WATERFOWL DISTRIBUTION, MOVEMENTS AND HABITAT USE RELATIVE TO RECENT HABITAT CHANGES IN THE CENTRAL VALLEY OF CALIFORNIA

PROGRESS REPORT – JUNE 2000

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CAIIFORNIA DEPARTMENT OF FISH AND GAME
CALIFORNIA WATERFOWL ASSOCIATION
CENTRAL VALLEY HABITAT JOINT VENTURE
DUCKS UNLIMITED INC.
GRASSLAND WATER DISTRICT
THE RICE FOUNDATION
UNITED STATES FISH AND WILDLIFE SERVICE
UNITED STATES BUREAU OF RECLAMATION

30 JUNE, 2000

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A cooperative project to investigate impacts of the Central Valley Habitat Joint Venture and changing agricultural practices on the ecology of wintering waterfowl

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EXECUTIVE SUMMARY

During the last decade, changing agricultural practices and conservation programs such as the Central Valley Habitat Joint Venture (CVHJV) have altered the landscape of the Central Valley of California, one of the most important waterfowl wintering areas in the world. Habitat goals of the CVHJV and other programs were based upon knowledge of waterfowl ecology at that time those programs were established. Since then, management on many lands has changed, including flooding rather than burning rice stubble, wetland restoration and enhancement and establishment of new National Wildlife Refuges (NWRs), California Wildlife Areas (WAs) and Non-Governmental Organization (NGO) preserves. The response of waterfowl to these changes was unknown and managers of the CVHJV and other habitat conservation efforts needed this information so their future efforts provide optimum benefit to the waterfowl resource and those who enjoy it. Progress made towards providing some of this information is reported here.

Preliminary results indicate that the ecology of waterfowl in the Central Valley has changed in response to changing habitat conditions. Although current waterfowl abundance patterns for the Central Valley as a whole are similar to what was planned for by the CVHJV, waterfowl abundance patterns for some basins and species differ greatly from what CVHJV goals were based upon. In addition, evidence of reduced flight distances by waterfowl suggests that energetic (and thus habitat) requirements for waterfowl should be recalculated. Local movement patterns varied among years and species. Habitat conservation planning should incorporate current data of waterfowl ecology.

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This report presents the progress made on the four study objectives. Planned methods, accomplishments and **preliminary** results are listed for each objective.

STUDY AREA

The Central Valley of California is a critical wintering habitat for many species of waterfowl in the Pacific Flyway. Once estimated at 1.6 - 2 million hectares, Central Valley wetlands have been reduced by over 90% (U.S. Fish and Wildlife Service (USFWS) 1978, Gilmer et al. 1982).

The Central Valley is composed of 9 basins including the Suisun Marsh and Delta (Figure 1). Waterfowl habitat varies among basins. Habitat in the Northern and Southern San Joaquin (Tulare) Basins consists primarily of shallow, seasonal wetlands in three distinct blocks (up to 23,313 ha in the Grassland EA, 2762 ha in Mendota WA and 2946 ha in the Tulare Lake Basin during 1991-94) that are separated by agricultural lands (e.g., orchards, cotton fields) that were rarely flooded and were of little value to waterfowl (Fleskes 1999). The Tulare Basin also includes preirrigated fields (i.e., barley-wheat, safflower, alfalfa and cotton fields that were harvested and then flooded for several days or weeks, up to 2399 ha during 1991-94). In contrast, the 20,000-27,000 ha of wetlands in the Sacramento Valley (Colusa, Butte, Sutter, American and northern Yolo basins) were interspersed among 24,000 - 60,000 ha of rice fields flooded after harvest (Central Valley Habitat Joint Venture Technical Committee 1996) which provided a relatively contiguous block of important waterfowl habitat. In the Delta, approximately 12,000 ha of grain fields that were flooded after harvest, (Central Valley Habitat Joint Venture Technical Committee 1996) and 7,000 ha of wetlands (Heitmeyer et al.1989) provide waterfowl habitat. Suisun Marsh provides 22,000 ha of brackish wetland habitat

(Heitmeyer et al.1989).

Management on many Central Valley lands has changed during the last decade, including increased flooding of rice stubble in the Sacramento Valley , wetland restoration and enhancement and establishment of new National Wildlife Refuges (NWRs), California Wildlife Areas (WAs) and Non-Governmental Organization (NGO) preserves (see Figures 1-2).

During 1991-94, The Grassland Ecological Area vicinity (Figure 3) was composed of the Grassland Ecological Area and nearby habitats, including the 6300 ha San Luis Reservoir (includes the O=Neill Forebay). Up to 23,313 ha of seasonal marsh, 1160 ha of semipermanent and permanent marsh, 1258 ha of flooded uplands, 245 ha of sewer ponds, 39 ha of evaporation ponds and 314 ha of flooded agricultural fields were available in the Grassland EA vicinity during 1991-94 (Fleskes 1999). The Grassland EA was divided into north, south and east parts. The north grasslands was composed of public lands with some wetlands closed to hunting (San Luis NWR, Kesterson NWR, Los Banos WA), public areas without closed zones (Volta, Salt Slough and China Island WAs) and privately owned waterfowl hunting clubs. (North Clubs). The Grassland State Park in the north grasslands was closed to hunting but had no waterfowl habitat. The south grasslands were composed entirely of private waterfowl hunting clubs (South Clubs). The east grasslands was composed of Merced and Arena Plains NWRs and private waterfowl hunting clubs (East Clubs).

Several habitat management changes occurred in the Grassland Ecological Area between 1991-94 and 1998-00. These changes included establishment of West Bear Creek NWR, East Bear Creek NWR, Gadwall WA, Mud Slough WA and the addition of a southern section to Merced NWR. Also, much of the AGadwall@ Unit of Kesterson NWR (not to be confused with the Gadwall WA in the South

Grasslands) was converted from waterfowl sanctuary to controlled hunting area that were open on Sundays, Wednesdays and Saturdays (i.e., shoot days) during the hunting season. Also, the north section of Merced NWR, Arena Plains NWR, Salt Slough WA and China Island WA were either just established or much of the habitat restoration was just started near the end of the 1991-94 study.

The Suisun Marsh (Figure 4) did not change significantly with respect to land ownership or restored wetlands between 1991 and 2000. Two areas which did change are Island Slough WA and the West Family Unit (Included in the West Side Units). Island slough had recently been purchased in 1991 and had undergone very little improvement during the 1991-93. The habitat in Island slough was considerably different during 1998-2000, as wetland management in this area improved the existing habitat. The West Family Unit, previously the West Family Duck Club, was one addition to state lands along the west side of the Suisun Marsh, although habitat management practices on this area during 1998-00 were probably similar to those in 1991-93.

Numerous changes occurred in the Sacramento Valley and Delta during the last 5-7 years including establishment of Upper Butte Creek (UBC) wildlife areas, Llano Seco NWR and Wattis Sanctuary in the Butte Basin (Figures 1-2), the Vic Fazio WA in Yolo Basin and Stone Lake NWR, Prospect Island and Consumnes Ecological Preserve in the Delta (Figure 5).

OBJECTIVE 1: ASSESS ANY CHANGES IN WINTERING WATERFOWL DISTRIBUTION IN THE CENTRAL VALLEY SINCE THE 1970s.

PLAN

Conduct five (revised from six) complete aerial waterfowl surveys of the Central Valley

between September - January during both field seasons and compare distribution with that during 1973 and 1978-82, when periodic aerial surveys of the entire Central Valley were last conducted. Match the timing of our aerial surveys with the 1973-82 surveys to facilitate comparisons.

Track the daily movements and distribution of radio-tagged northern pintails, mallards, and white-fronted geese during August-April and compare regional movements and distribution with results from earlier studies. Replicate field methodology of earlier studies, including dates and locations of radio-tagging and day and night tracking (Heitmeyer 1989b, Day et al. 1990, Miller et al. 1993, 1995, Fleskes et al. 1997, J. Takekawa pers. comm.) to facilitate comparisons. Each fall, capture and radio-tag 250 waterfowl; 50 white-fronted geese in Alaska or Klamath Basin, 50 mallards in the Sacramento Valley and 50 northern pintails each in the Sacramento Valley, Suisun Marsh and San Joaquin Valley. Radio-tag adult females because they were marked during all earlier studies, are especially important to population dynamics, share similar movement patterns and habitat use with hatch-year birds (Heitmeyer 1989b, Day et al. 1990, Miller et al. 1993, Miller et al. 1995, Fleskes et al. 1997, J. Takekawa, pers. comm.), usually have higher survival than hatch-year birds and thus provide the maximum comparative data at the lowest cost.

ACCOMPLISHMENTS

Due to the efforts of numerous cooperators, five aerial waterfowl surveys of the Central Valley were conducted between September - January during each field season (Table 1). We developed and used a stratified transect survey method to estimate waterfowl abundance in the Sacramento Valley basins, Yolo basin and the Delta (Figure 6). We stratifed our survey effort among basins according to

waterfowl abundance and habitat acreage. We conducted 100% surveys of National Wildlife Refuges and Wildlife Areas and flew transects over ricefields and other wetland and agricultural habitats. Waterfowl habitat was completely surveyed in the Northern (i.e., Grassland Ecological Area) and Southern San Joaquin Basins (i.e., Tulare Basin including Mendota WA). We matched the timing of our aerial surveys with the 1973 and 1978-82 surveys to facilitate comparisons. As expected, some areas were missed due to weather and logistical problems but data collected are adequate to compare current and historical distribution of waterfowl among Central Valley regions. We have plotted duck abundance for 1973-74 and 1978-82 vs 1998-00. However, 1973-82 counts need to be checked for consistency of coverage and should be considered preliminary; 1973-82 goose counts are being compiled.

We successfully replicated field methodology of earlier studies including dates and locations of radio-tagging, and day and night tracking (Table 2). We captured and radio-tagged approximately 260 adult female waterfowl each year during 1998 and 1999; 60 white-fronted geese during in Alaska, 50 mallards in the Sacramento Valley, 50 northern pintails in the Sacramento Valley, 50 northern pintails in Suisun Marsh and 55 northern pintails in the San Joaquin Valley (Table 2). In addition, 237 green-winged teal were radio-tagged in the San Joaquin Valley during 1997-00 (Table 3) and 50 immature female mallards were radio-tagged in the Sacramento Valley in 1999 and as part of related studies. We collected approximately 55,203 duck locations during the day and night and 1850 goose roosting and feeding locations in California between 1 September 1998 and 10 April 2000 to compare with approximately 95,000 waterfowl locations from earlier studies . All data were compiled and error-checked, except mallard tracking data from 1988-90, which is currently being converted into a format

to allow processing. We have conducted preliminary analysis on pintail and green-winged teal distribution and movement patterns. White-fronted goose radio-telemetry data from 1987-90 and 1998-00 are currently being analyzed.

PRELIMINARY RESULTS

Preliminary comparisons of 1998-00 vs earlier aerial waterfowl surveys and tracking of radio-tagged waterfowl indicate that distribution and movements of waterfowl among Central Valley basins has changed.

Regional Waterfowl Distribution- 1973-82 vs 1998-00 Aerial Surveys

Total dabbling duck abundance during September - January (Figure 7) and use days during October - December (Figure 8) for all Central Valley basins combined was lower during 1998-00 than during 1973-74 and 1978-82 (hereafter 1973-82), primarily because of the decline in pintail abundance (Figure 9). Dabbling duck and pintail abundance patterns varied greatly among 1973-82 in some basins but was fairly consistent during 1998-99 and 1999-00.

Except for pintails, which were less abundant in all basins during 1998-00 than during 1973-82 (Figure 9), use days (Figure 10) and abundance patterns (Figures 11-17) for individual species differed greatly among basins and years. Divers were more abundant in the Northern San Joaquin and Tulare basins during 1998-00 than 1973-82; abundance of diving ducks was highly variable elsewhere. Mallards were more abundant in the Tulare Basin during 1998-00 than 1973-82 but counts were within range of earlier estimates in other basins. Green-winged teal abundance was greater in the Central

Valley during 1998-00 than 1973-82 but the timing of use in some basins varied between the early and later years. For instance, like pintails, green-winged teal abundance peaked earlier in the Northern San Joaquin Valley during 1998-00 than in earlier year. Abundance of american wigeon and northern shoveler during 1998-00 was similar to 1973-82 in most basins. Abundance of gadwall and cinnamon teal was greater during 1998-00 than most years during 1973-82. In the Tulare basin, all ducks except pintails were more abundant during 1998-00 than during 1973-82.

Pintail Distribution Among Basins - 1987-94 vs 1998-00 Radio-Telemetry

Comparisons of 1998-00 vs earlier weekly distribution of pintails radio-tagged in the San Joaquin Valley (Figure 18), Suisun Marsh (Figure 19) and Sacramento Valley (Figure 20) indicate that there have been some changes in distribution and timing of movements among Central Valley basins during the last decade. Changes include: a) an earlier northerly exodus of San Joaquin Valley pintails into the Delta and Sacramento Valley during 1998-00 than during 1991-94 (Figure 18); b) reduced percentage of Suisun pintails going to the San Joaquin Valley during 1998-00 compared to during 1991-93 (Figure 19); c) increased early season use of Suisun Marsh and reduced early season use of Yolo and Delta by Suisun Marsh pintails (Figure 19); and d) increased late season use of the Yolo basin by all pintails (Figures 18-20).

OBJECTIVE 2. IDENTIFY ANY CHANGES IN WINTERING NORTHERN PINTAIL, MALLARD AND WHITE-FRONTED GOOSE MOVEMENT PATTERNS AND USE OF SPECIFIC FEEDING AND ROOSTING SITES DURING THE LAST DECADE.

PLAN

Track the daily movements and use of feeding and roosting sites of radio-tagged white-fronted geese, mallards, and northern pintails during August-April, each year. Compare local and movement patterns and locations of feeding and roosting sites with patterns and sites identified during earlier studies. (Also see objective 1 plan).

ACCOMPLISHMENTS

All pintail and green-winged teal locations were plotted and intersected with an ownership map to identify use patterns of individual areas. Percentage of weekly locations in each area were calculated and compared among years. (Also see Objective 1 accomplishments.) Also Historical and 1998-98 flight distances between feeding and roosting sites were calculated.

PRELIMINARY RESULTS

Pintail Distribution and Movements In the Grassland Ecological Area- 1991-94 vs 1998-00.

Pintail distribution and movements in the Grassland Ecological Area differed among seasons (Prehunt, Early Hunt, Late Hunt, Posthunt) diurnal period (day vs night) and for shoot and nonshoot days during 1991-94 and 1998-00. (See Figures 21-22 for percent of radio-tagged pintails in each area each week; Figures 23-32 for maps of pintail locations by season, shoot-nonshoot days and diurnal period; and Figures 33-38 for day-night movements by season and shoot-nonshoot days.)

Distribution and movement patterns were generally similar among years but habitat restoration and differences in prehunt water delivery patterns and late winter precipitation affected pintail use of specific areas.

During Prehunt, most pintail use during the day and night was on North and South Clubs (Figures 21-22). Pintails regularly flew to a different wetlands at night, even during Prehunt (Figure 33). Pintail distribution generally tracked flooding patterns and differences in the timing of water delivery caused the differences in relative importance of north and south clubs during Prehunt (see weeks 1-6, Figures 21-22). Delayed flooding reduced early use of Kesterson NWR during 1999-00. Also, pintails did respond to habitat restoration at the Gadwall WA.

During Hunt, most pintails followed a pattern of roosting on sanctuaries on shoot days and flying out to duck clubs in the evening; 50-75% remained on clubs on nonshoot days. San Luis NWR was the major shoot day roost site during all years and the lack of a ASplit@ in the hunting season during 1998-00 increased overall use of San Luis NWR. Pintail use of Kesterson NWR was lower during 1998-00 than 1991-94 perhaps a result of delayed flooding or reduction in the size of the AGadwall@ unit sanctuary.

Pintails used some of the Anew@ areas that were added after or near the end of the 1991-94 study. Arena Plains was the third most important shoot day roost site during Early Hunt in 1998-99; during 1991-94 use was minimal except during Prehunt. Most of the pintails that roosted on Arena Plains went to North and East Clubs at night.

The recently restored Gadwall WA in the south grasslands received use throughout Prehunt and Early Hunt during 1999-00 and may be at least partially to credit for the increase in use of the South

Grasslands by pintails that year.

Earlier analysis of 1991-94 pintail movements indicated a link between Merced NWR and the South Grasslands. Review of day-night movements shows this link is still evident but also an increase in movement of Merced pintails to East Grassland areas.

During the late Hunt season of 1993-94, the recently created watergrass wetlands of Salt Slough WA began to receive use by pintails at night. Although some night use is still evident, most pintails flying out of San Luis NWR at night are still going to North or South Grassland Clubs.

Green-winged Teal Distribution & Movements in the Grassland Ecological Area- 1997-00.

Green-winged Teal distribution among areas in the Grassland Ecological Area varied somewhat during 1997-00. (See Figure 39 for percent of radio-tagged teal in each area each week; Figures 40-47 for maps of teal locations by season, shoot-nonshoot days and diurnal period; and Figures 48-53 for day-night movements by season and shoot-nonshoot days.). In general, local distribution and movements were similar to northern pintails.

Like pintails, early water delivery patterns largely governed Prehunt use of areas by teal. For instance, in 1999 canal work delayed water delivery to Kesterson NWR and some North Clubs and areas in the South Grasslands became more important.

Like pintails, San Luis NWR was the major shootday roost site for teal. However, Kesterson NWR, rather than Merced NWR, was the next most important shoot-day roost site. The apparent increase in day and night use of San Luis during the second half of 1998-99 is an artifact resulting from our trapping and radio-tagging a new sample of teal on San Luis NWR in December to replace the

September sample after all their transmitters failed. Unlike the September sample, which distributed themselves among all sanctuaries once hunting began, the teal we trapped at San Luis NWR in December did not use other roost sites. In addition, unlike the September sample, which was not trapped on San Luis NWR, but moved to San Luis NWR once hunting started and used other areas at night, more that 50% of the December sample stayed on San Luis NWR at night. The reason why many December- captured teal remained on San Luis NWR at night is unclear but perhaps these were teal that arrived in the Grasslands during the hunting season and were less familiar with off-refuge habitats. There was some evidence that December-captured teal also left the Grasslands earlier than September-captured teal (i.e., 47% of December captured vs 29% September-captured in Sacramento Valley or Delta by January 24).

Green-winged teal tended to feed at night closer to where they roosted compared to pintails. Thus, use of areas with or near sanctuaries (i.e. San Luis NWR, Salt Slough NWR, North Grassland Clubs east rather than west of Sante Fe Grade) received most use during the hunting season. Higher night use of Salt Slough WA by teal compared to pintails may also be due to differences in habitat preferences.

The importance of sanctuary distribution on green-winged teal distribution is evident with the Gadwall WA in the South Grasslands. Increased use of the Gadwall WA sanctuary coincided (resulted in) increased use of South Grassland Clubs.

Private land shootday use was low for both teal and pintails, except in 1997-98 where we regularly located >20% of the teal on private lands. The level of shootday use of duck clubs that we measured underestimates actual opportunity for hunters. Radio-tagged ducks must land in one location

for at least a few minutes for us to triangulate their location. The likelihood of a duck remaining in one location in hunted areas is low.

Pintail Distribution and Movements In the Suisun Marsh-Delta 1991-93 vs 1998-00.

Daytime use of Suisun Marsh areas by pintails differed greatly between 1998-00 and 1991-93. (See Figures 54-55 for percent of radio-tagged pintails in each area each week; 56- 57 for day and night locations; and Figures 58-61 for day-night movements by season and shoot-nonshoot days.). During 1991-93, Grizzly Island WA provided the bulk of the early season daytime use and use of private clubs increased as they flooded. Once the hunting season began in 1991-92, daytime use shifted almost exclusively to Joice Island WA; Hill Slough WA was also important in 1992-93 (the west side of Hill Slough WA was not flooded in 1991). During Posthunt, the birds began to use private wetlands again during the day.

In 1998-00, most early season use was on Island Slough WA, where we captured many of our sample. Grizzly Island WA still provided early season habitat, but private clubs were equally important. The most striking difference in daytime distribution, was the greatly reduced use of Joice Island during the hunting season. Pintails were more evenly distributed between Hill Slough, Joice Island, Grizzly Island and private clubs. Day use in 1999-00 increased for the West Side Units compared with previous years.

Nighttime use was fairly consistent between the two study periods. Grizzly Island WA provided much of the early season habitat while private wetlands provided the majority of the use thereafter. Grizzly Island WA was more important at night during 1999-00 than earlier years. Night use of Island Slough WA was also evident during the 1998-00 periods.

Pintail distribution in the Delta was generally similar during 1991-93 and 1998-00 but there were some differences. Mandeville Island, Rindge Tract, Bouldin Island, Venice Island and Webb Tract received the bulk of pintail use during both 1991-93 and 1998-00 and Mandeville Island remained the major day roost site during the hunting season (Figures 62-67). However, changing management or habitat restoration increased the use of Prospect Island, Twitchell Islands and in the Consumnes Preserve. In contrast, use of lower Yolo duck clubs and Staten Island during Prehunt and Early hunt declined drastically between the two periods. There was little movement of pintails between the Suisun and the Delta on a daily basis and most roosting in the Suisun or Delta stayed withing those areas at night (Figures 68-71)

Pintail Distribution and Movements In the Sacramento Valley- 1987-90 vs 1998-00.

In general, pintail distribution and movement patterns in the Sacramento Valley were similar during 1987-90 and 1998-00. (See Figures 72-73 for percent of radio-tagged pintails in each area each week; 74-81 for day and night locations by season; and Figures 82-86 for day-night movements by season and shoot-nonshoot days.) Early season use was concentrated in the mid-Colusa Basin NWRs and other lands in the Colusa Basin. Pintails dispersed easterly as winter progressed so by Early Hunt pintails were more evenly distributed in the Butte and Colusa basins. Dispersal continued so that by late hunt more pintails were outside the midColusa Basin than in it and by Posthunt most pintails were in the Lower American and Lower Colusa and Sutter basins (and in the Yolo during 1998-00). Unlike in the Grassland Ecological Area, most pintails in the Sacramento Valley returned to sanctuaries on both shoot and Anonshoot@ days (Figures 72-73 and 87-88).

Pintail use of lands where Llano Seco NWR, Upper Butte Creek WA and Wattis Sanctuary were established during the 1990s increased dramatically between 1987-90 and 1998-00. Interestingly, these new Butte basin areas appear not to have increased the portion of the pintail population using Butte basin but rather served to disperse those in the Butte basin.

The reason for the decline in pintail use of District 10 between 1987-90 and 1998-00 is not known. A private sanctuary, present in Lower American Basin during 1998-00 but not 1987-90 received high use by pintails and may have reduced the percentage going to District 10.

As discussed earlier, most pintails from Suisun Marsh and San Joaquin Valley went to the Sacramento Valley during winter. Distribution within the Sacramento Valley during 1998-00 was similar for pintails radio-tagged in the Sacramento Valley, Suisun Marsh and San Joaquin Valley (Figures 89-94).

OBJECTIVE 3. DETERMINE IF WINTERING NORTHERN PINTAILS, MALLARDS AND WHITE-FRONTED GEESE HAVE CHANGED THEIR USE OF WETLAND AND AGRICULTURAL HABITAT TYPES IN THE CENTRAL VALLEY DURING THE LAST DECADE.

PLAN

Measure day and night habitat use of radio-tagged white-fronted geese, mallards, and northern pintails during August-April each year, and compare use rates of wetland and agricultural habitats with earlier studies.

ACCOMPLISHMENTS

Habitat types for historical locations are known. Habitat types for the 1998-00 duck and goose locations will be obtained by intersecting locations with a habitat map that is being produced by Ducks Unlimited (see Figure 6). Location and monthly flooding of wetlands, rice fields and other waterfowl habitats are also being mapped from satellite imagery for the Delta region and Sacramento Valley and compiled from aerial surveys for the San Joaquin Valley.

PRELIMINARY RESULTS

None. Require background map being produced by Ducks Unlimited to make any comparisons.

OBJECTIVE 4. EVALUATE WETLAND AND AGRICULTURAL HABITAT GOALS OF THE CVHJV AND MAKE RECOMMENDATIONS FOR CHANGES IF APPROPRIATE.

PLAN

Measure waterfowl use in each Central Valley basin throughout the wintering period by conducting two spring (February and March) aerial waterfowl surveys in addition to the five we conduct during September - January (see Objective 1 above). Use our estimates of the timing and magnitude of waterfowl use in each Central Valley basin, the locations of feeding and roost sites, daily and seasonal movement patterns, and use rates of wetland and agricultural habitats to determine habitat requirements

by interval (i.e. pre-season, hunting season, post-season) and evaluate the adequacy of CVHJV habitat goals.

ACCOMPLISHMENTS

Monthly aerial waterfowl surveys of the Central Valley were conducted between September - March (Table 1). Some regions were missed during some surveys due to weather and logistical problems. However, combined with radio-telemetry data on inter-basin waterfowl movements, aerial survey data collected were adequate to estimate waterfowl use days in each Central Valley basin during Sept 15 - Feb 15, 1998-00 and compare these with CVHJV goals. Once 1998-00 spring breeding populations estimates (D. Yparraguirre, unpublished data) become available for each basin we will calculate waterfowl use days for the entire year. We will use our estimates of the timing and magnitude of waterfowl use in each Central Valley basin the locations of feeding and roost sites, daily and seasonal movement patterns, flight distances and use rates of wetland and agricultural habitats to determine habitat requirements by interval.

