that allow for an annual population increase greater than 5% such as:

For Sacramento and Delevan NWRs and Grizzly Island W.A.

- a. Restrict daily bag limit to one bird.
 - b. Regulate length and timing of open season pending desired population increase.
 - c. Develop quota for number of tules to be harvested.
4. Population index of less than 3,200; the season on all whitefronts on Sacramento and Delevan NWRs and Grizzly Island W.A. should be closed and additional geographic area closures considered.

| | |
|-------------------------|-------------|
| Lead Agencies: | USFWS, CDFG |
| Participating Agencies: | ADFG, ODFW |
| Priority: | 1 |
| Schedule: | Begin 1991 |

Plan Implementation and Review

The Whitefront Subcommittee shall meet twice annually or as needed to review progress toward achieving the goal and objectives of this plan and to recommend actions and revisions. The Subcommittee should report through the Pacific Flyway Study Committee on status of the cooperative management efforts to the Pacific Flyway Council and those state and federal agencies and organizations either interested or cooperating in management of these geese. The Pacific Flyway Study Committee should coordinate management activities regarding the TW and, when appropriate, with those of the PFCWG Subcommittee, and when appropriate, with the Central Flyway Technical Committee.

The Subcommittee should be composed of a representative from each federal and state agency having management responsibility for this population. It would be the responsibility of those members to assure that the objectives and procedures of this plan are integrated and coordinated with those plans and

activities of various wildlife and land management agencies and local planning systems within their agency's purview. Chairmanship should be appointed biannually and rotated among member agencies. The Subcommittee should invite to its meetings any individual, group, agency, or representative whose expertise, counsel, or managerial capacity is required for the coordination and implementation of management programs.

Lead Agency/Group:
Priority:
Schedule:

Subcommittee

1

Twice annually - at the March and July meetings of the Pacific Flyway Study Committee. Schedule for 2-year chairmanship rotation is:

Beginning October 1, 1991 - Washington

Beginning October 1, 1993 - USFWS (Reg.1)

Beginning October 1, 1995 - California

Beginning October 1, 1997 - Alaska

VIII. LITERATURE CITED

- BAUER, R.D. 1979. Historical and status report of the tule white-fronted goose. Pp 44-55 in R. L. Jarvis and J. C. Bartonek (eds.) "Management and Biology of Pacific Flyway Geese." Oregon State University Book Stores, Corvallis
- ELY, C.R. 1979. Breeding Biology of the White-fronted Goose (Anser albifrons frontalis) on the Yukon-Kuskokwim Delta, Alaska. Thesis Univ. of California, Davis. 110 pp.
- ELY, C.R. and TAKEKAWA, J.Y. 1990. Distribution of sub-populations of greater white-fronted geese in the Pacific Flyway - USFWS unpublished progress report. 23 pp.
- HARTLAUB, G. 1852. Descriptions de quelques nouvelles especes d'oiseaux. Revue et Magasin de Zoologie Pure et Appliquee 4 (2nd series):3-9
- KRAMER, G.W. USFWS unpublished data.
- MENSIK, J.G. 1988 and 1989 USFWS Fall/winter tule white-front populations unpublished reports.
- SMITH, R.A. Calif. Dept. of Fish and Game unpublished data.
- SWARTH, H.S. and BRYANT, H.C. 1917. A study of the races of the white-fronted goose (Anser albifrons) occurring in California. Univ. Calif. Publ. Zool. 17:209-22.
- TIMM, D.E., WEGE, M.L., and GILMER, D.S. 1982. Current status and management challenges for tule white-fronted geese. Trans. N. Am. Wildl. and Nat. Resour. Conf. 47:453-63.
- WEGE, M.L. 1984. Distribution and abundance of tule geese in California and southern Oregon. Wildfowl 35:14-20.

Appendix A. Areas used by Pacific Flyway tule greater white-fronted geese

| State | Location | Type of Use | Population Indexes | Year | Habitat Condition and Threats |
|------------|-------------------|-----------------------------------|--------------------|--------------|------------------------------------------------------------------------------------------------------------|
| ALASKA | Redoubt Bay | nesting, molting broodrearing | 1,000-1,500 165 | 1980 1990 | State Critical Habitat Area of Volcanic activity potentially affects habitat. On-off shore oil production. |
| | Susitna Flats | nesting, molting, broodrearing | unknown 460 | 1980 1990 | State game refuge. On-off shore oil production. |
| OREGON | | | | | |
| | Summer Lake WMA | fall migration | 1,000-2,000 | 1989 | State Wildlife Area |
| | Malheur NWR | fall and spring migration | 2,000-3,000 | 1989 | Private land and National Wildlife Refuge |
| CALIFORNIA | | | | | |
| | Klamath Basin NWR | fall and spring migration | 1,000-3,000 | 1980 | National Wildlife Refuge |
| | Sacramento NWR | fall and wintering | 1,800-2,200 | 1989 | National Wildlife Refuge |
| | Delevan NWR | fall and wintering | 3,000-4,300 | 1989 | National Wildlife Refuge |
| | Colusa NWR | fall and wintering | 200-500 | 1988 | National Wildlife Refuge |
| | Butte Sink | fall and wintering | 200-300 | 1979 | Private land with some USFWS easement |
| | Grizzly Island WA | wintering | 1,000-1,500 | 1989 | State Wildlife Area |
| | Napa Marsh | wintering | 100-200 | 1989 | Private land - duck clubs |

Appendix B. Peak monthly population indices for TW on migration, stopover, and wintering areas in Oregon and California for 1978-79 through 1981-82, 1988-89, and 1989-90^a

| | Sacramento NWR | Delevan NWR | Colusa NWR | Sacramento Complex | Grizzly Is. WA | Lower Klamath NWR | Summer Lake WMA | Malheur NWR | TOTAL ^b |
|----------------|-------------------|----------------|---------------|-----------------------|-------------------|----------------------|--------------------|----------------|--------------------|
| 1978-79 | | | | | | | | | |
| Nov | | | | 1300 | | | | | 1300 |
| Dec | | | | 900 | 1000 | | | | 1900 |
| 1979-80 | | | | | | | | | |
| Sept | | | | 300 | | 500 | | | 800 |
| Oct | | | | 1300 | 500 | 25 | | | 1825 |
| Nov | | | 100 | 1000 | | | | | 1000 |
| Dec | | | 100 | 1000 | 800 | | | | 1800 |
| Jan | | | 100 | 700 | 500 | | | | 1200 |
| Feb | | | | 400 | | 300 | | | 700 |
| Mar | | | | | | 500 | | | 500 |
| Apr | | | | | | 500 | | | 500 |
| 1980-81 | | | | | | | | | |
| Sept | | | | 1000 | | | 1500 | | 2500 |
| Oct | | | | 3000 | 500 | 2000 | | | 5500 |
| Nov | | | | 3500 | | | | | 3500 |
| Dec | | | | 3000 | 1500 | | | | 4500 |
| Jan | | | | | | | | | |
| Feb | | | | | | | | | |
| Mar | | | | | | | | | |
| Apr | | | | | | 1000 | | | 1000 |
| 1981-82 | | | | | | | | | |
| Sept | | | | 500 | | | 2100 | | 2600 |
| Oct | | | | 2000 | 1000 | 1200 | | | 4200 |
| Nov | | | | 3500 | | | | | 3500 |
| Dec | | | | 3500 | 1200 | | | | 4700 |
| Jan | | | | | | | | | |
| Feb | | | | | | | | | |
| Mar | | | | | | | | | |
| Apr | | | | | | 3000 | | | 3000 |
| 1988-89 | | | | | | | | | |
| Sept | 2000 | 3100 | | 5100 | 85 | 100-200 | 644 | 1830 | 7809 |
| Oct | 2000 | 3400 | 245 | 5645 | 300 | 100-200 | 800 | | 6895 |
| Nov | 1800 | 3500 | 150 | 5450 | 300 | | 23 | | 5773 |
| Dec | 1800 | 3500 | | 5300 | 970 | | | | 6270 |
| Jan | | | | | 1050 | | | | 1050 |
| Feb | | | | | 1229 | 200 | | | 1429 |
| Mar | | | | | | 500 | | | 500 |
| 1989-90 | | | | | | | | | |
| Sept | 1200 | 2200 | | 3400 | 100 | | 1875 | 3240 | 8615 |
| Oct | 1800 | 3150 | 120 | 5070 | 97 | | 850 | 200 | 6217 |
| Nov | 2770 | 3488 | | 6258 | 557 | | 56 | | 6871 |
| Dec | 1700 | 4300 | | 6000 | 890 | | 3 | | 6893 |
| Jan | | | | | 913 | | | | 913 |
| Feb | | | | | 1190 | | | | 1190 |

a Data are summarized and represent estimates from a number of individuals studying TW during these years.

b Peak monthly counts for each area include birds counted in other areas.

Appendix C.