PRELIMINARY RESULTS

Waterfowl use day calculations-goals vs 1998-00

Radio-tracking of pintails (one of the more mobile species) show that most (>86%) pintails use the same basin during the day and night (Table 4). Thus, daytime aerial surveys are appropriate for estimating waterfowl abundance and use days for each basin.

Aerial surveys indicate that overall waterfowl (i.e., Duck-Geese-Swan combined) abundance

and waterfowl use days in the Central Valley as a whole during 1998-99 were near but slightly below CVHJV goals, primarily because of low pintail abundance. However, current abundance patterns and use days in some basins for some species differed greatly from the CVHJV goal. (See Figure 95-96 for waterfowl use days and Figures 97-112 for waterfowl abundance during 1998-00 vs CVHJV goals). For example, current waterfowl abundance and use days in the American basin far exceeds those upon which American basin CVHJV habitat goals are based. This discrepancy occurred primarily because CVHJV goals were based upon midwinter (i.e. late December-early January) surveys during the 1970s and most waterfowl use of the American basin now occurs later than the midwinter. In contrast, waterfowl abundance and use days in the Delta during 1998-00 are far below what CVHJV habitat goals are based upon primarily because of lower abundance of pintails and white-fronted geese than planned. Tracking of radio-tagged Suisun Marsh pintails (Figures 54-55) and white-fronted geese (see 1999 Progress Report) also show a drastic decline in use of Delta by these two species.

Dabbling duck abundance and use days were below CVHJV goal levels in most basins except Colusa Butte, and the Suisun Marsh. Diving duck abundance and use days were greater than planned for in Colusa and the Northern and Southern San Joaquin (i.e. Tulare) basins. White-fronted goose abundance was generally above goals for Sacramento Valley basins and below goals elsewhere. Differences between goals and 1998-00 abundance and use days for other species varied greatly.

Waterfowl daily energy needs calculations-lower flight costs

Pintail flight distances between day locations and night locations appears to have decreased since earlier studies in the Sacramento Valley, Suisun Marsh and Grasslands; elsewhere differences

varied by interval (Table 5). This is primarily a result of increased availability and use of new lands on which state, federal and private wetlands have been restored or enhanced since earlier studies (i.e., Llano Seco, Upper Butte Creek WA, Esquon Ranch, Yolo Basin WA, Arena Plains, North Merced NWR, West Bear Creek Unit).

The reduction of flight distances in the Sacramento Valley, Suisun Marsh and Grasslands is in line with increased or improved waterfowl habitat in these areas over the last 5-10 years.

season, post-season).

FUTURE PLANS

Pending continued funding to support statistical analysis and GIS work, we hope to complete analysis and write up within a year. Results of the project will be made available in reports and publications that can be used by the CVHJV management board and planning committees, resource agencies, and private managers to design and manage habitat projects.

ACKNOWLEDGMENTS

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TABLE 1. TIMING AND OBSERVERS OF CENTRAL VALLEY AERIAL WATERFOWL SURVEYS CONDUCTED DURING 1998-99

	SURVEY AREAS			
SURVEY YEAR-MONTH	**WEST SACVAL**	**ESACV, DELTA SUISUN MARSH**	**NORTH SAN JOAQUIN VAL**	**SOUTH SAN JOAQUIN VAL**
1998 SEP	9/16/ CDFG[1]	9/16 CDFG	9/16 CDFG 9/30 CDFG	9/28-9/29 USFWS
OCT	10/14 CDFG[1]	10/14 CDFG	10/14 CDFG	
NOV	11/18 USFWS	11/18 CDFG	11/18 CDFG	11/20 USFWS
DEC	12/16 USFWS	12/16 CDFG	12/15 CDFG	12/15 USFWS
JAN	1/8-1/12 USFWS	1/6-1/13 CDFG	1/27-1/28 CDFG	1/14-1/15 USFWS
FEB	2/19 USFWS	2/19 CDFG		2/18-2/19 USFWS
MAR		3/17 CDFG	3/10 CDFG	
	G. MENSIK M. WOLDER E. BUELNA R. KING	D. YPARRAGUIRRE D. BECKER D. ZEZULAK	J. BEAM G. GERSTENBERG	D. HARDT B. DAY J. ALLEN B. VANWAGENEN

[1]D. YPARRAGUIRRE & D. BECKER (CDFG) SURVEYED ALL SACRAMENTO VALLEY IN SEPTEMBER AND OCTOBER.

TABLE 2. LOCATIONS AND DATES THAT ADULT FEMALE WATERFOWL WERE RADIO-TAGGED DURING THIS AND EARLIER STUDIES.

SPECIES-AREA COHORT	EARLIER STUDIES			CURRENT STUDY		
	DATE	#	LOCATION	DATE	#	LOCATION
PINTAIL-SACVAL	8/23/87-9/07/87	33	SACRAMENTO NWR	8/27/98-8/31/98	50	SACRAMENTO NWR
		21	DELEVAN NWR			
	8/21/88-8/30/88	48	SACRAMENTO NWR	8/31/99-9/02/99	50	SACRAMENTO NWR
		12	DELEVAN NWR			
	8/22/89-8/30/89	73	SACRAMENTO NWR			
PINTAIL-SUISUN	8/29/91-9/23/91	55	SUISUN MARSH	9/12/98-9/15/98	50	SUISUN MARSH
	8/28/92-9/16/92	61	SUISUN MARSH	9/07/99-9/22/99	50	SUISUN MARSH
PINTAIL-SANJVAL	8/29/91-10/6/91	44	N & S GRASSLANDS	9/4/98-9/22/98	20	N & S GRASSLANDS
		22	MENDOTA WA		30	MENDOTA WA
	8/31/92-10/5/92	30	N & S GRASSLANDS	9/6/99-10/5/99	33	N & S GRASSLANDS
		18	MENDOTA WA		22	MENDOTA WA
	8/28/93-9/25/93	46	N & S GRASSLANDS			
		33	MENDOTA WA			
MALLARD-SACVAL	9/29/88-10/14/88	30	GRAYL /BUTTE SINK	8/30/98-9/15/98	11	GRAY LODGE WA
					39	UBC-LIT. DRY CR.
	9/7/89-9/16/89	23	UBC/ GRAY/B. SINK	8/28/98-9/13/99	50	GRAYLODGE WA
WHITE-FRONTED GOOSE	7/1/87-10/25/87	92	KLAMATH, ALASKA	6/25/98-7/20/98	59	YK DELTA, ALASKA
	7/1/88-10/25/88	99	KLAMATH, ALASKA	6/25/99-7/20/99	60	YK DELTA, ALASKA
	7/1/89-9/30/89	60	KLAMATH, ALASKA			

TABLE 3. ROOSTING-TO-FEEDING FLIGHT DISTANCES (METERS) OF ADULT FEMALE PINTAILS DURING 1998-99 AND EARLIER STUDIES

REGION AND YEARS	INTERVAL AND SHOOTING STATUS [1]							
	PREHUNT	1ST HUNT SEASON		SPLIT PERIOD[2]		2ND HUNT SEASON		POSTHNT
	NO SHT	NO SHT	SHOOT	NO SHT	SHOOT	NO SHT	SHOOT	NO SHT
SACV 1987-90	2376	8446	8899	9949	10151	11813	13174	5161
SACV 1998-99	3333	7106	7486	7679	8971	8447	10112	5438
CHANGE m (%)	+957(40)	-1340(16)	-1430(16)	-2270(23)	-1180(12)	-3366(28)	-3062(23)	+277(5)
DELTA 1991-94	3153	6385	9380	4565		3085	4404	2176
DELTA 1998-99	408[3]	5037	5367	5144	6759	5301	4968	3419
CHANGE m (%)	-2745(87)	-1348(21)	-4013(43)	+579 (13)		+2216(72	+564 (13)	+1243(64)
SUISUN 1991-94	2014	3726	4060	2993		2326	2465	1500
SUISUN 1998-99	3429	2517	3286	2463	3118	1669	2777	1180
CHANGE m (%)	+1415(70)	-1209(32)	-774(19)	-530(18)		-657(28)	+312(13)	-320(21)
GRASSL 1991-94	2741	5156	11313	3770		5031	11981	1967
GRASSL 1998-99	3445	4599	10104	2580	11641	5216	9486	1259
CHANGE m (%)	+704(26)	-557(11)	-1209(11)	-1190(32)		+185(4)	-2495(21)	-708(36)
MENDOTA 91-94	1930	2940	2266	2661		2189	2427	1395
MENDOTA 98-99	1590	2602	3087	3657	.	1735	3326	1959
CHANGE m (%)	-340(18)	-338(11)	+821(36)	+996 (37)		-454(21)	+899(37)	+564 (40)

[1]SHOOTING STATUS: SHOOT DAYS ARE SUNDAY, WEDNESDAY AND SATURDAYS DURING HUNTING SEASON. NO-SHOOT DAYS ARE ALL OTHER DAYS.

[2]SPLIT PERIOD INCLUDES THE 2-4 WEEKS WHEN HUNTING SEASON WAS CLOSED IN 1988-94 AND TWO WEEKS DURING THE SAME TIME IN 1987 AND 1998 WHEN THERE WAS NO ACTUAL SPLIT BETWEEN HUNTING SESASONS.

[3]SMALL SAMPLE SIZE

TABLE 4. NIGHT DESTINATION OF PINTAILS FROM EACH BASIN DURING PRESEASON, HUNTING SEASON AND POSTSEASON, 1998-99

PRESEASON

PERCENT IN EACH BASIN AT NIGHT

DAY BASIN	Colusa	Butte	Sutter	American	Yolo	Suisun	Delta	NSJV	SSJV
Colusa	98.0892	1.9108	.	.	.	.	.	.	.
Butte	2.0408	97.9592	.	.	.	.	.	.	.
Sutter	.	.	.	.	.	.	.	.	.
American	.	.	.	100	.	.	.	.	.
Yolo	.	.	.	.	.	.	.	.	.
Suisun	.	.	.	.	.	99.576	0.42373	.	.
Delta	.	.	.	.	.	100.000	.	.	.
NSJV	.	.	.	.	.	.	.	100	.
SSJV	.	.	.	.	.	.	.	.	100

HUNTING SEASON

PERCENT IN EACH BASIN AT NIGHT

DAY BASIN	Colusa	Butte	Sutter	American	Yolo	Suisun	Delta	NSJV	SSJV
Colusa	92.3214	6.5179	0.5357	0.4464	0.0893	.	.	0.0893	.
Butte	1.7760	93.7158	2.1858	1.9126	0.2732	.	0.1366	.	.
Sutter	.	3.4188	94.0171	1.7094	0.8547	.	.	.	.
American	.	4.1420	2.3669	91.1243	2.3669	.	.	.	.
Yolo	0.6803	1.3605	.	4.0816	88.4354	0.6803	4.7619	.	.
Suisun	.	.	.	.	1.4894	97.8723	0.6383	.	.
Delta	0.2028	.	0.2028	.	1.0142	1.0142	97.5659	.	.
NSJV	.	.	.	0.1227	.	.	0.1227	99.7546	.
SSJV	.	.	.	.	.	.	.	3.4483	96.5517

POSTSEASON

PERCENT IN EACH BASIN AT NIGHT

DAY BASIN	Colusa	Butte	Sutter	American	Yolo	Suisun	Delta	NSJV	SSJV

Colusa	96.2963	.	1.2346	1.2346	.	.	1.2346	.	.
Butte	2.5641	89.7436	.	2.5641	2.5641	.	2.5641	.	.
Sutter	.	.	92.1569	5.8824	.	.	1.9608	.	.
American	.	.	0.9804	97.0588	1.4706	.	0.4902	.	.
Yolo	.	.	.	2.2472	86.5169	.	11.2360	.	.
Suisun	.	.	.	.	.	100	.	.	.
Delta	.	.	.	3.2258	9.6774	.	87.0968	.	.
NSJV	.	.	.	.	.	.	.	98.1818	1.818
SSJV	.	.	.	.	.	.	.	.	100.000

LIST OF ATTACHED FIGURES

1998.

24 **Delta day** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh and San Joaquin Valley during 1991- 93 and 1998.

25 **Delta night** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh and San Joaquin Valley during 1991- 93 and 1998.

26 **Suisun Marsh day** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh during 1991- 92 and 1998.

27 **Suisun Marsh night** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh during 1991- 92 and 1998.

28 **Suisun Marsh shoot and nonshoot day** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh during 1991- 92.

29 **Suisun Marsh shoot and nonshoot day** locations during the hunting season of northern pintails radio-tagged in the Suisun Marsh during 1998.

30 **Grasslands Prehunt day** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

31 **Grasslands Prehunt night** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

32 **Grasslands Earlyhunt day** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

33 **Grasslands Earlyhunt night** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

34 **Grasslands Latehunt day** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

35 **Grasslands Latehunt night** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

36 **Grasslands Posthunt day** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

37 **Grasslands Posthunt night** locations of northern pintails radio-tagged in the San Joaquin Valley during 1991-93 and 1998.

38 **Grasslands shoot and nonshoot day** locations during the hunting season of northern pintails radio-tagged in the San Joaquin Valley during 1991- 93.

39 **Grasslands shoot and nonshoot day** locations during the hunting season of northern pintails radio-tagged in the San Joaquin Valley during 1998.

40 **Mallard Prehunt** locations in the Sacramento Valley during 1998.

41 **Mallard Hunt Season** locations in the Sacramento Valley during 1998.

42 **Mallard Posthunt** locations in the Sacramento Valley during 1998.

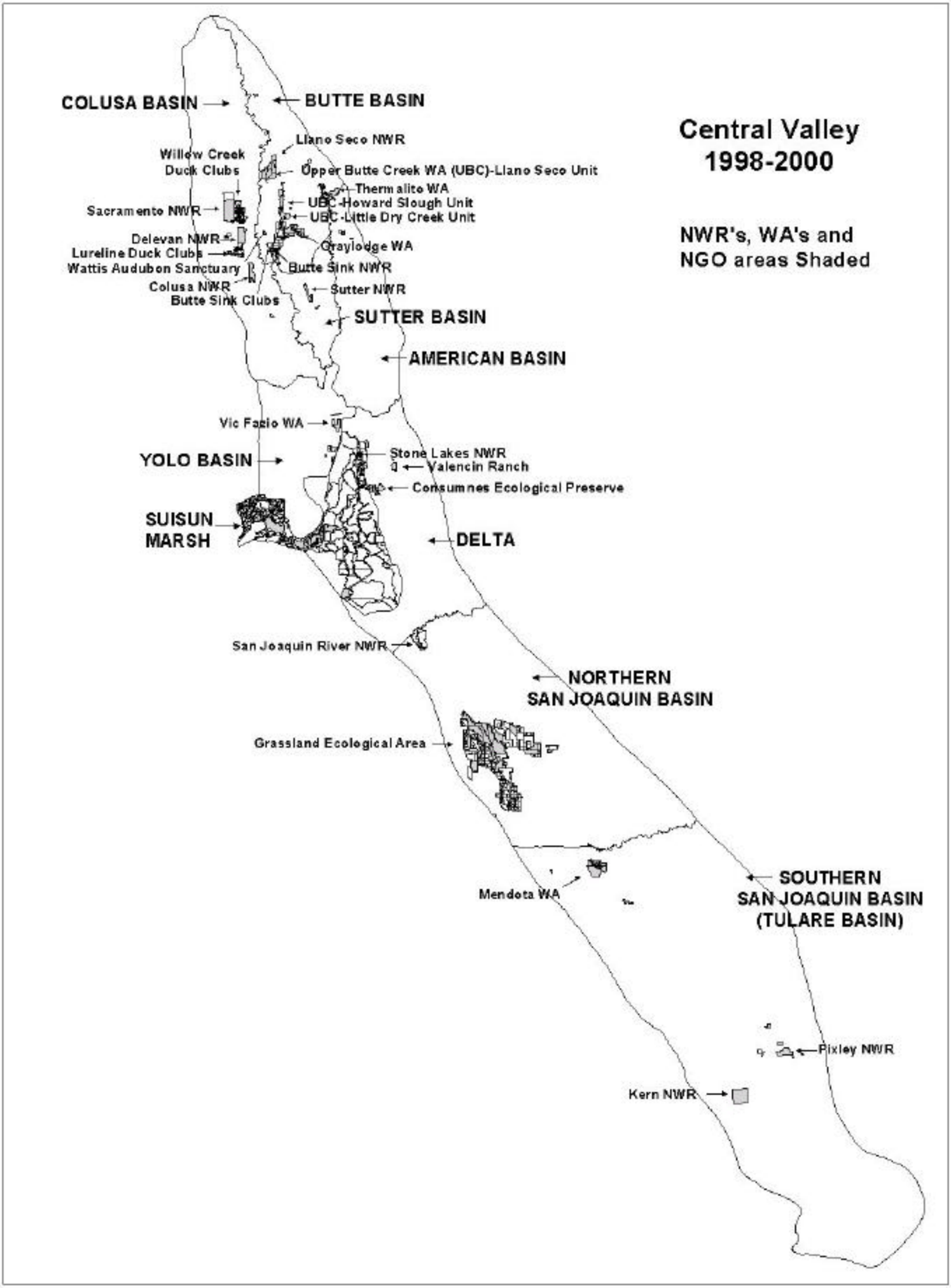
43 **Pintail night use of B22 properties** before and after enrollment in the program.

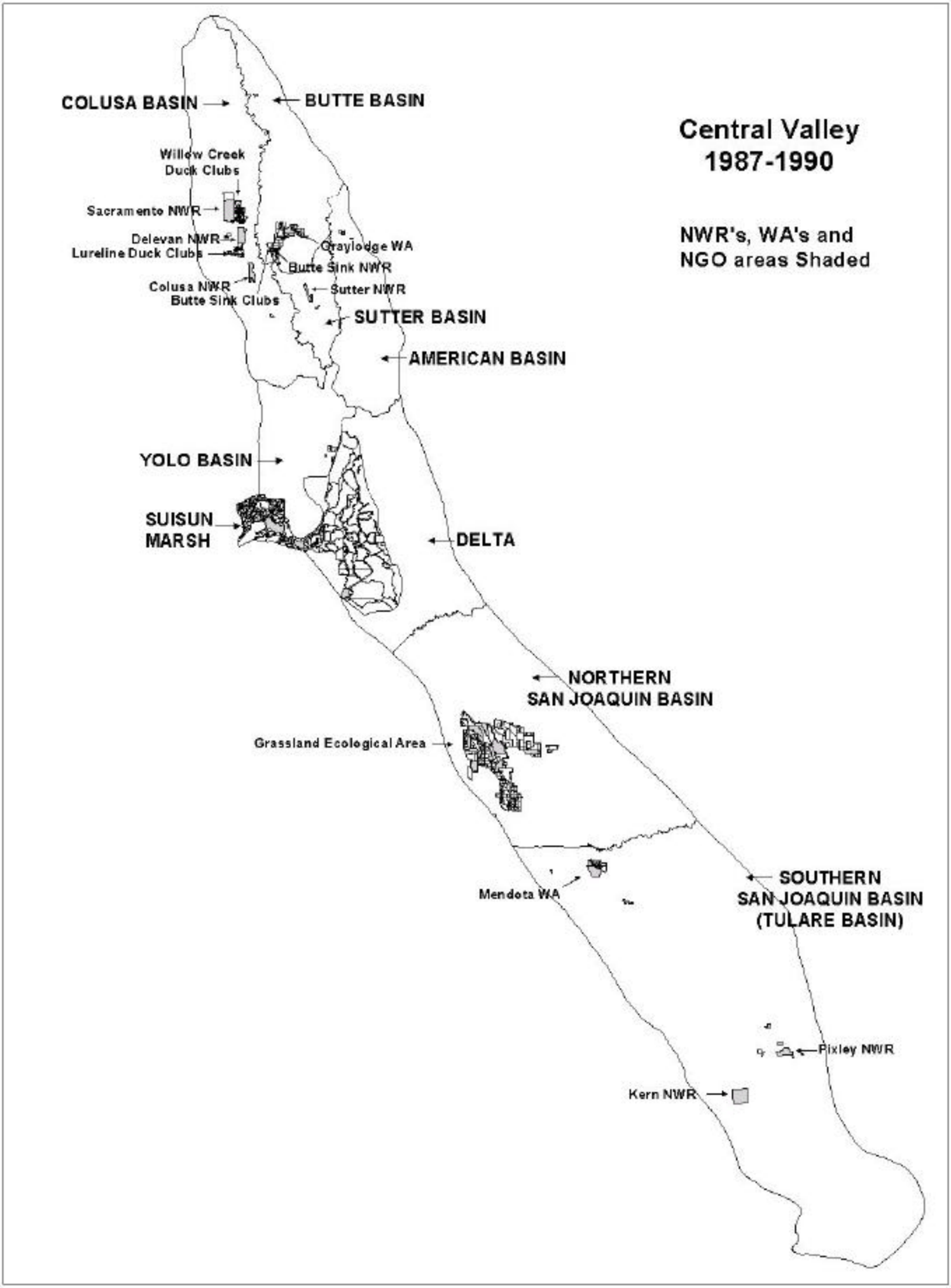
44 **White-fronted goose roosting** locations during 1998-99 and 1987-90.

45 **White-fronted goose feeding** locations during 1998-99 and 1987-90.

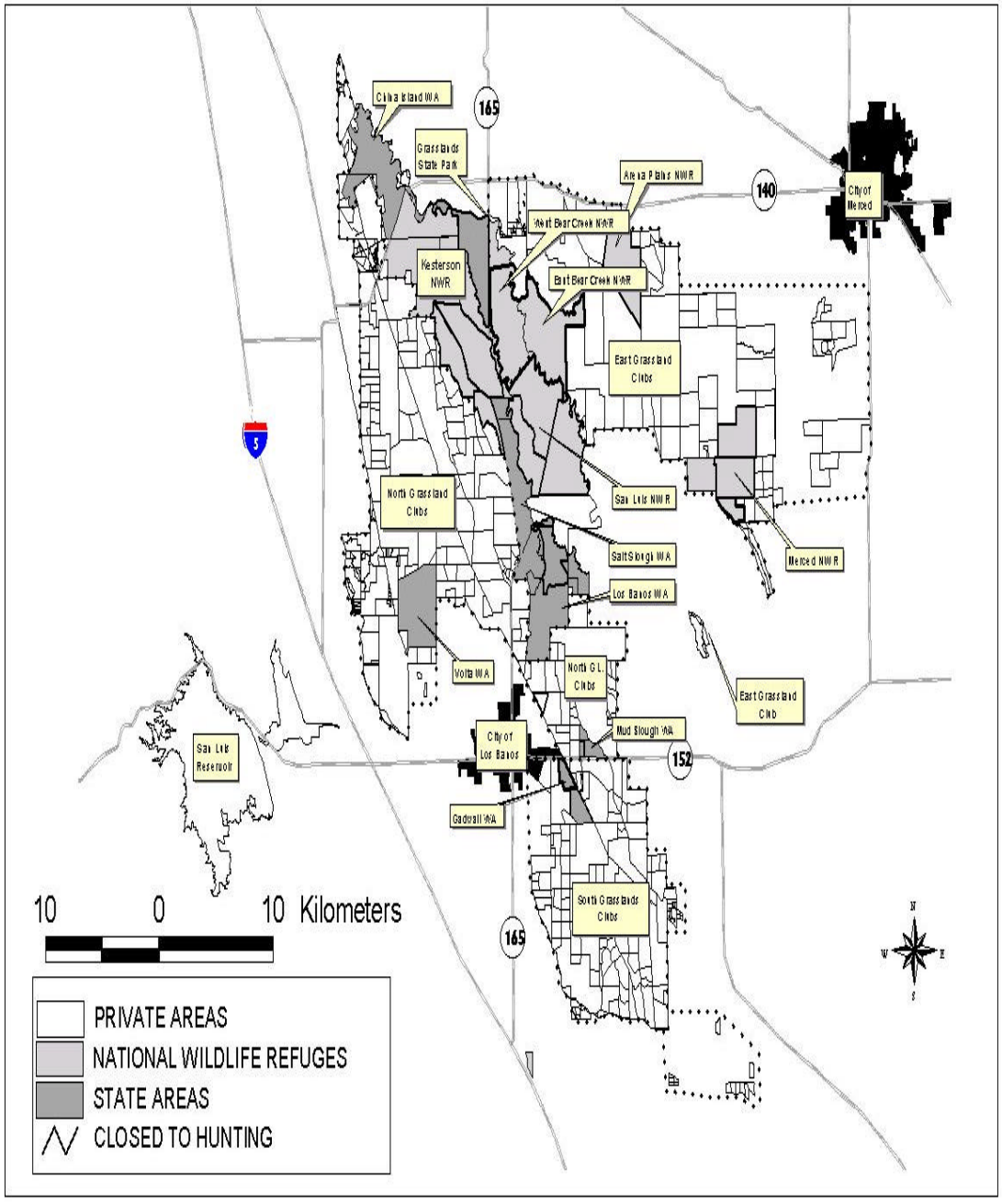
46 **Mendota Wildlife Area Day** locations of pintails

47 **Mendota Wildlife Area Night** locations of pintails


Central Valley
1998-2000
NWR's, WA's and
NGO areas Shaded
COLUSA BASIN
BUTTE BASIN
Llano Seco NWR
Willow Creek
Duck Clubs
Upper Butte Creek WA (UBC)-Llano Seco Unit
Thermalito WA
Sacramento NWR
UBC-Howard Slough Unit
UBC-Little Dry Creek Unit
Delevan NWR
Lureline Duck Clubs
Graylodge WA
Wattis Audubon Sanctuary
Butte Sink NWR
Colusa NWR
Butte Sink Clubs
Sutter NWR
SUTTER BASIN
AMERICAN BASIN
Vic Fazio WA
YOLO BASIN
Stone Lakes NWR
Valencin Ranch
Consumnes Ecological Preserve
SUISUN
MARSH
DELTA
San Joaquin River NWR
NORTHERN
SAN JOAQUIN BASIN
Grassland Ecological Area
Mendota WA
SOUTHERN
SAN JOAQUIN BASIN
(TULARE BASIN)
Pixley NWR
Kern NWR