Estimated WHITE-FRONTED GOOSE harvests and the age ratios of those harvests in the Pacific flyway.

| Year | WA | OR | ID | MT | WY | CA | NV | UT | CO | AZ | NH | PF Total | AK | PF & AK | Imm/Ad |
|------------------|--------|--------|---------|---------|---------|--------|---------|---------|---------|-------|------|----------|-------|---------|--------|
| 1961 | | | | | | | | | | | | | | | |
| 1962 | 300 | 1,267 | 0 | 0 | 0 | 50,088 | 0 | 0 | 0 | 0 | 0 | 51,655 | | 51,655 | 1.95 |
| 1963 | 64 | 6,140 | 0 | 0 | 0 | 56,694 | 147 | 0 | 0 | 0 | 0 | 63,045 | | 63,045 | 1.25 |
| 1964 | 140 | 4,710 | 0 | 0 | 0 | 51,735 | 982 | 0 | 0 | 0 | 0 | 57,567 | | 57,567 | 1.33 |
| 1965 | 531 | 3,251 | 248 | 0 | 0 | 42,211 | 94 | 55 | 0 | 0 | 0 | 46,390 | | 46,390 | 1.05 |
| 1966 | 368 | 6,015 | 161 | 0 | 21 | 65,321 | 0 | 0 | 0 | 38 | 0 | 71,924 | 75 | 71,999 | 1.52 |
| 1967 | 0 | 5,141 | 0 | 0 | 0 | 62,819 | 0 | 84 | 0 | 0 | 0 | 68,044 | 699 | 68,743 | 1.24 |
| 1968 | 438 | 3,723 | 112 | 0 | 0 | 47,345 | 0 | 0 | 0 | 0 | 0 | 51,618 | 856 | 52,474 | 1.50 |
| 1969 | 1,464 | 2,080 | 0 | 0 | 0 | 68,443 | 0 | 0 | 0 | 0 | 0 | 71,987 | 1,204 | 73,191 | 2.06 |
| 1970 | 862 | 2,516 | 215 | 110 | 0 | 70,639 | 304 | 142 | 30 | 255 | 0 | 75,073 | 1,267 | 76,340 | 1.05 |
| 1971 | 0 | 484 | 0 | 0 | 0 | 34,216 | 298 | 0 | 0 | 52 | 0 | 35,050 | 2,815 | 37,865 | 1.44 |
| 1972 | 203 | 1,304 | 289 | 0 | 0 | 51,813 | 0 | 0 | 0 | 0 | 0 | 53,609 | 716 | 54,325 | 1.58 |
| 1973 | 0 | 963 | 0 | 0 | 0 | 44,615 | 1,640 | 126 | 0 | 0 | 0 | 47,344 | 754 | 48,098 | 0.88 |
| 1974 | 321 | 251 | 0 | 0 | 0 | 40,682 | 0 | 0 | 0 | 0 | 0 | 41,254 | 338 | 41,592 | 0.63 |
| 1975 | 2,167 | 4,574 | 0 | 249 | 0 | 30,193 | 0 | 0 | 0 | 85 | 0 | 37,268 | 1,217 | 38,485 | 1.21 |
| 1976 | 0 | 678 | 0 | 0 | 0 | 44,044 | 0 | 0 | 0 | 0 | 0 | 44,722 | 1,288 | 46,010 | 1.84 |
| 1977 | 289 | 0 | 0 | 0 | 0 | 33,572 | 0 | 364 | 0 | 150 | 0 | 34,375 | 1,191 | 35,566 | 2.68 |
| 1978 | 658 | 1,474 | 0 | 0 | 0 | 34,719 | 0 | 0 | 0 | 0 | 0 | 36,851 | 1,170 | 38,021 | 2.14 |
| 1979 | 592 | 1,390 | 78 | 73 | 0 | 21,599 | 94 | 0 | 0 | 170 | 0 | 23,796 | 599 | 24,395 | 2.12 |
| 1980 | 584 | 1,304 | 0 | 0 | 0 | 18,693 | 0 | 0 | 0 | 0 | 0 | 20,581 | 293 | 20,874 | 1.59 |
| 1981 | 0 | 645 | 58 | 0 | 0 | 21,781 | 222 | 0 | 0 | 0 | 0 | 22,706 | 145 | 22,851 | 0.96 |
| 1982 | 991 | 204 | 0 | 0 | 0 | 15,004 | 68 | 0 | 0 | 0 | 0 | 16,267 | 505 | 16,772 | 0.83 |
| 1983 | 115 | 267 | 0 | 78 | 0 | 16,157 | 73 | 0 | 0 | 0 | 0 | 16,690 | 446 | 17,136 | 0.90 |
| 1984 | 481 | 468 | 0 | 0 | 0 | 6,686 | 0 | 0 | 0 | 0 | 0 | 7,635 | 671 | 8,306 | 0.80 |
| 1985 | 170 | 0 | 0 | 0 | 0 | 15,157 | 0 | 0 | 0 | 0 | 0 | 15,327 | 343 | 15,670 | 0.41 |
| 1986 | 149 | 0 | 110 | 0 | 0 | 7,542 | 0 | 0 | 0 | 67 | 0 | 7,868 | 968 | 8,836 | 0.56 |
| 1987 | 135 | 93 | 0 | 0 | 0 | 9,634 | 84 | 0 | 56 | 0 | 0 | 10,002 | 960 | 10,962 | 1.03 |
| 1988* | 83 | 292 | 0 | 0 | 0 | 3,831 | 0 | 0 | 0 | 48 | 0 | 4,254 | 1,047 | 5,301 | 0.89 |
| Averages: | | | | | | | | | | | | | | | |
| 1961-65 | 300 | 3,800 | 100 | <50 | 0 | 50,200 | 300 | <50 | 0 | 0 | 0 | 54,664 | | 54,664 | 1.40 |
| 1966-70 | 600 | 3,900 | 100 | <50 | <50 | 62,900 | 100 | <50 | 6 | 59 | 0 | 67,729 | 820 | 68,549 | 1.47 |
| 1971-75 | 500 | 1,500 | 100 | 100 | 0 | 40,304 | 400 | <50 | 0 | 27 | 0 | 42,905 | 1,168 | 44,073 | 1.15 |
| 1976-80 | 400 | 1,000 | <50 | <50 | 0 | 30,500 | <50 | 100 | 0 | 64 | 0 | 32,065 | 908 | 32,973 | 2.07 |
| 1981-85 | 400 | 300 | <50 | <50 | 0 | 15,000 | 100 | <50 | 0 | 0 | 0 | 15,725 | 422 | 16,147 | 0.78 |
| 1986-88 | 142 | 47 | 55 | 0 | 0 | 8,588 | 42 | 0 | 28 | 34 | 0 | 8,935 | 964 | 9,899 | 0.80 |
| X Change from: | | | | | | | | | | | | | | | |
| 1987 | -38.5% | 214.0% | nc | nc | nc | -60.2% | -100.0% | nc | -100.0% | nc | nc | -57.5% | 9.1% | -51.6% | |
| 1982-87 | -80.4% | -84.5% | -100.0% | -100.0% | -100.0% | -89.6% | -100.0% | -100.0% | -100.0% | 52.8% | ERR | -89.2% | 24.4% | -86.8% | |
| X Tot Goose Hvst | | | | | | | | | | | | | | | |
| 1962-87 | 1.0% | 4.6% | 0.2% | 0.3% | 0.1% | 22.1% | 2.4% | 0.2% | 0.3% | 1.0% | 0.0% | 12.9% | 7.4% | 12.8% | |
| 1988* | 0.2% | 1.0% | 0.0% | 0.0% | 0.0% | 7.5% | 0.0% | 0.0% | 0.0% | 0.7% | 0.0% | 2.4% | 17.3% | 2.9% | |

* - Preliminary data.

Appendix D. Greater white-fronted goose harvest on state and federal public hunting areas where TW occurred in California between 1981-1990.

| | Sacramento NWR | Delevan NWR | Colusa NWR | Sutter NWR | Sacramento Complex Total | Gray Lodge WA | Grizzly Is. WA | Klamath Basin NWRs | Calif. Total |
|---------|-------------------|----------------|---------------|---------------|--------------------------------|------------------|-------------------|-----------------------|-----------------|
| 1981-82 | 161 | 431 | 13 | 45 | 650 | 56 | 40 | 3700 | 4479 |
| 1982-83 | 143 | 372 | 33 | 127 | 675 | 54 | 41 | 2190 | 2986 |
| 1983-84 | 120 | 334 | 10 | 1 | 465 | 50 | 22 | 2700 | 3304 |
| 1984-85 | 88 | 208 | 17 | 29 | 342 | 38 | 2 | 863 | 1269 |
| 1985-86 | 181 | 250 | 23 | 84 | 538 | 31 | 24 | 592 | 1202 |
| 1986-87 | 38 | 122 | 8 | 4 | 172 | 5 | 11 | 898 | 1105 |
| 1987-88 | 30 | 91 | 13 | 6 | 140 | 2 | 7 | 1030 | 1205 |
| 1988-89 | 13 | 97 | 3 | 2 | 115 | 4 | 5 | 1439 | 1582 |
| 1989-90 | 108 | 317 | 25 | 4 | 454 | 49 | 31 | 1151 | 1757 |