Central Valley
1987-1990
NWR's, WA's and
NGO areas Shaded
COLUSA BASIN
BUTTE BASIN
Willow Creek
Duck Clubs
Sacramento NWR
Delevan NWR
Lureline Duck Clubs
Colusa NWR
Butte Sink Clubs
Graylodge WA
Butte Sink NWR
Sutter NWR
SUTTER BASIN
AMERICAN BASIN
YOLO BASIN
SUISUN
MARSH
DELTA
NORTHERN
SAN JOAQUIN BASIN
Grassland Ecological Area
Mendota WA
SOUTHERN
SAN JOAQUIN BASIN
(TULARE BASIN)
Pixley NWR
Kern NWR

Grassland Ecological Area 1998-2000



Suisun Marsh State Wildlife Areas and Duck Club Boundaries, 1998-2000

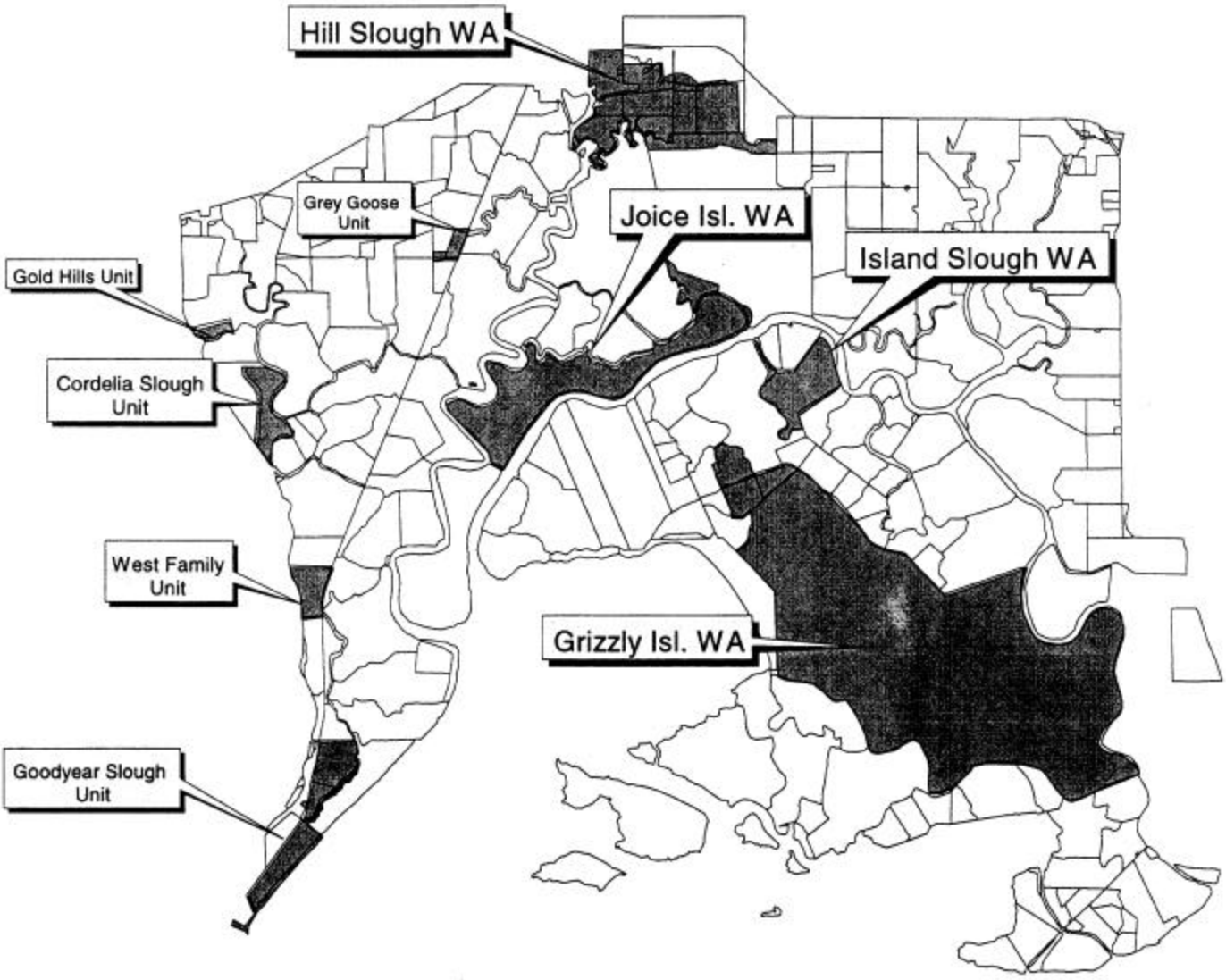


Figure 4

Areas in the Lower Yolo - Delta Region (1998-2000)

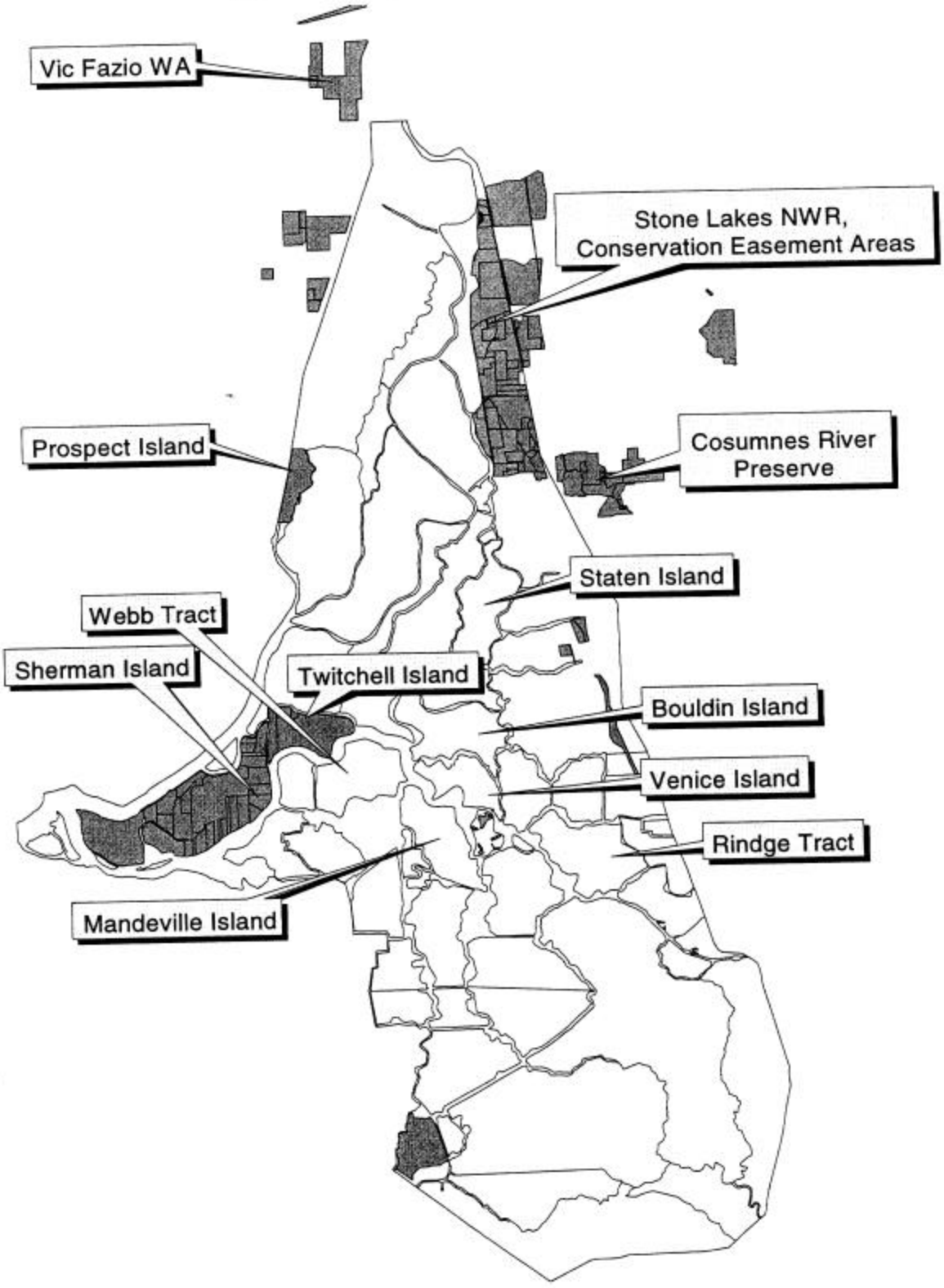
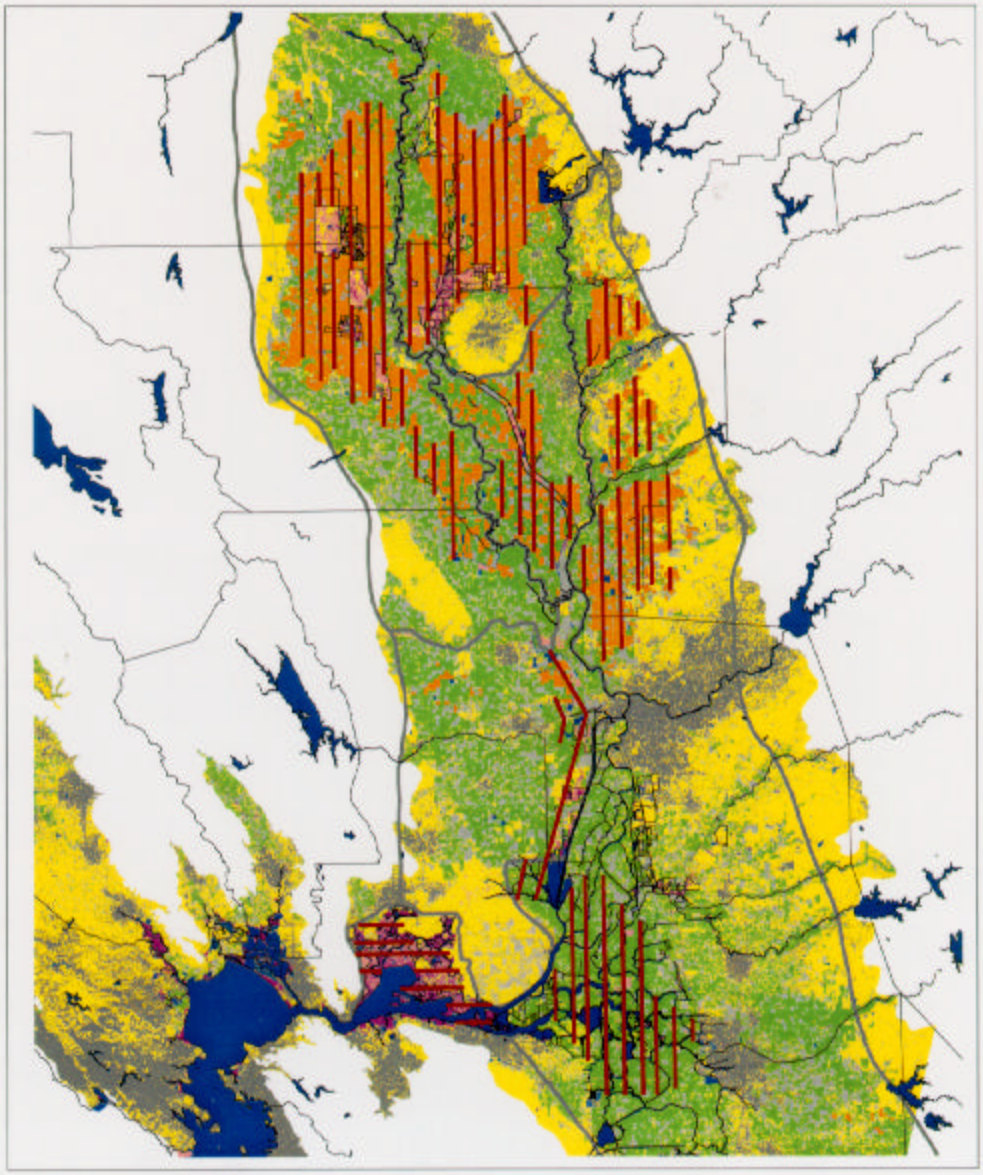


Figure 5



Waterfowl Aerial Survey Transects

USGS
science for a changing world

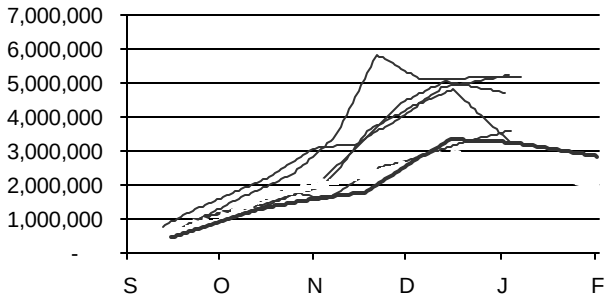
30 0 30 60 Kilometers

Figure 6

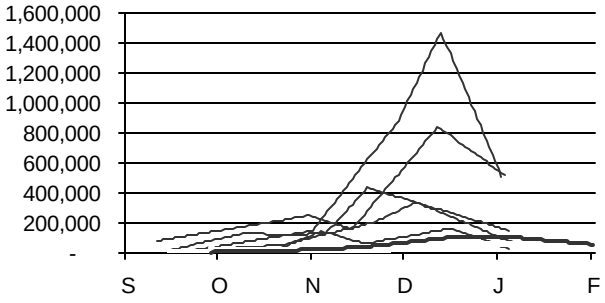
Dabbling duck abundance during September - January

1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

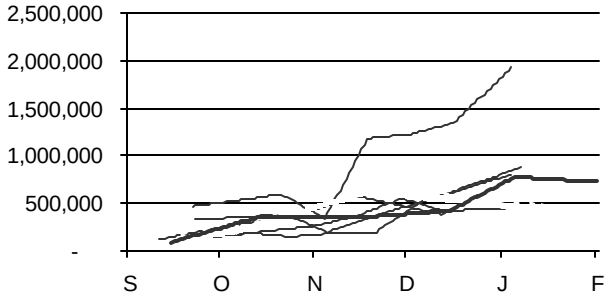
Central Valley Total



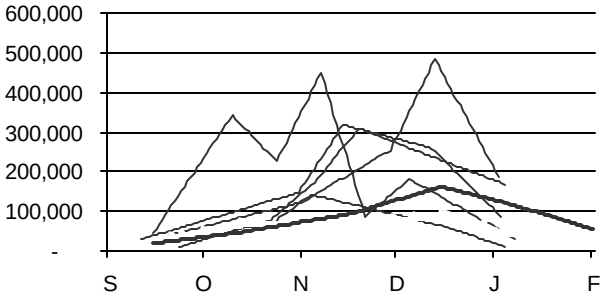
Delta



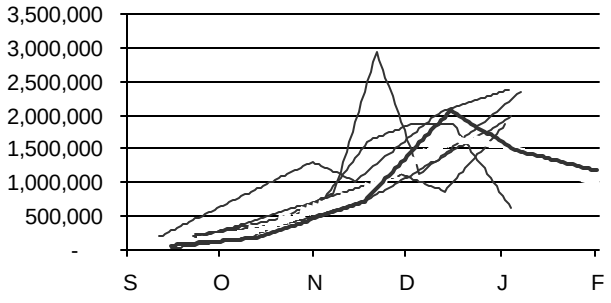
Colusa



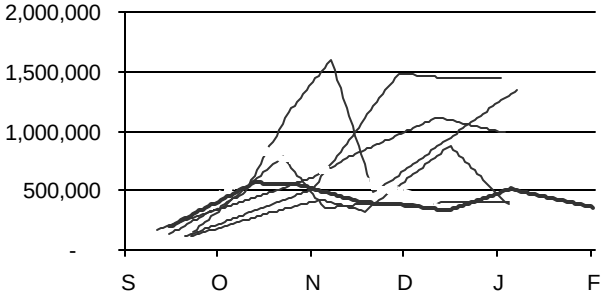
Suisun Marsh



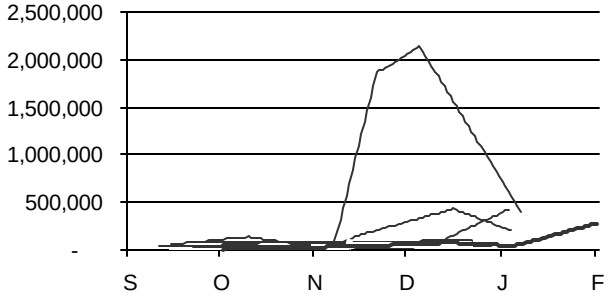
East Sacramento Valley



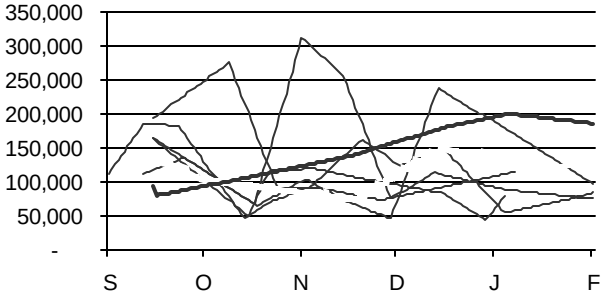
Northern San Joaquin



Yolo

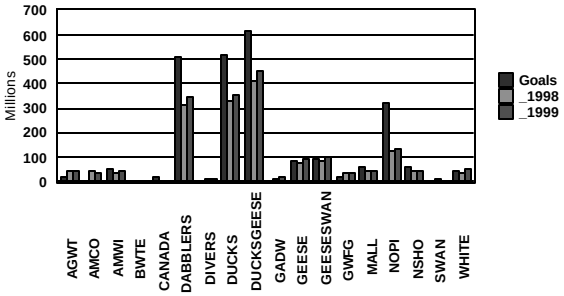


Tulare

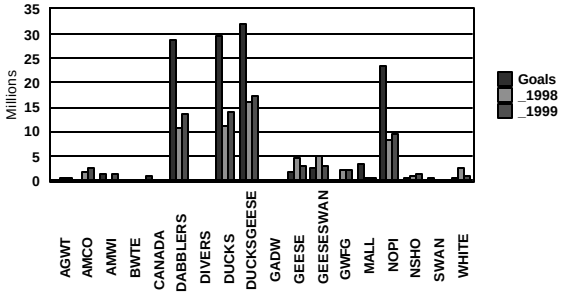


SEPT 15 - FEB 15 WATERFOWL USE DAYS
GOALS VS 1998-99 & 1999-00

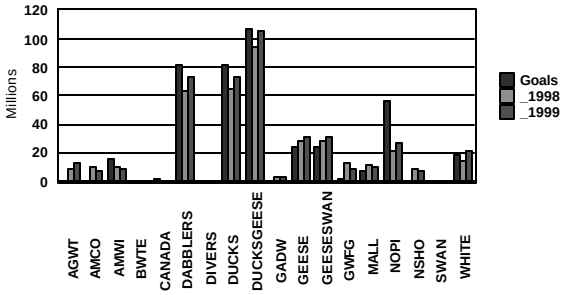
CENTRAL VALLEY TOTAL



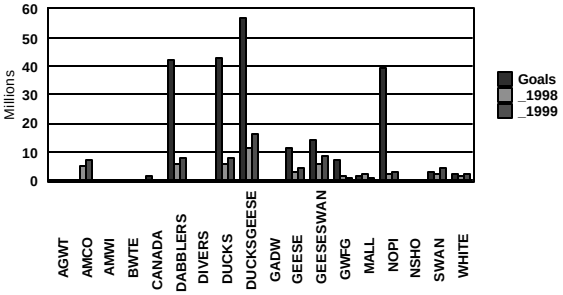
YOLO



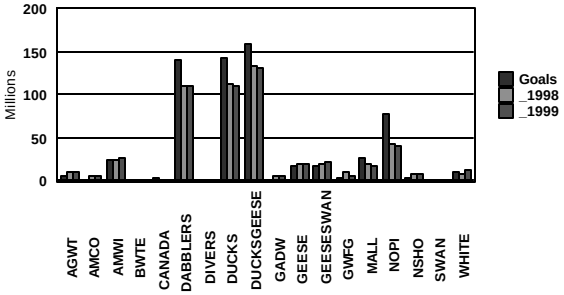
COLUSA



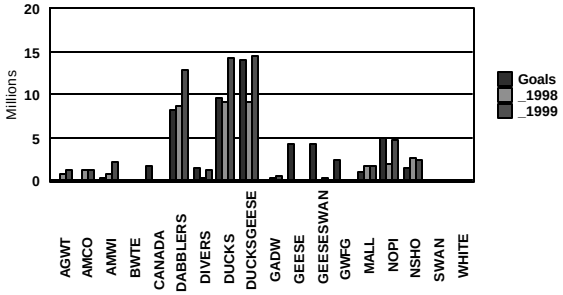
DELTA



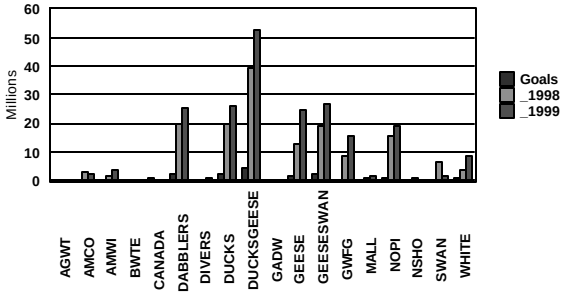
BUTTE



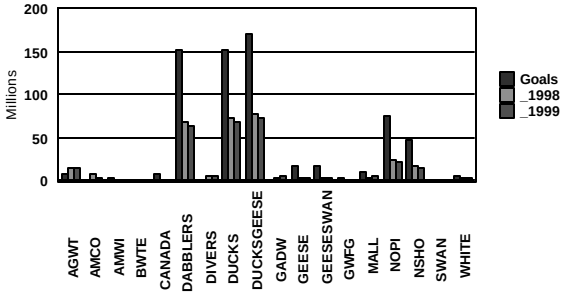
SUISUNMARSH



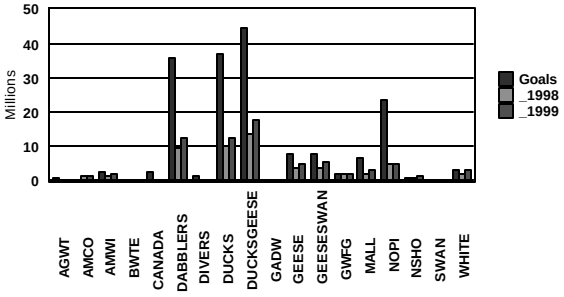
AMERD10



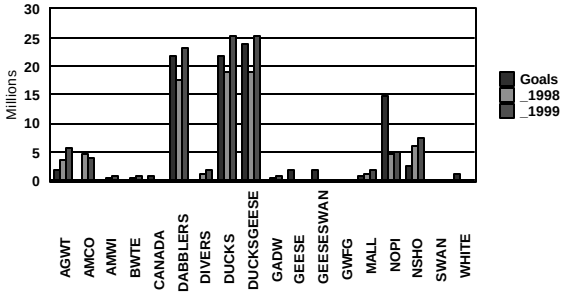
NSJV



SUTTER



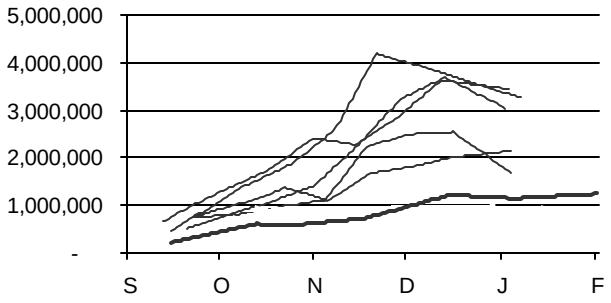
SSJV_MEN



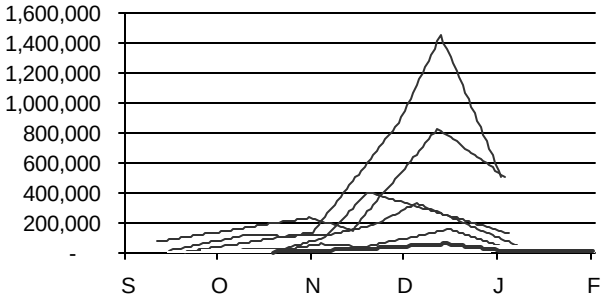
Northern Pintail abundance during September - January

1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

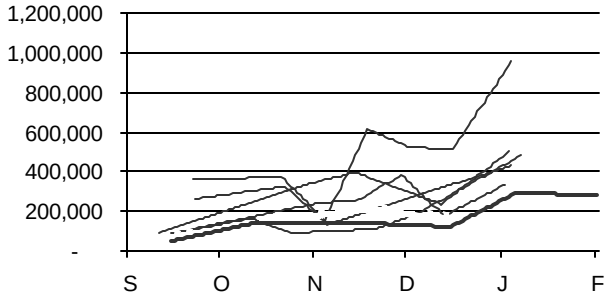
Central Valley Total



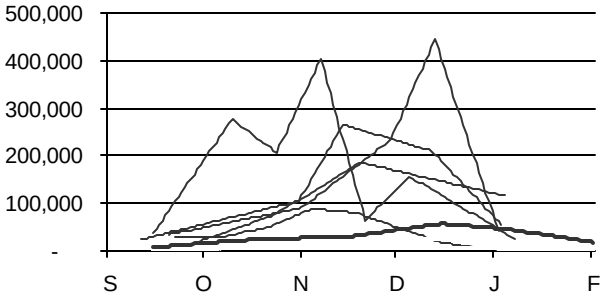
Delta



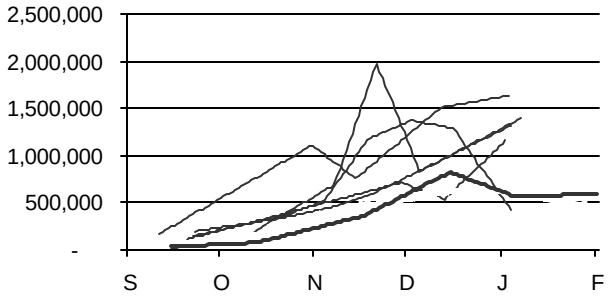
Colusa



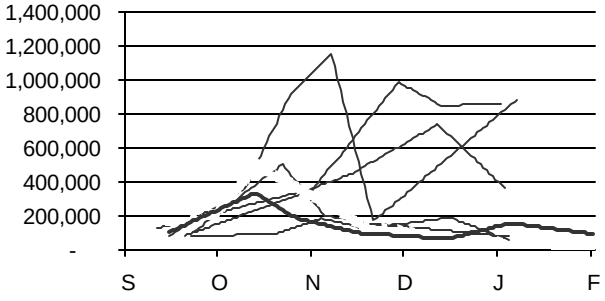
Suisun Marsh



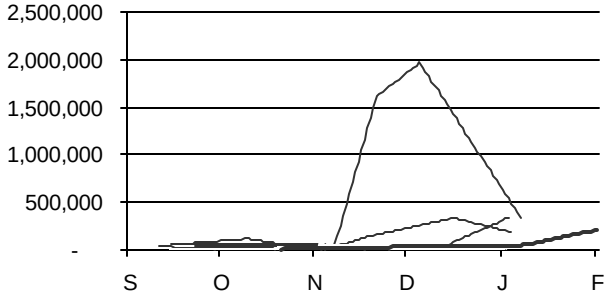
East Sacramento Valley



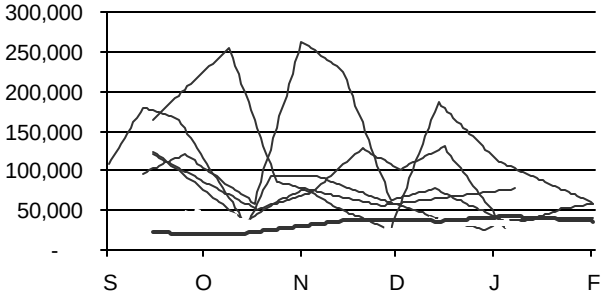
Northern San Joaquin



Yolo

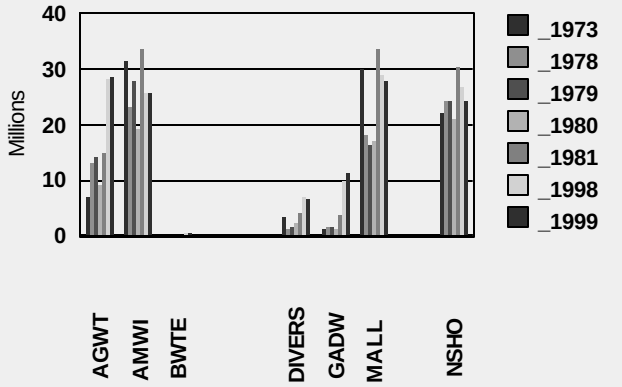


Tulare

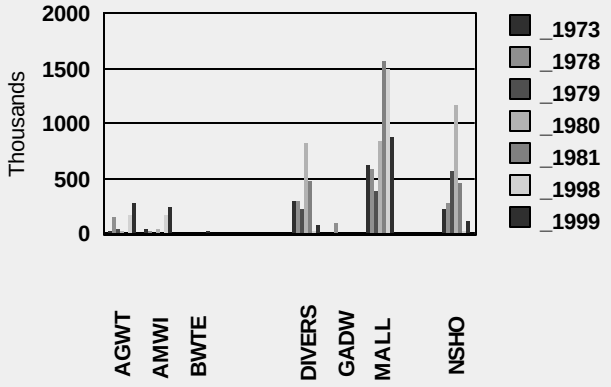


OCT 1 - DEC 31 WATERFOWL USE DAYS
1973 & 1978-81 VS 1998-99 & 1999-00 (Pintails & Totals not shown)

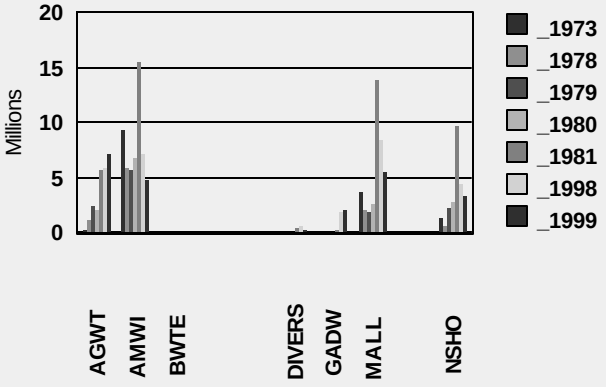
CENTRAL VALLEY TOTAL



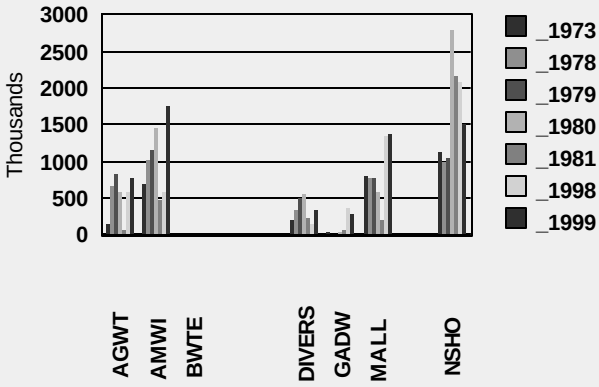
DELTA



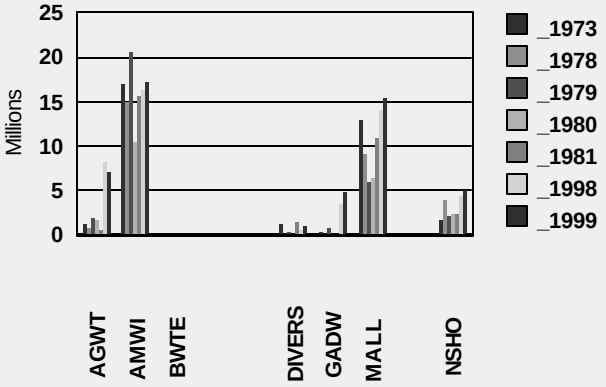
COLUSA



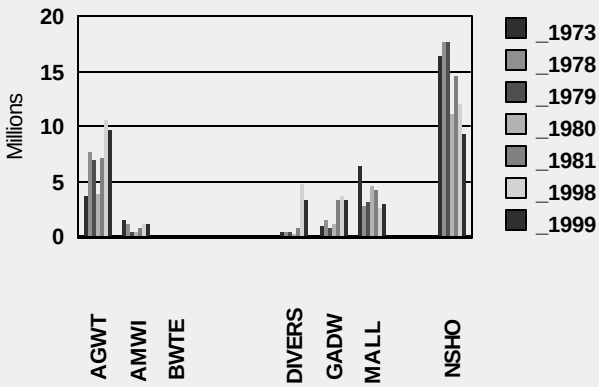
SUISUN MARSH



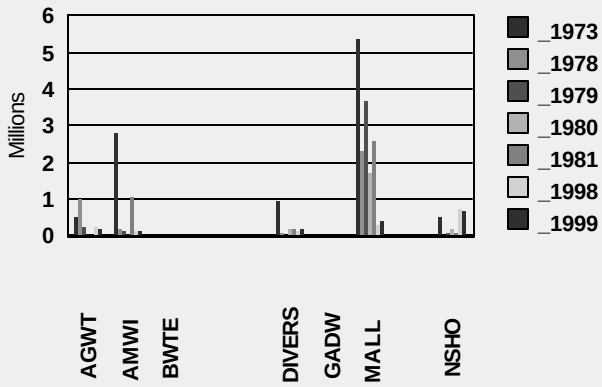
EAST SACV



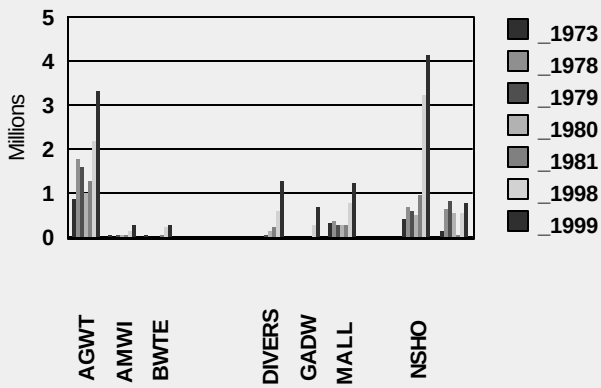
NSJV



YOLO



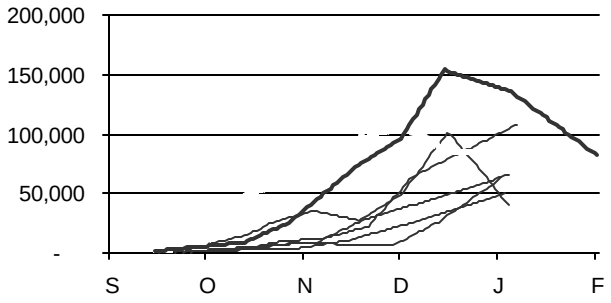
SSJV(Tulare)



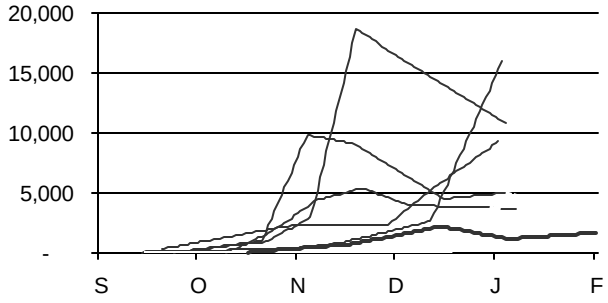
Diving duck abundance during September - January

1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

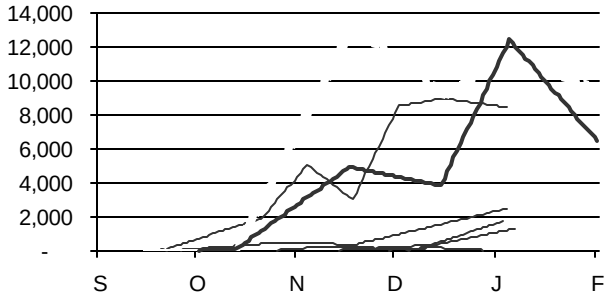
Central Valley Total



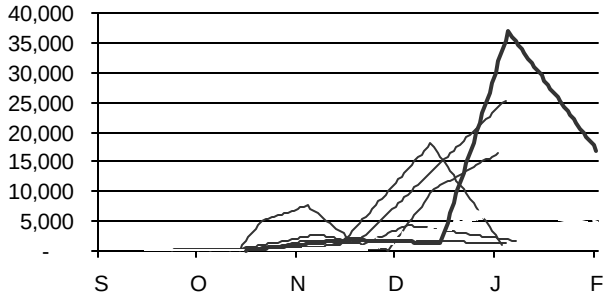
Delta



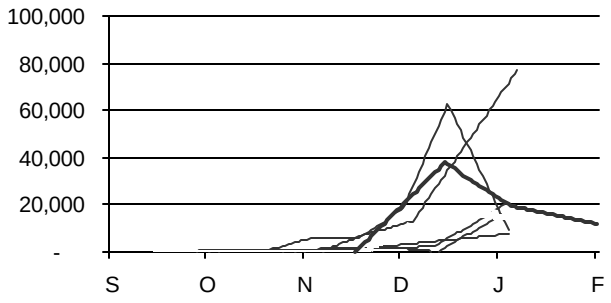
Colusa



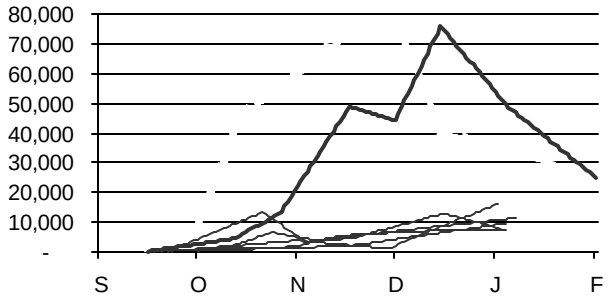
Suisun Marsh



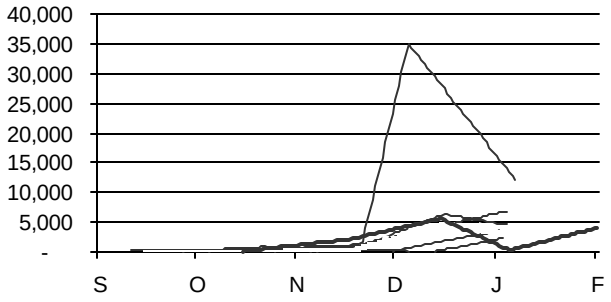
East Sacramento Valley



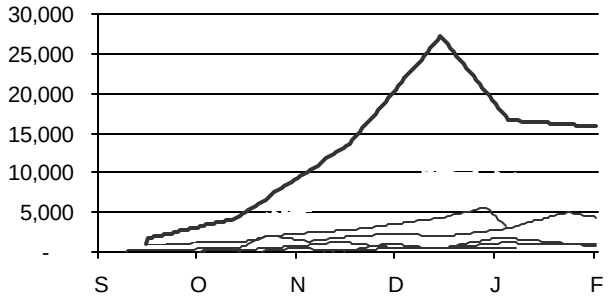
Northern San Joaquin



Yolo

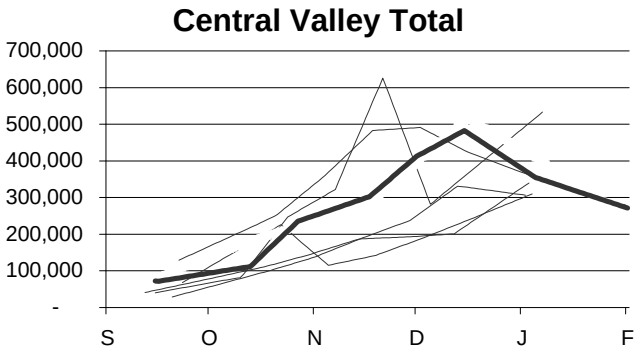


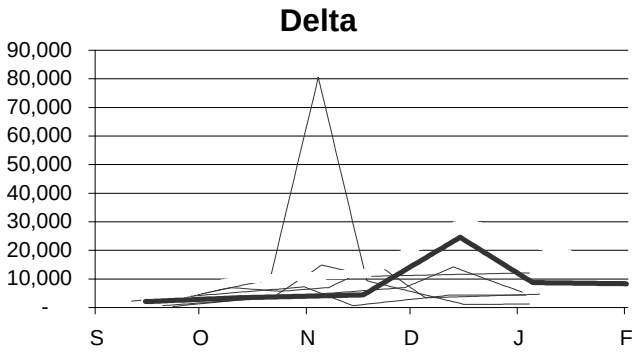
Tulare

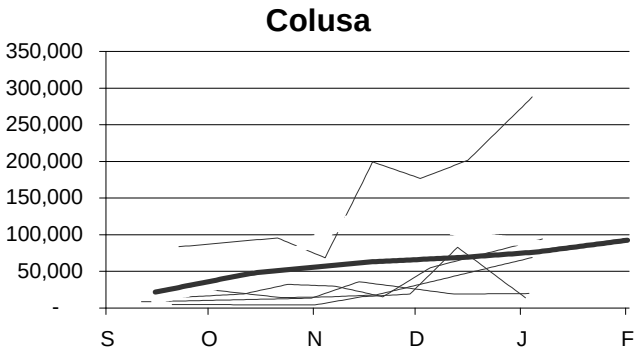


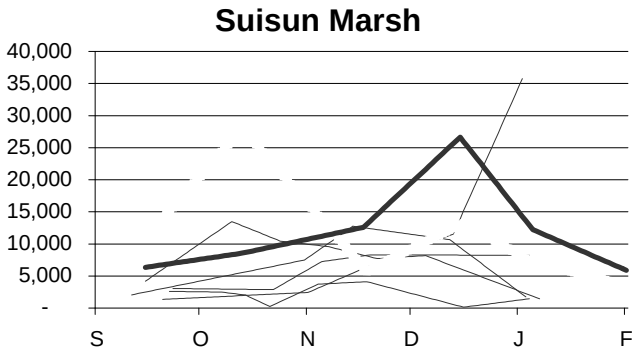
Mallard abundance during September - January

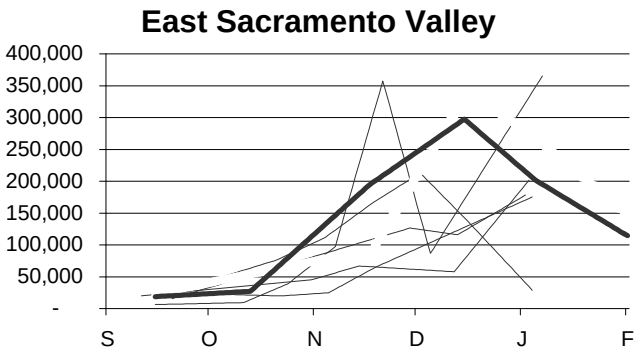
1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

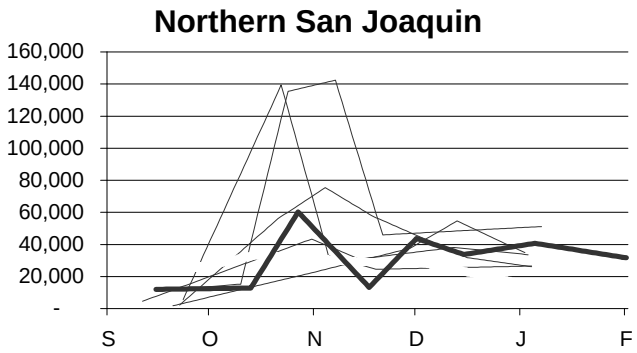


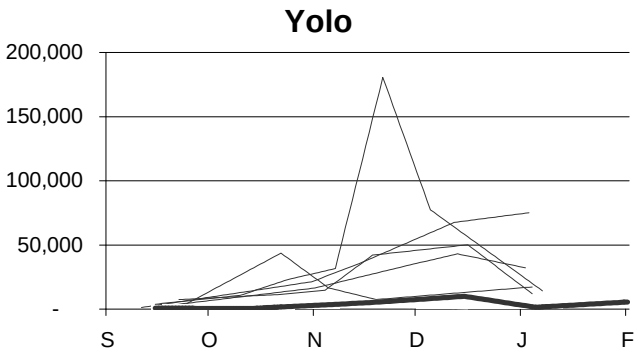


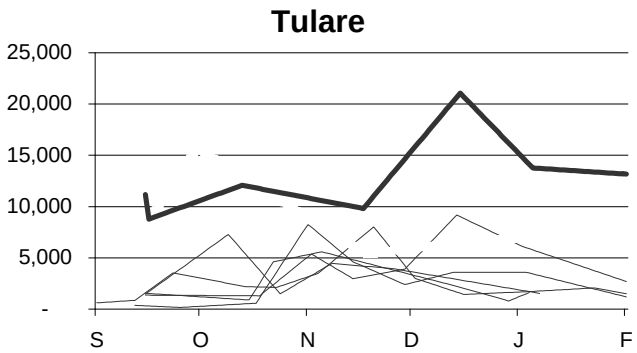






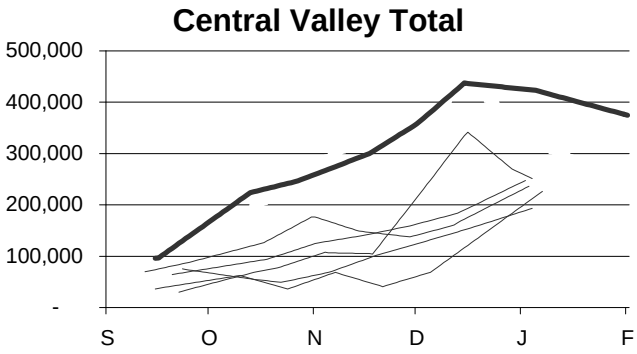


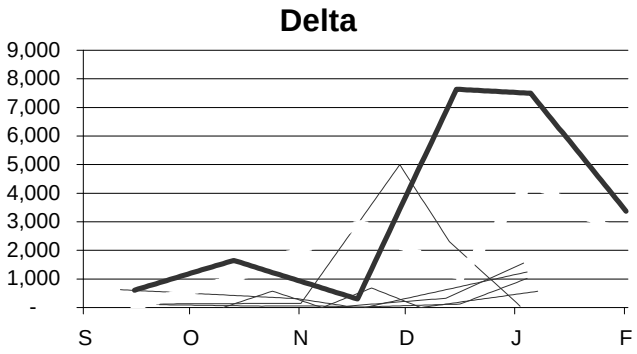


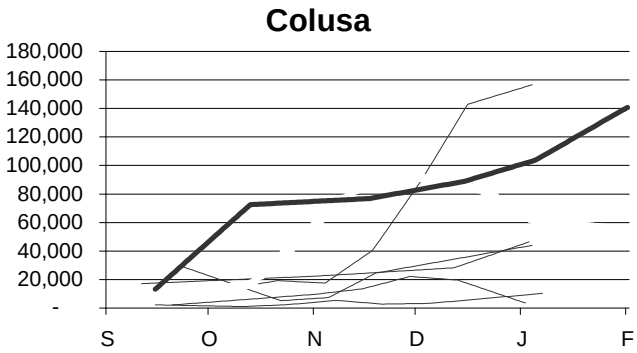


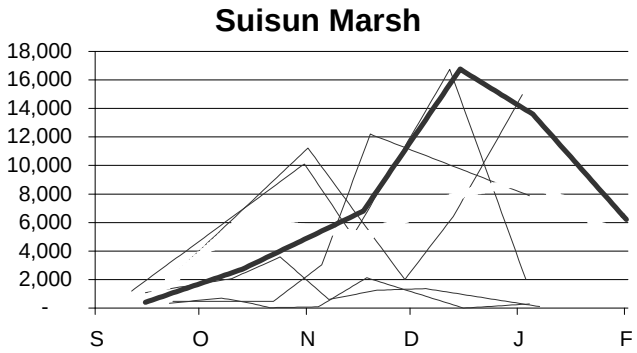
Green-winged Teal abundance during September - January

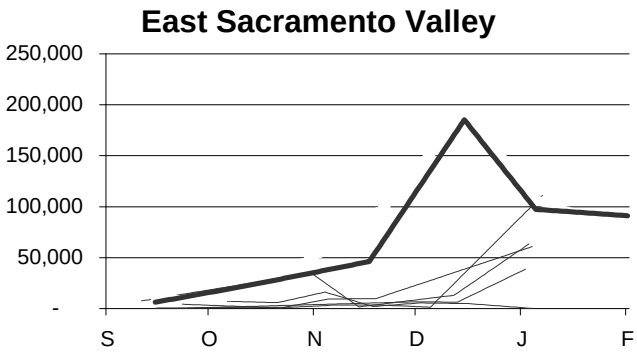
1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

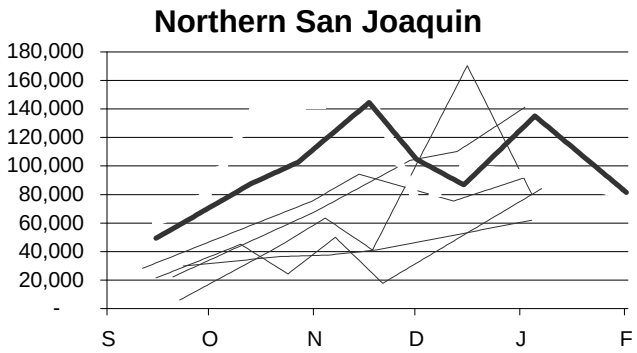


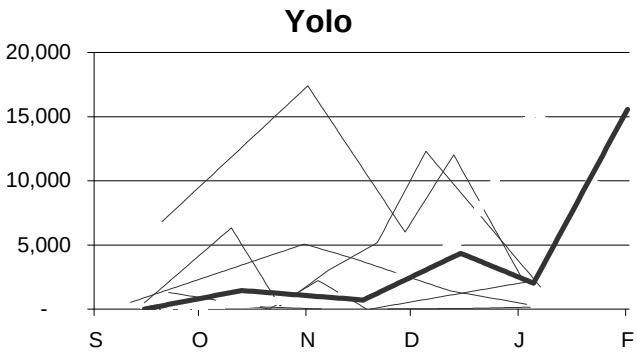


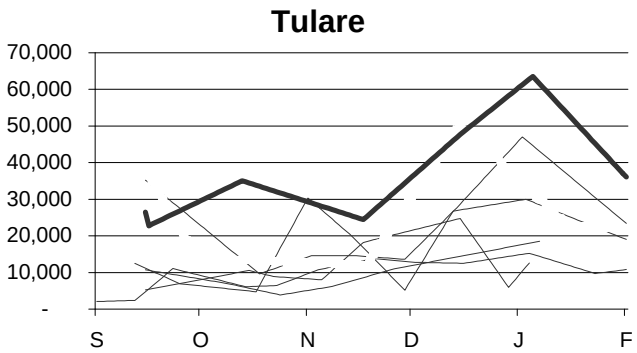






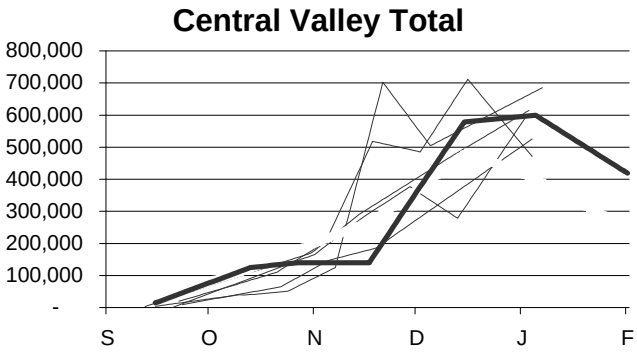


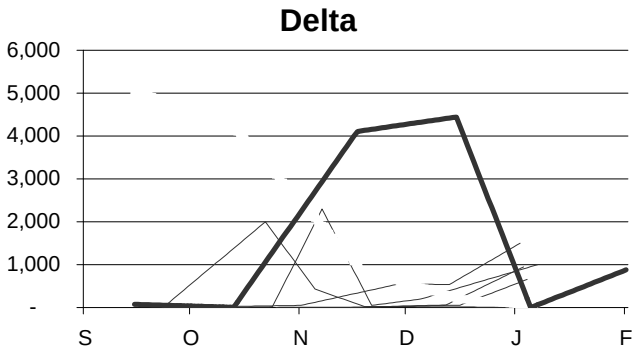


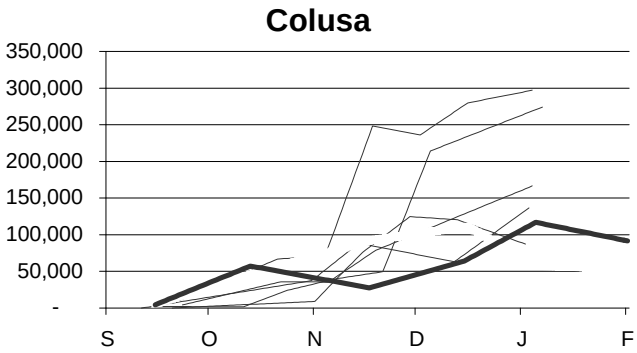


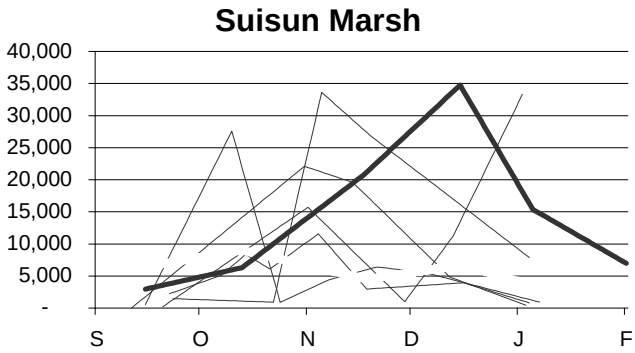
American Wigeon abundance during September - January

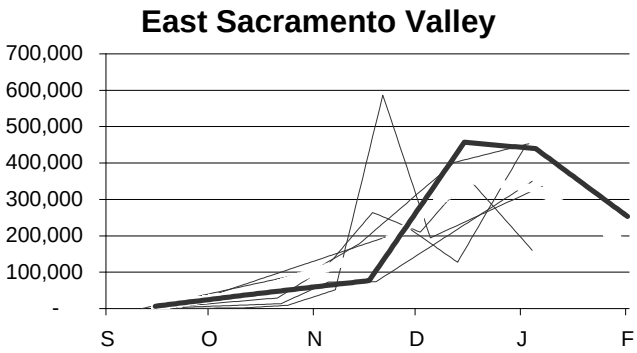
1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

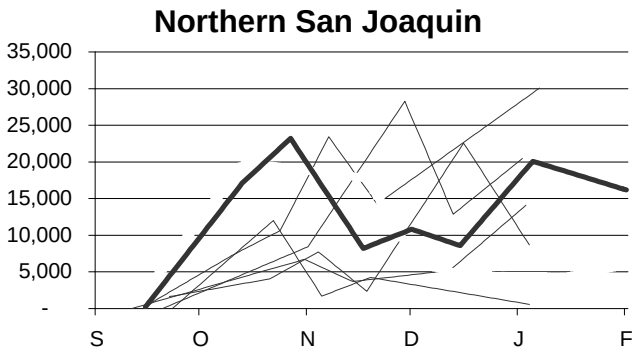


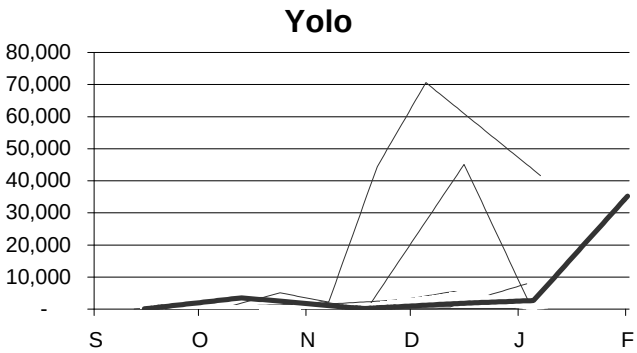


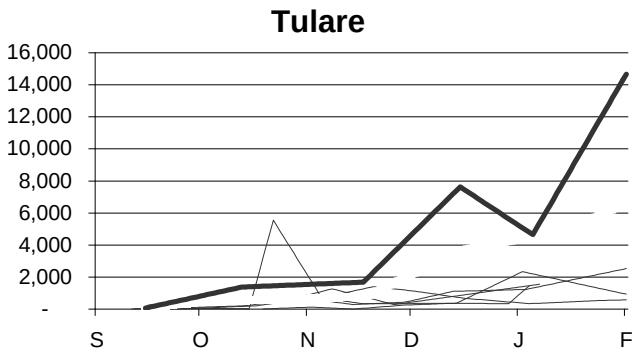






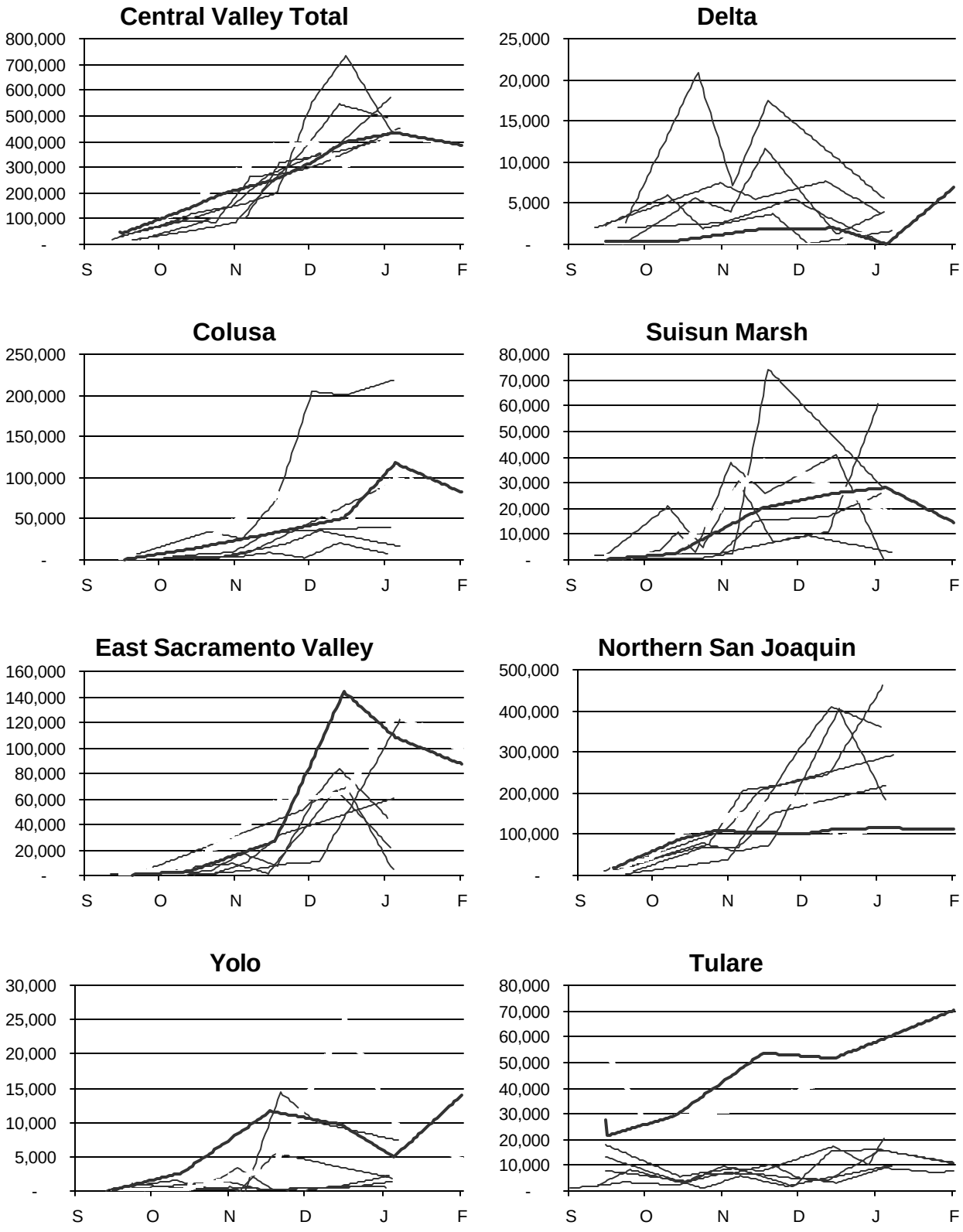






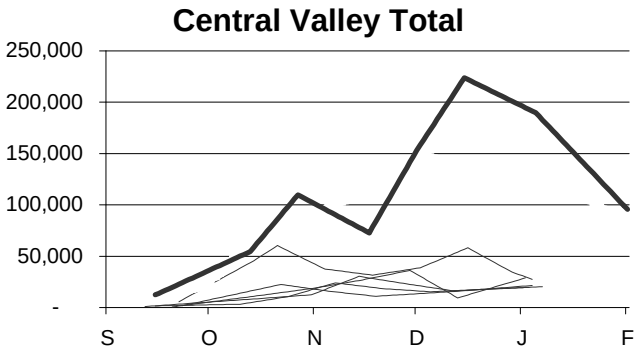
Northern Shoveler abundance during September - January

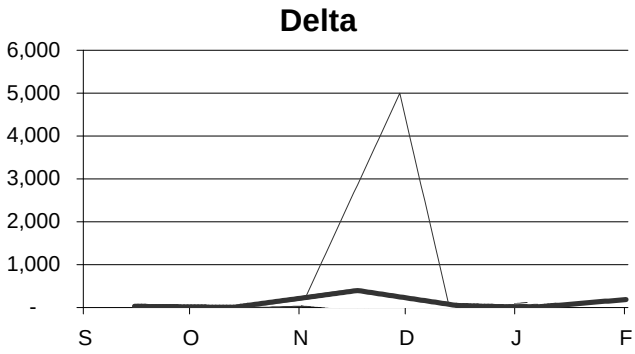
1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

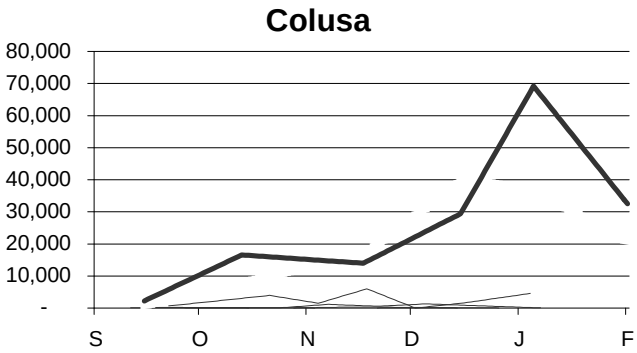


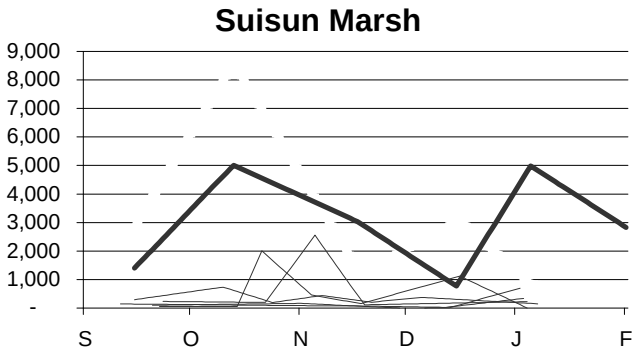
Gadwall abundance during September - January

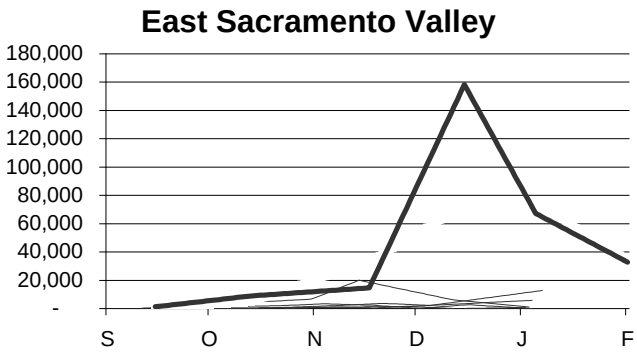
1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

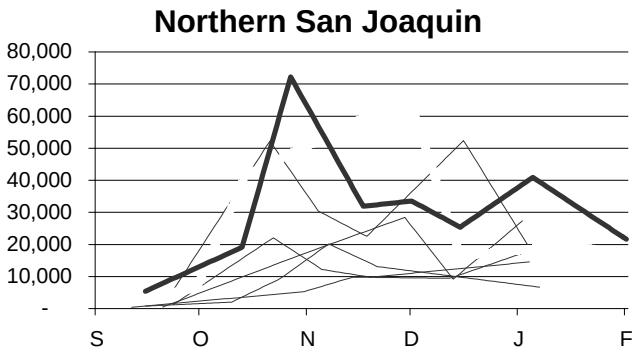


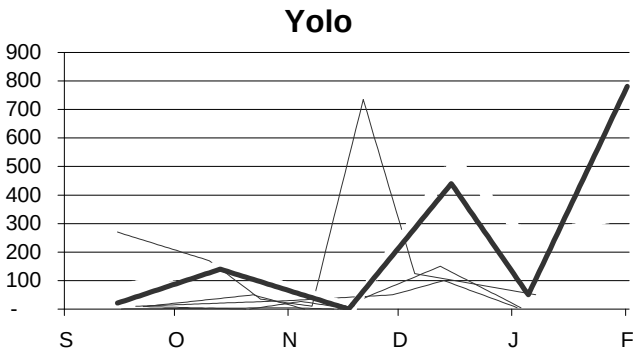


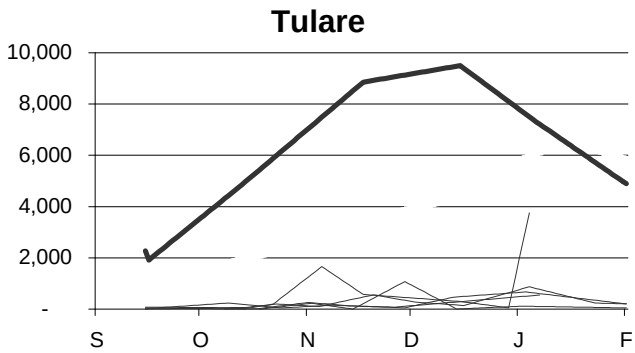








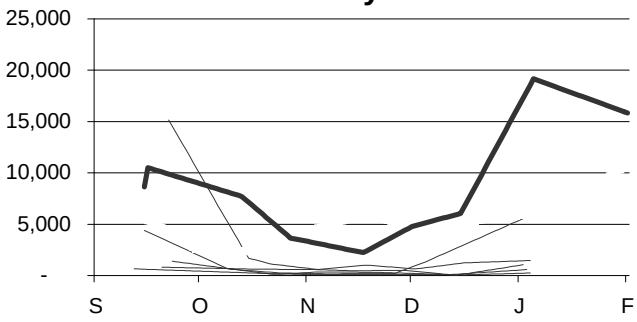




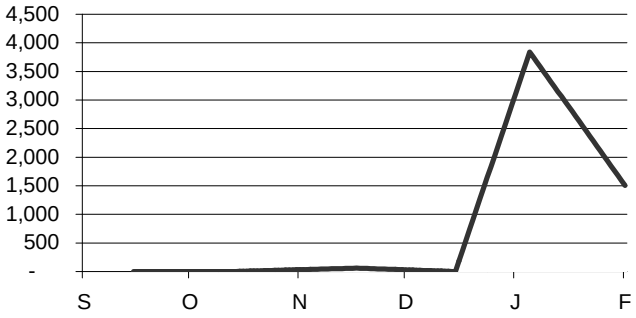
Cinnamon Teal abundance during September - January

1973-74 and 1978-82 (thin lines) vs 1998-99 (thick gray) and 1999-2000 (thick black)

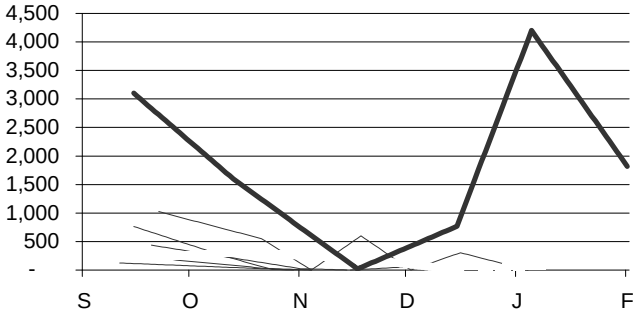
Central Valley Total



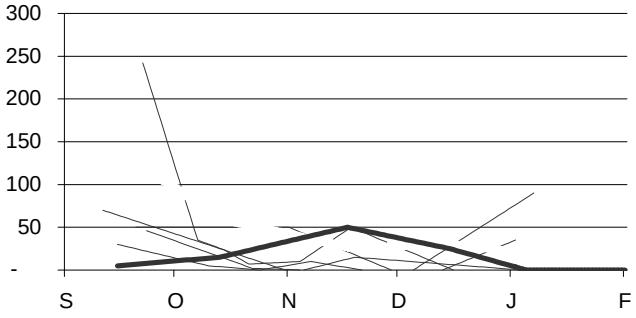
Delta



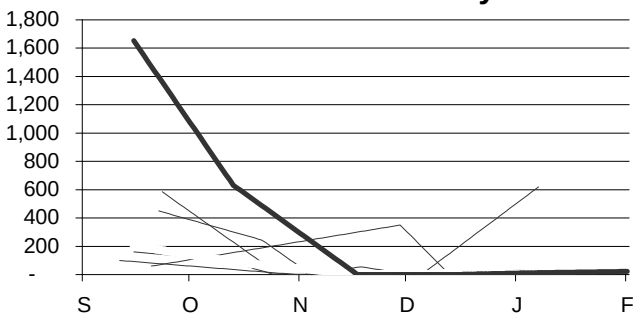
Colusa



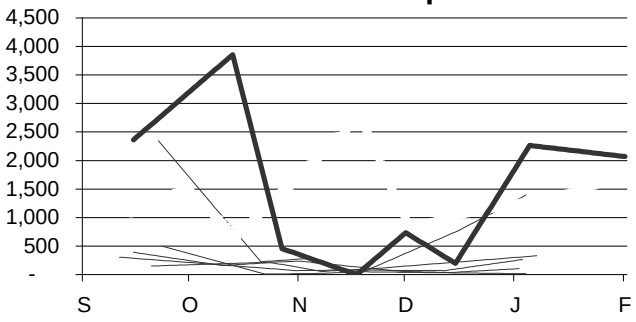
Suisun Marsh



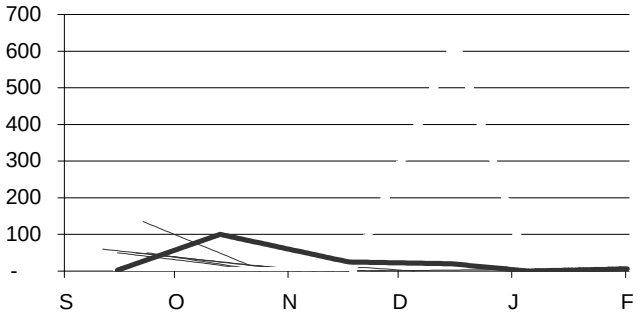
East Sacramento Valley



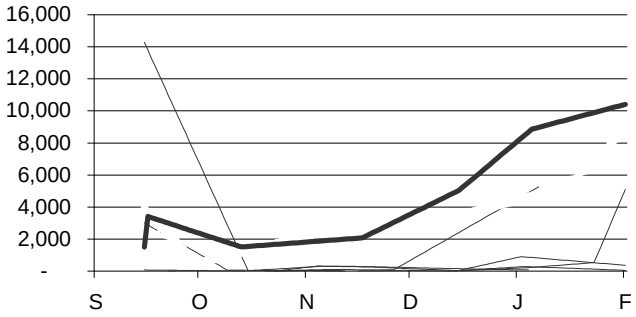
Northern San Joaquin



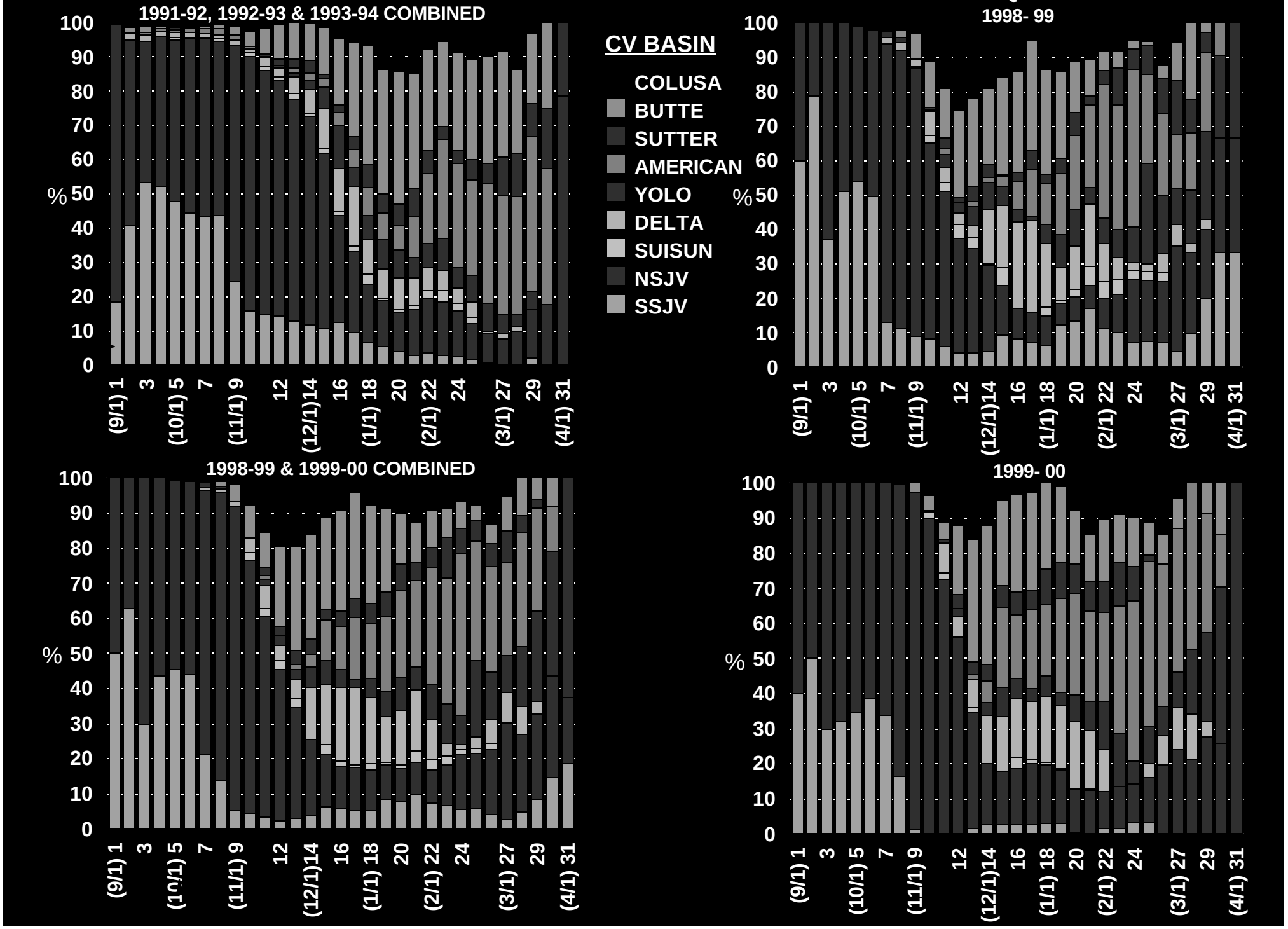
Yolo



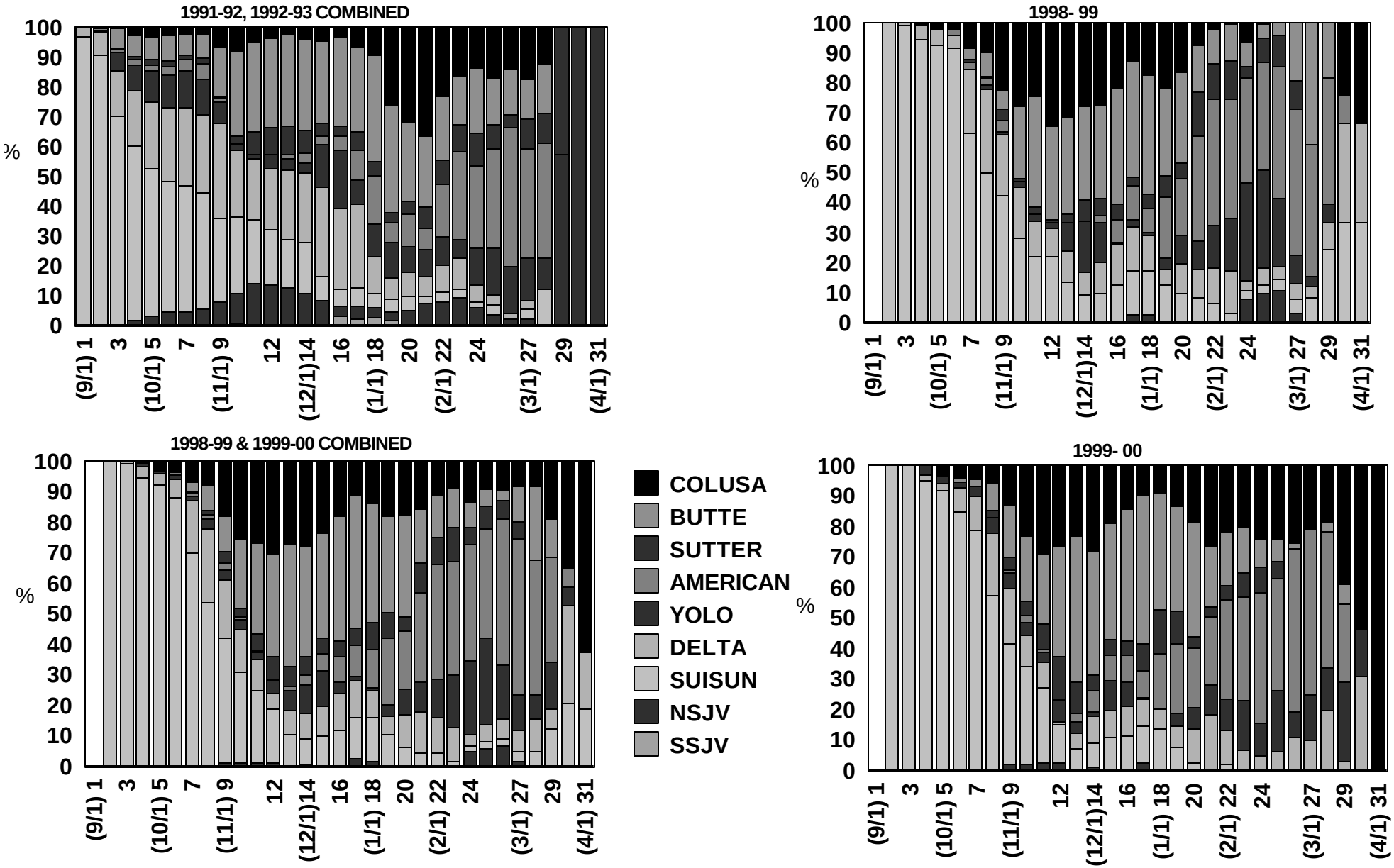
Tulare



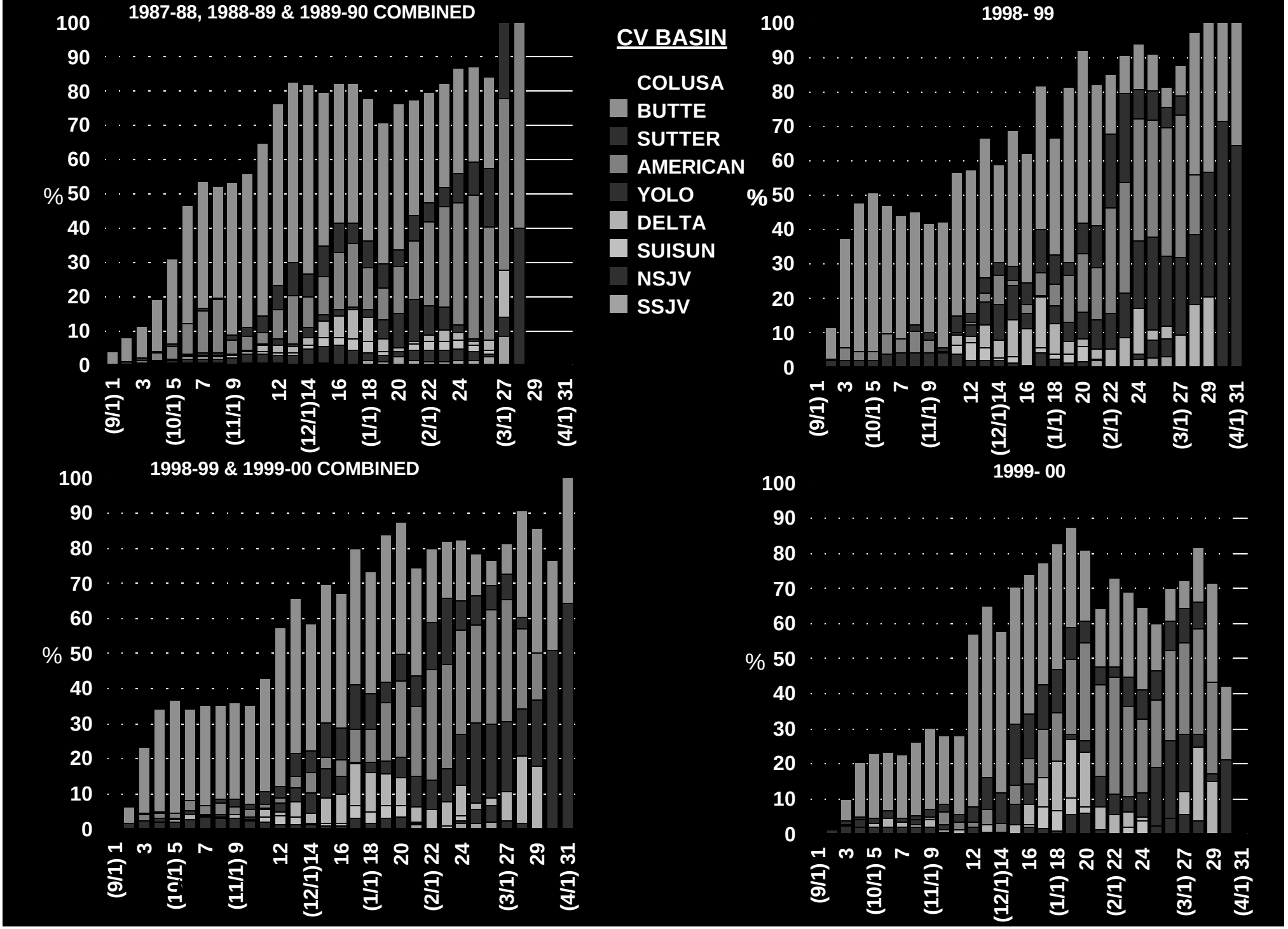
WEEKLY DISTRIBUTION OF PINTAILS RADIO-TAGGED IN THE SAN JOAQUIN VALLEY



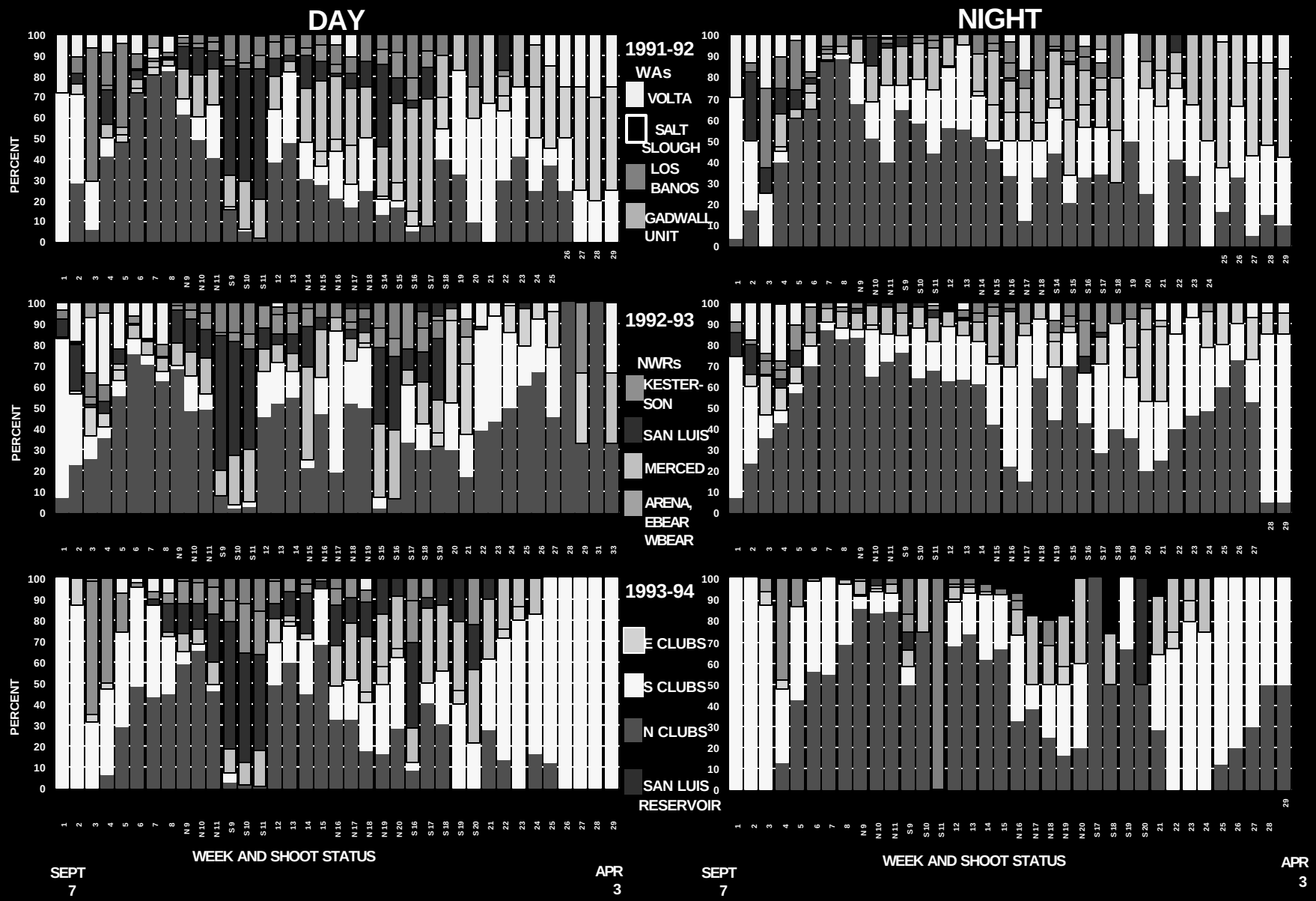
WEEKLY DISTRIBUTION OF PINTAILS RADIO-TAGGED IN THE SUISUN MARSH



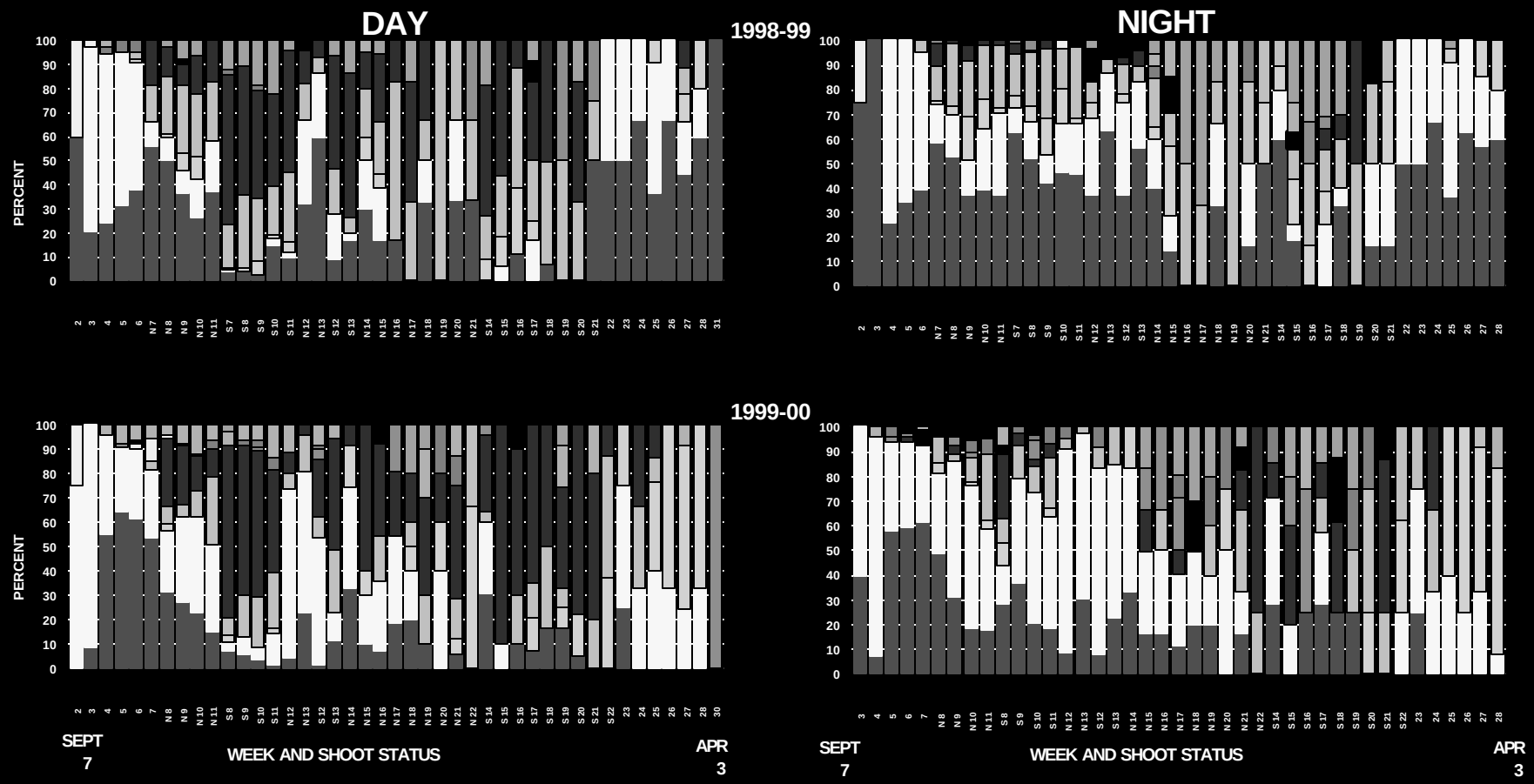
WEEKLY DISTRIBUTION OF PINTAILS RADIO-TAGGED IN THE SACRAMENTO VALLEY



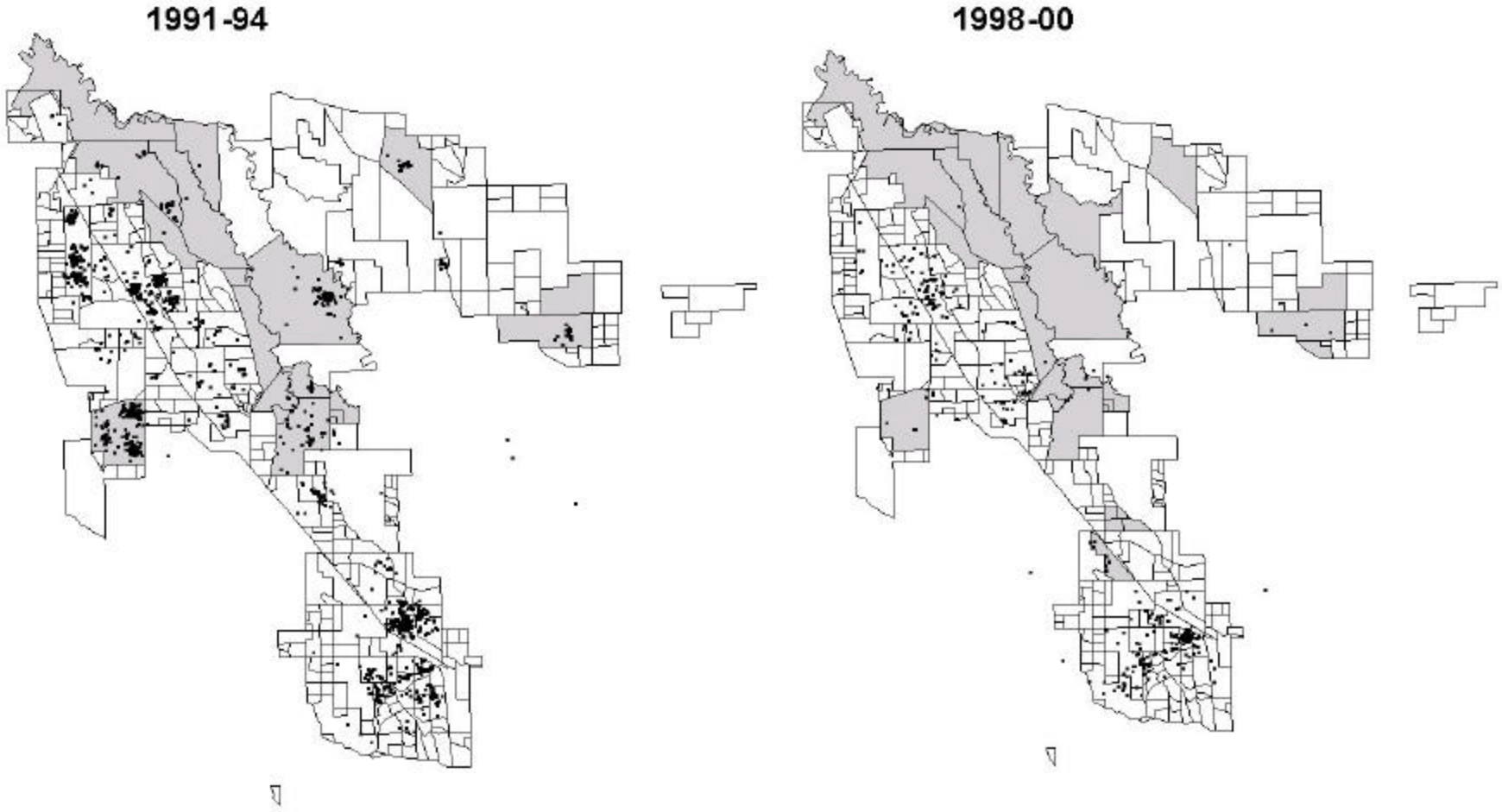
ADULT FEMALE NORTHERN PINTAIL DISTRIBUTION IN THE GRASSLAND ECOLOGICAL AREA 1991-92, 1992-93, 1993-94



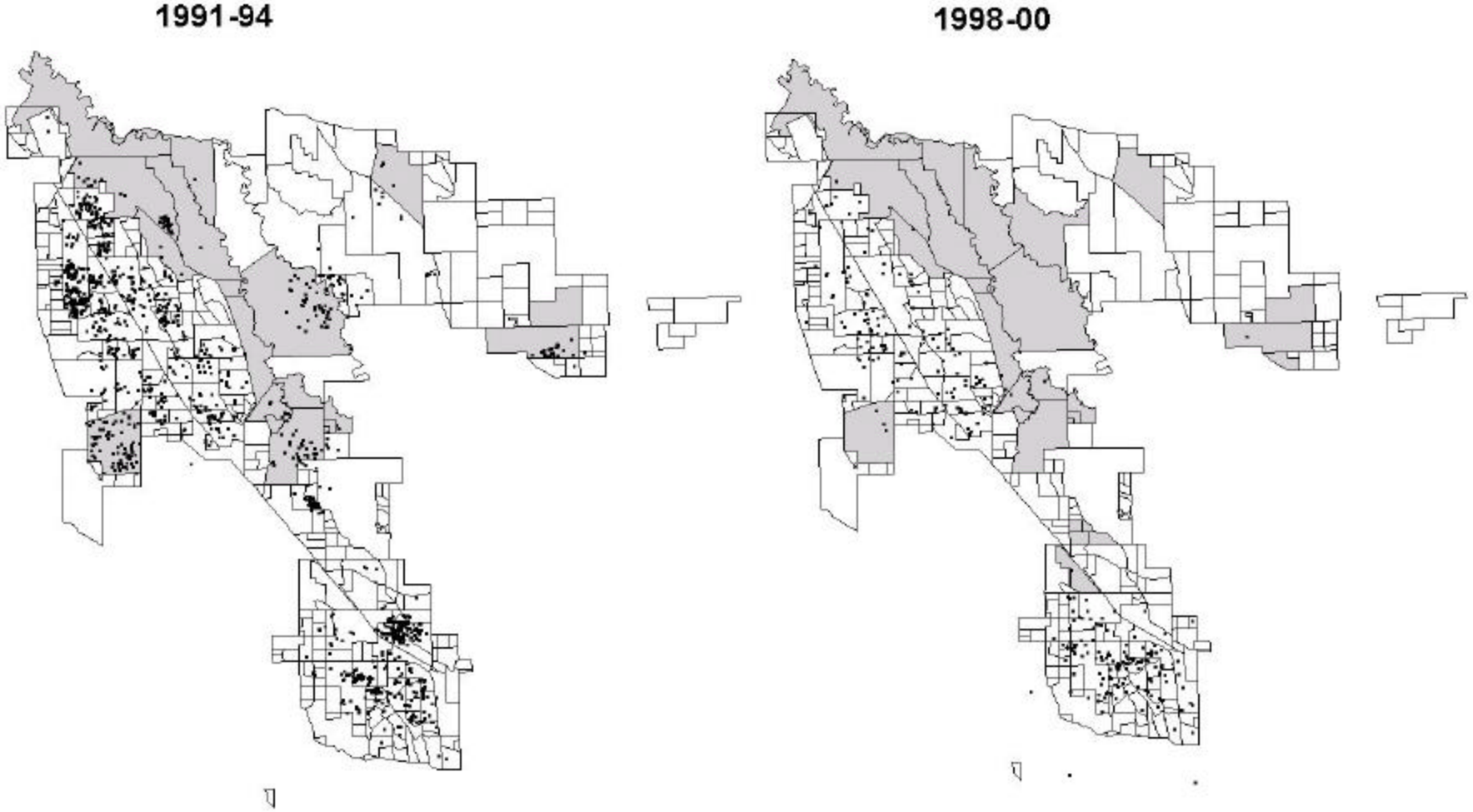
ADULT FEMALE NORTHERN PINTAIL DISTRIBUTION IN THE GRASSLAND ECOLOGICAL AREA 1998-99, 1999-00



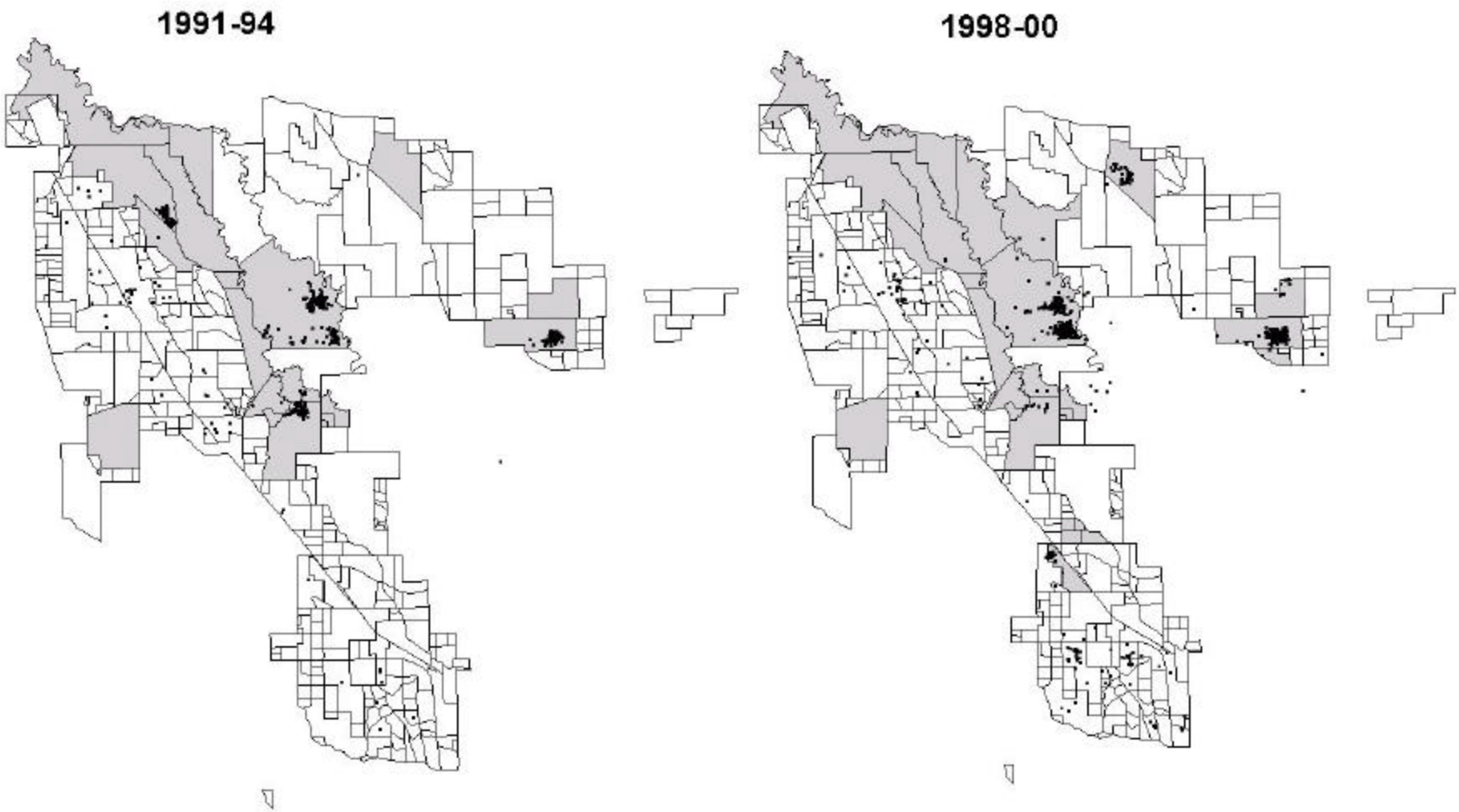
Prehunt Grassland Ecological Area day locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



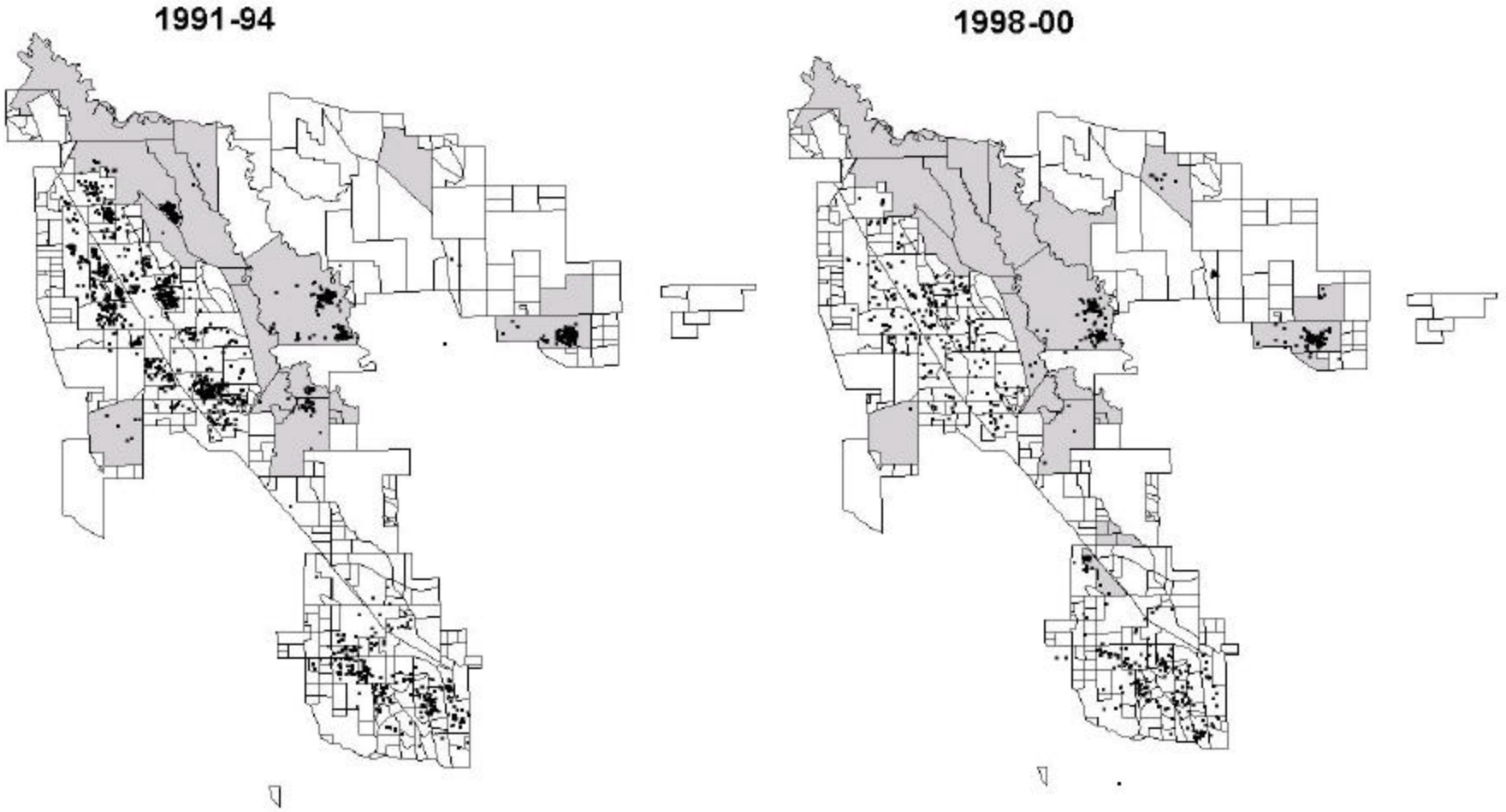
Prehunt Grassland Ecological Area night locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



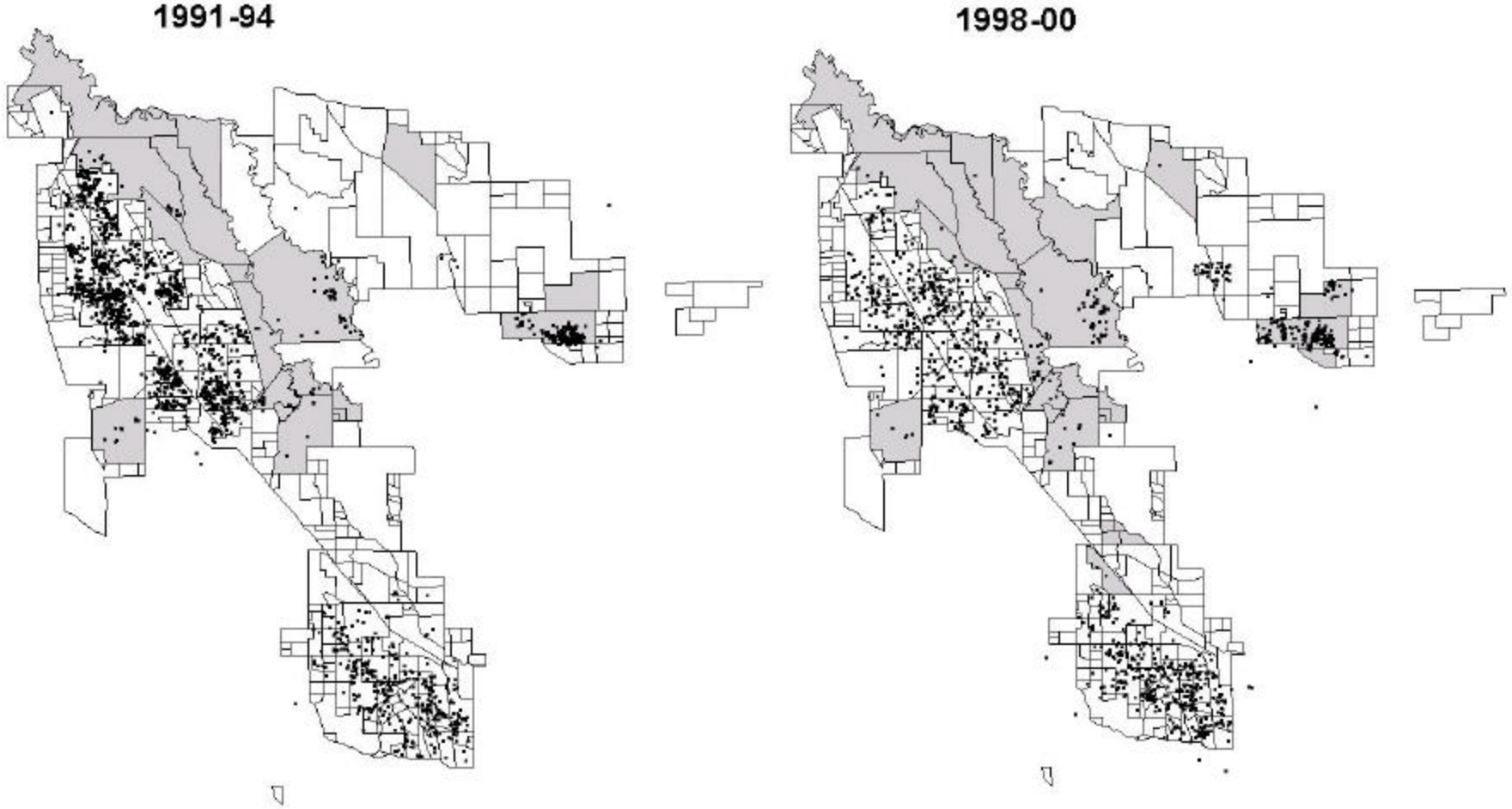
Early hunt Grassland Ecological Area shootday locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



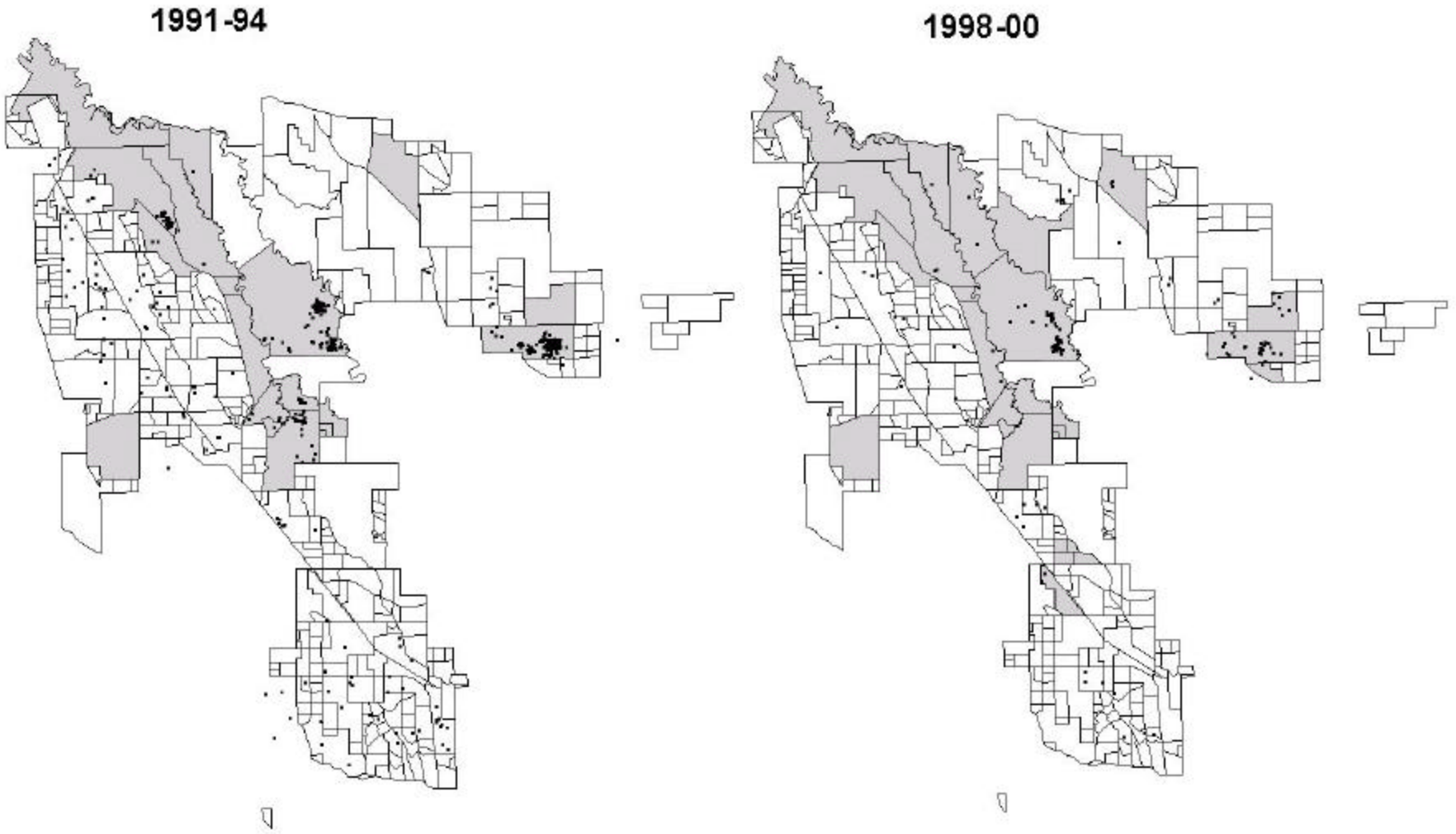
Early hunt Grassland Ecological Area nonshootday locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



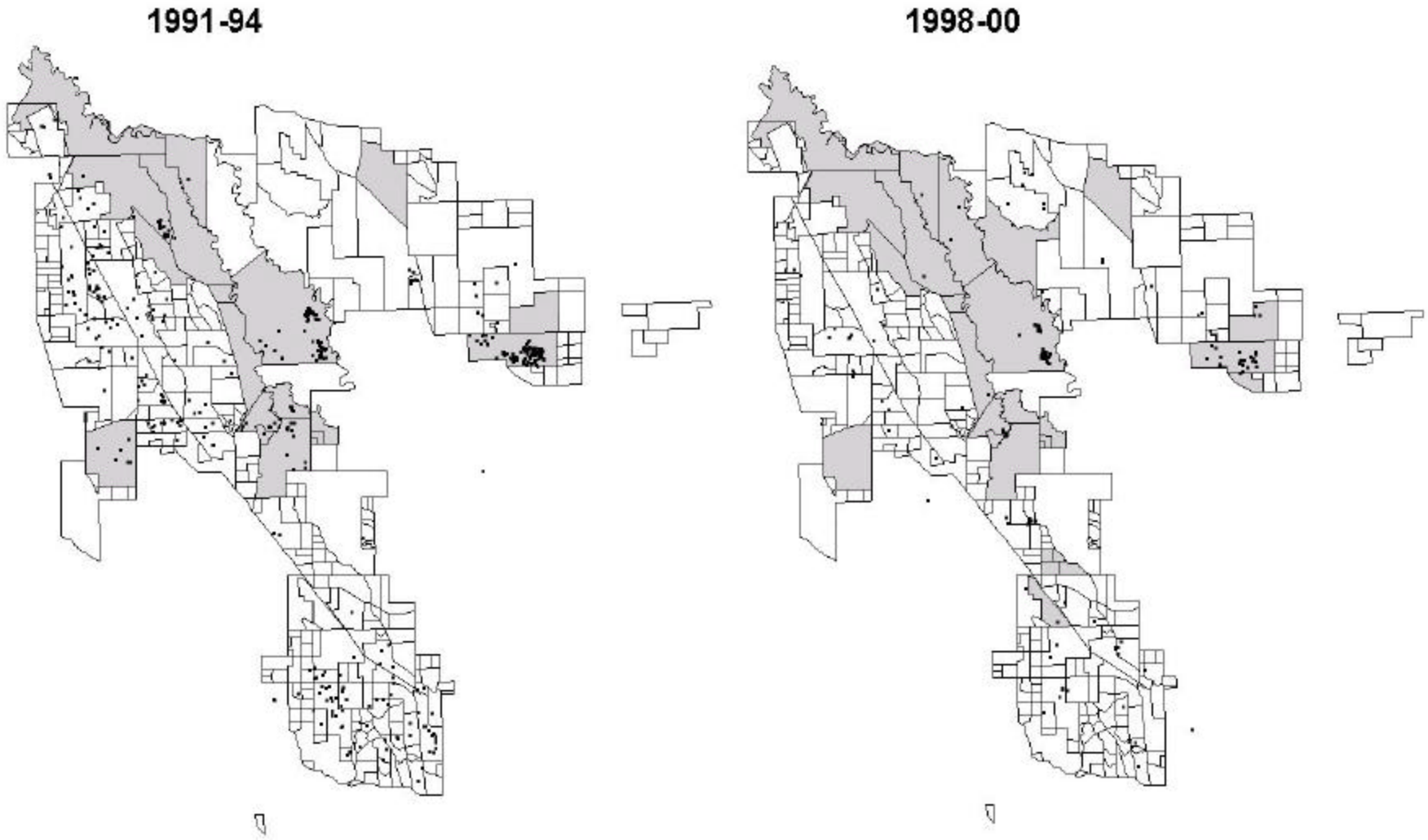
Early hunt Grassland Ecological Area night locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



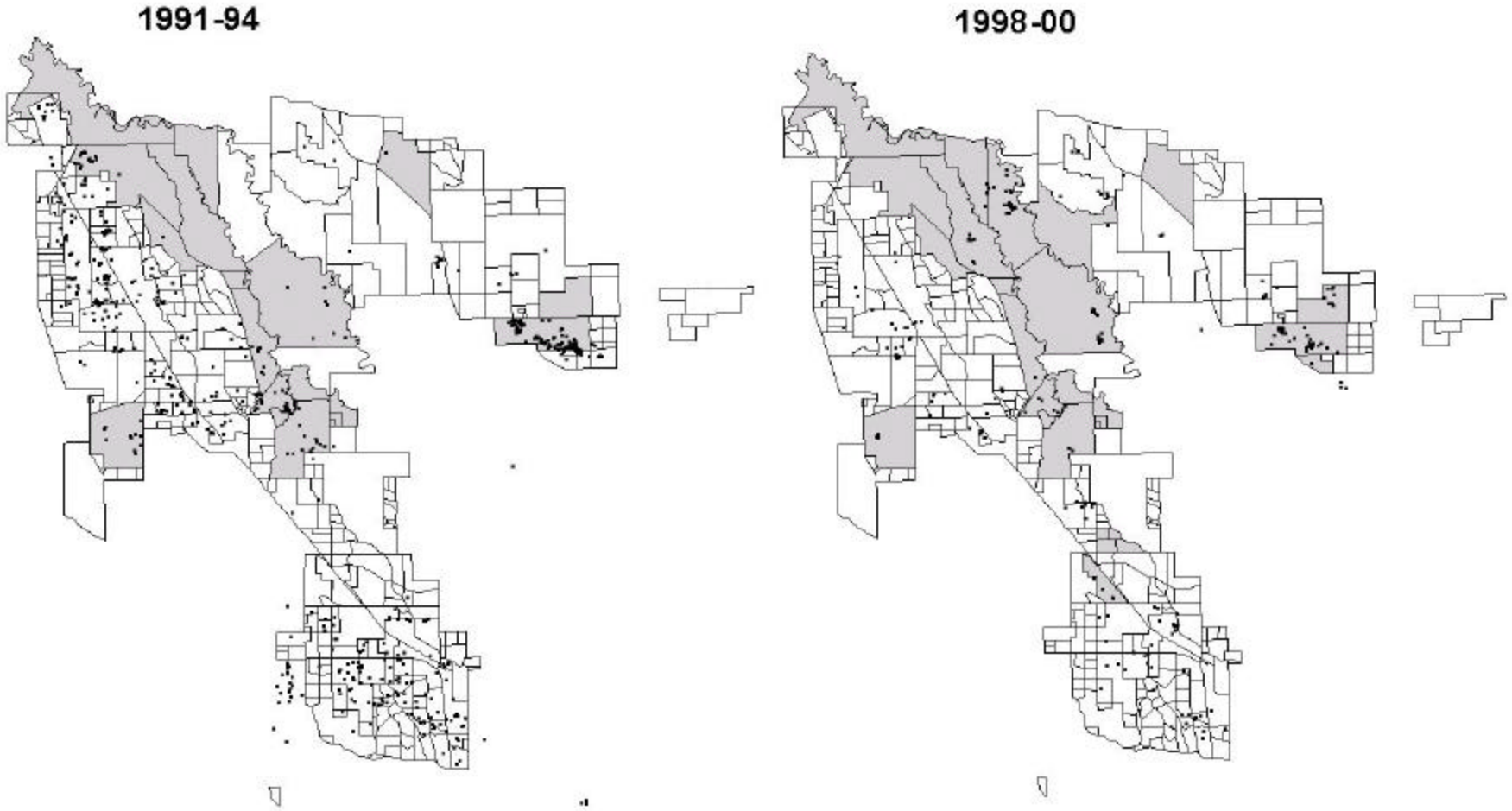
Late hunt Grassland Ecological Area shootday locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



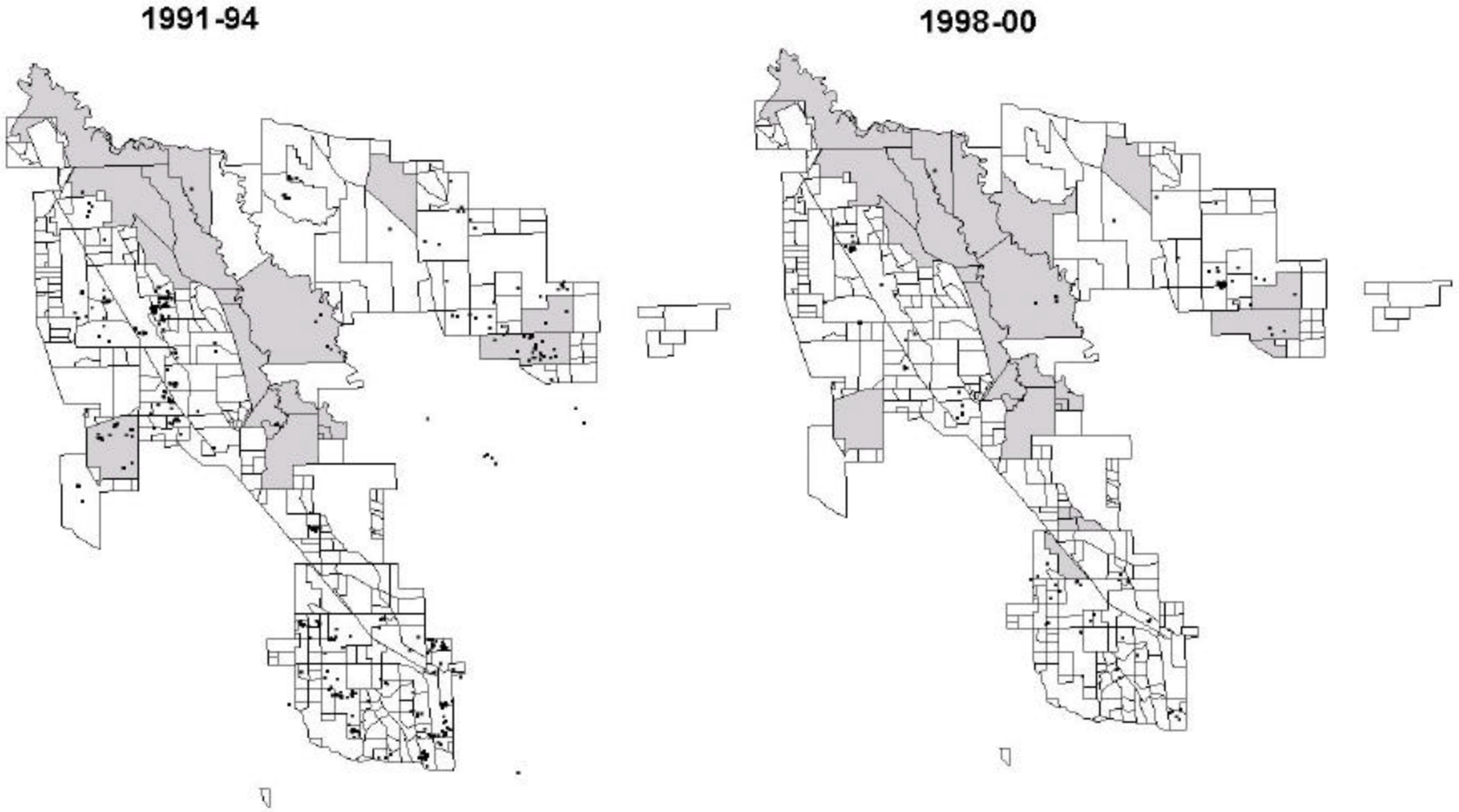
Late hunt Grassland Ecological Area nonshootday locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



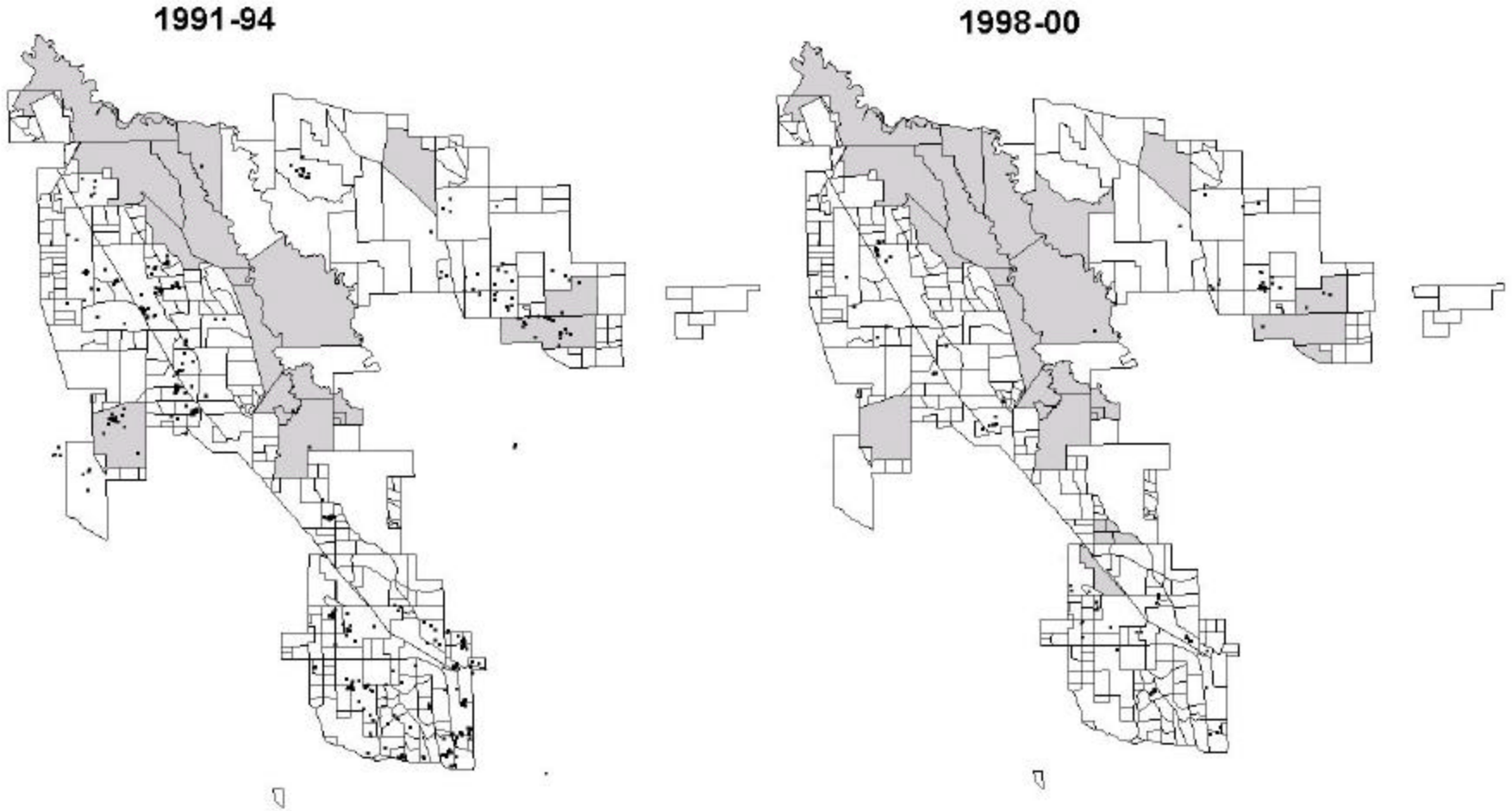
Late hunt Grassland Ecological Area night locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



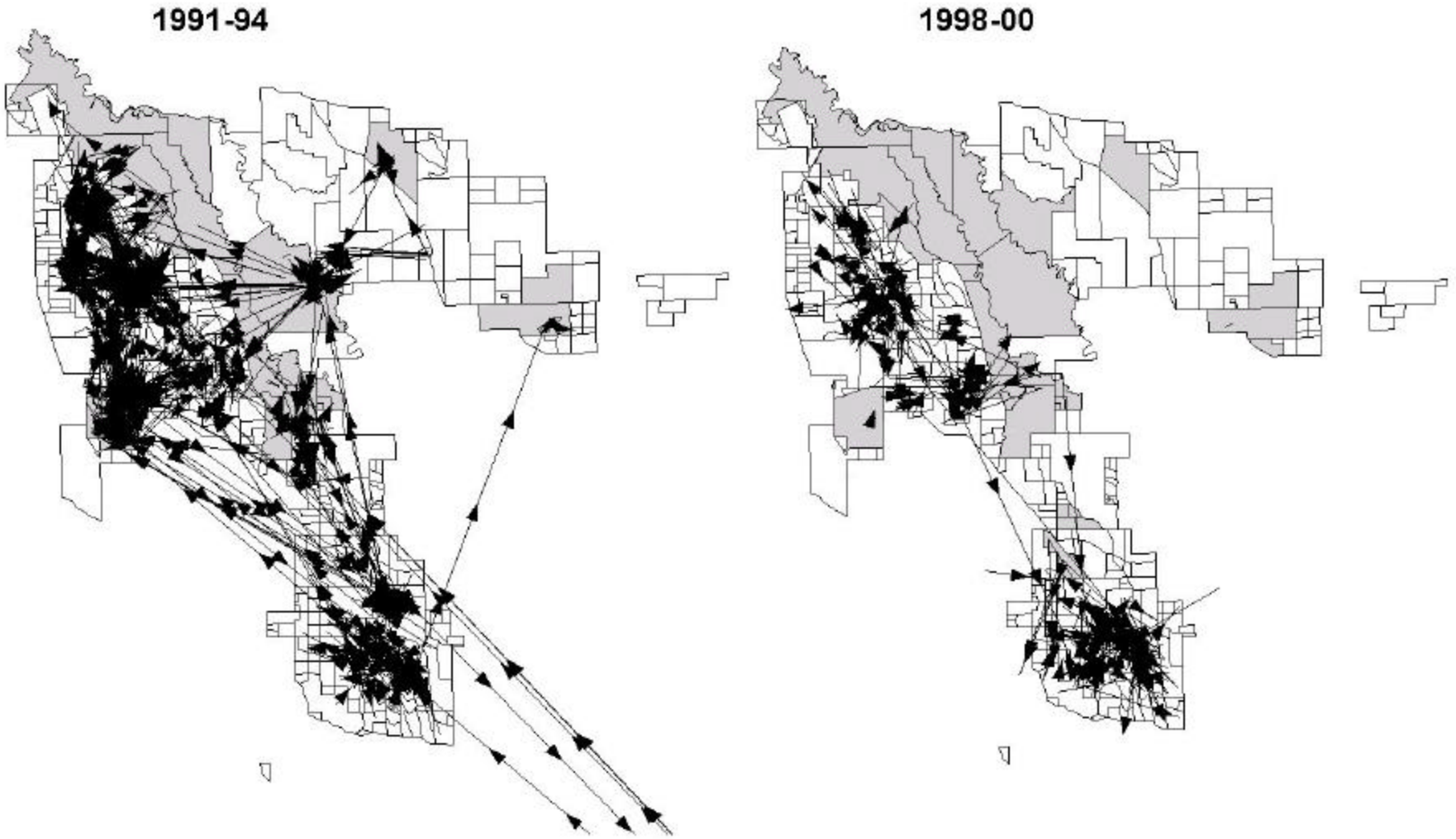
Posthunt Grassland Ecological Area day locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



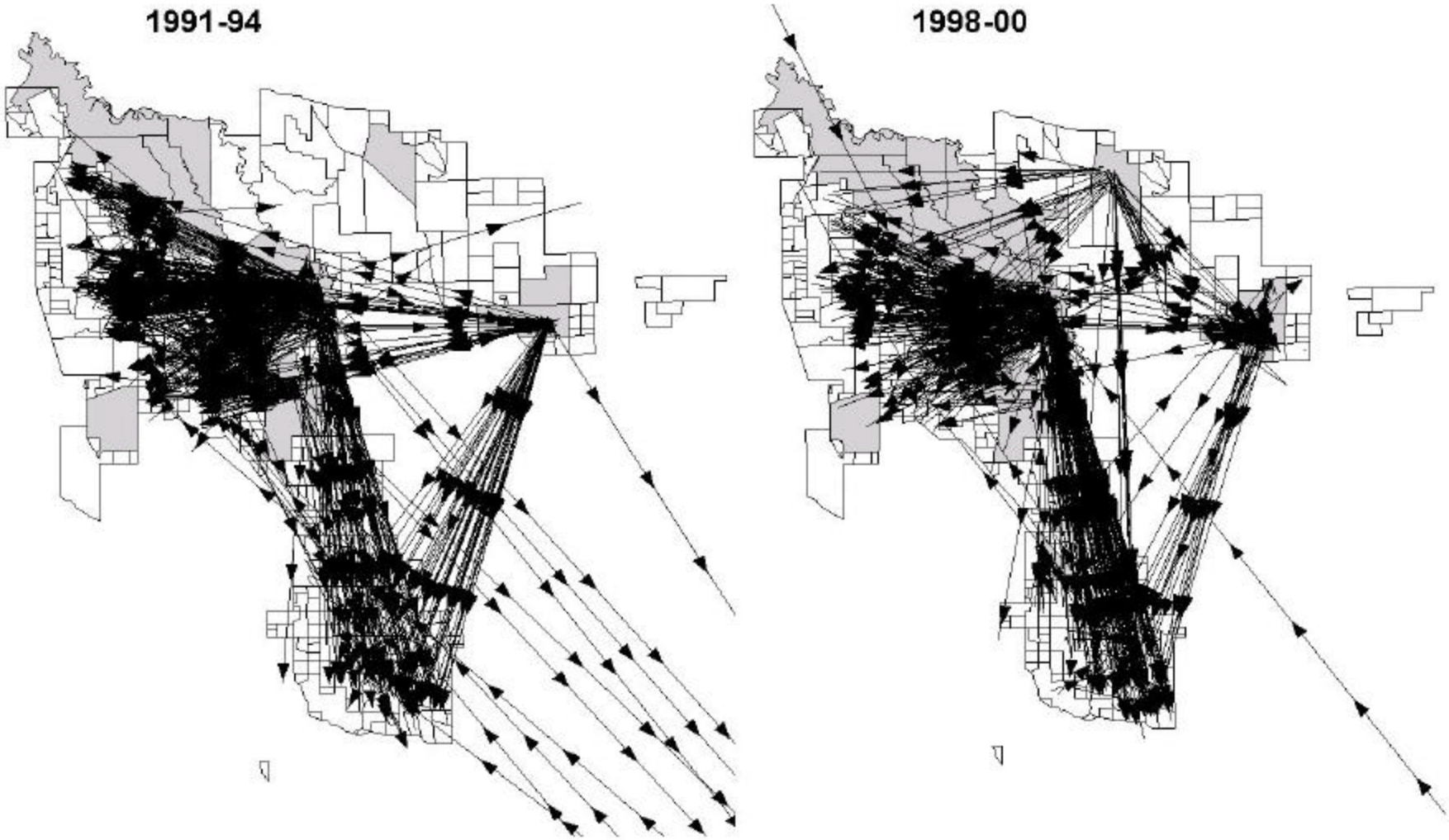
Posthunt Grassland Ecological Area night locations of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



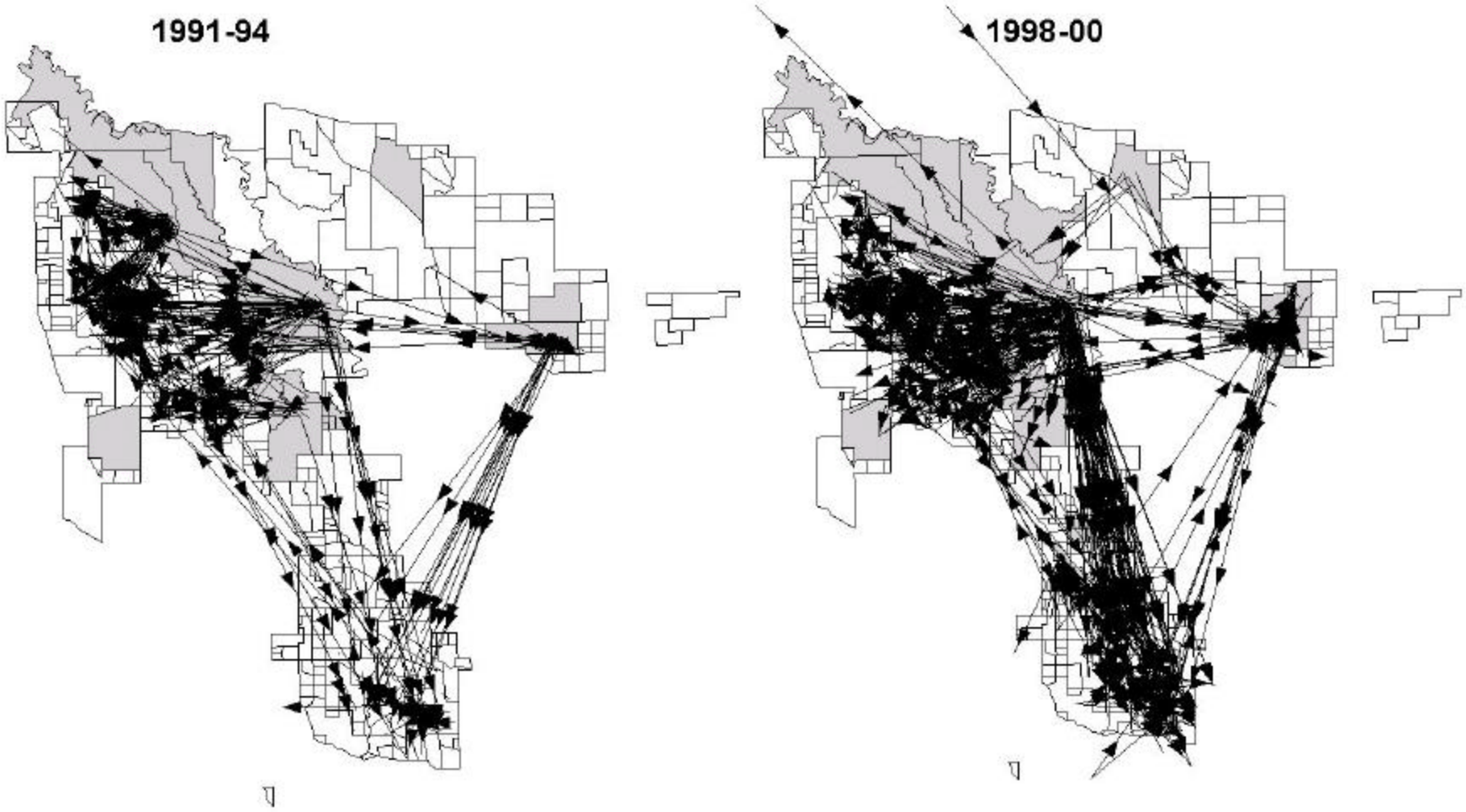
Prehunt Grassland Ecological Area day-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



Early hunt Grassland Ecological Area shootday-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh

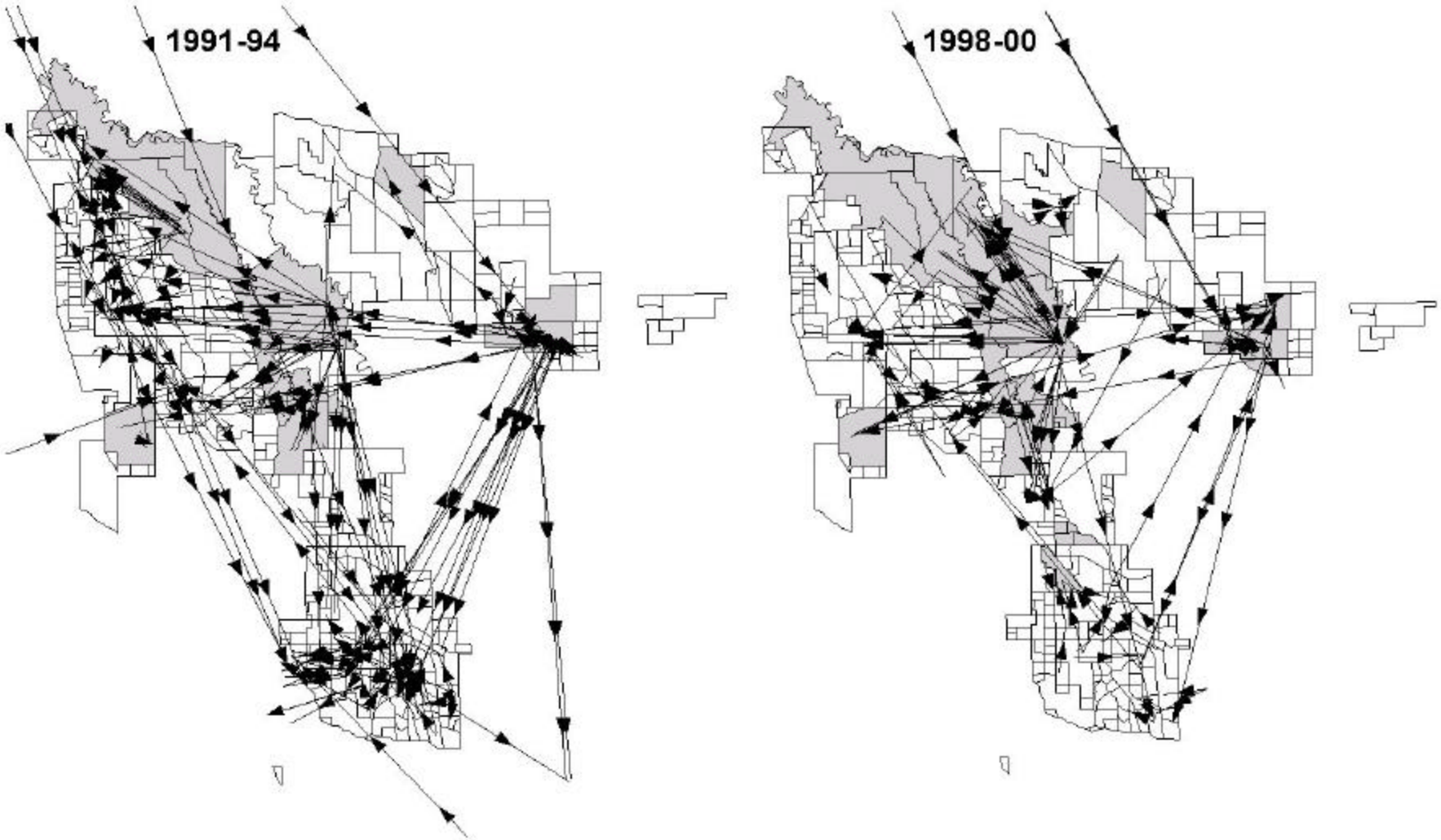


Early hunt Grassland Ecological Area nonshootday-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh

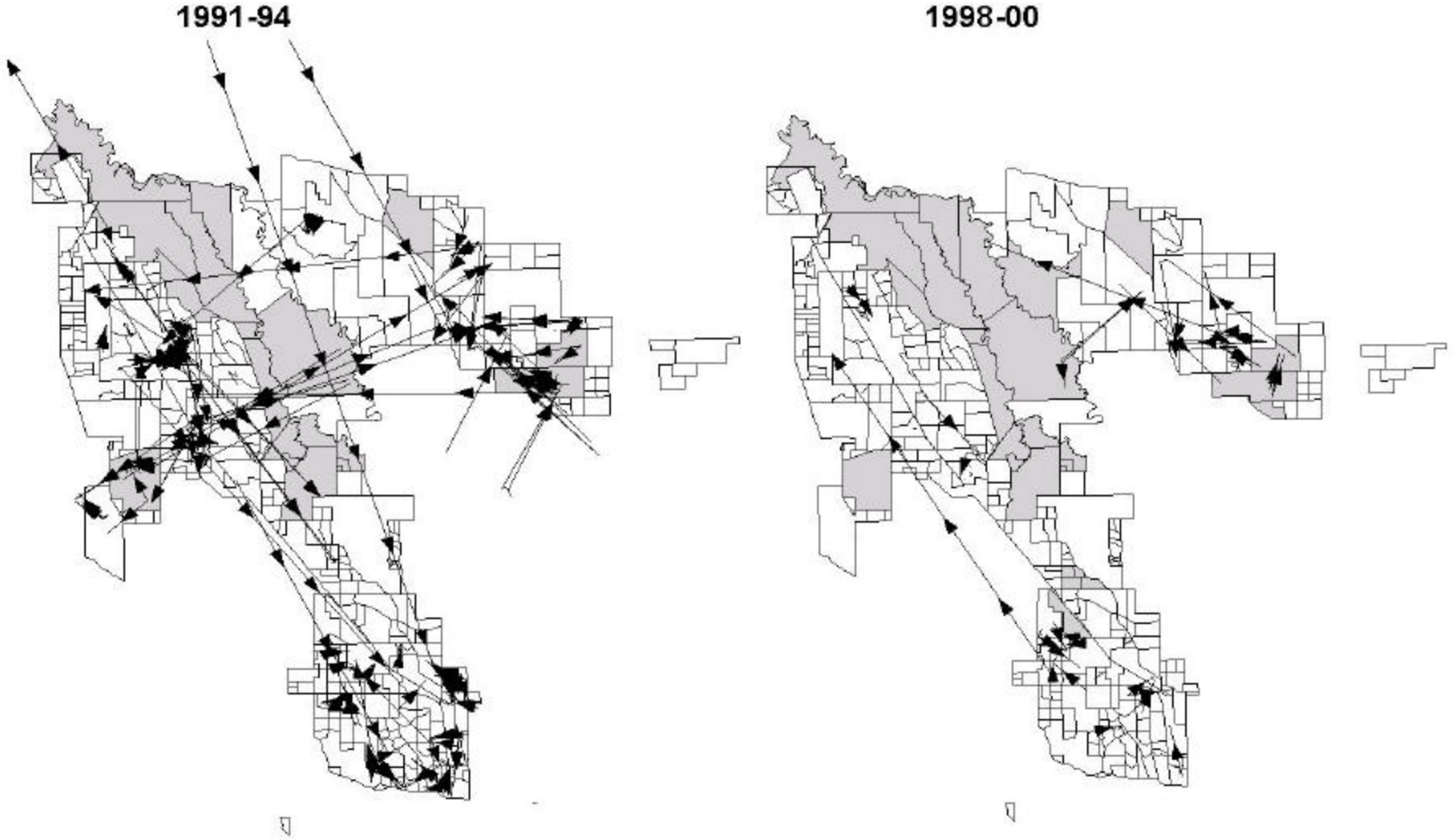


Late hunt Grassland Ecological Area shootday-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh

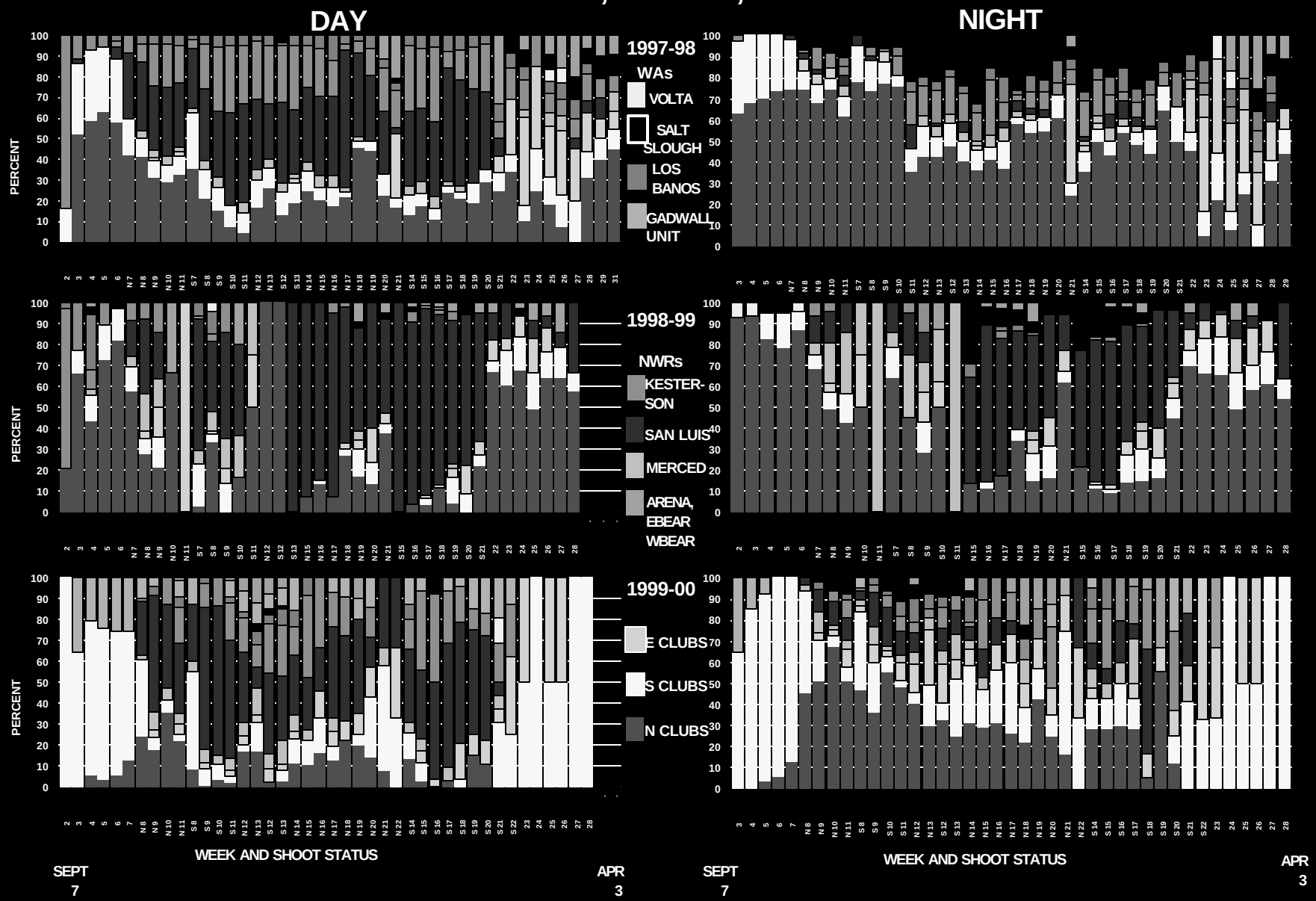
Late hunt Grassland Ecological Area nonshootday-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh



Posthunt Grassland Ecological Area day-night movements of adult female pintails radio - tagged during August - October in the San Joaquin Valley and Suisun Marsh

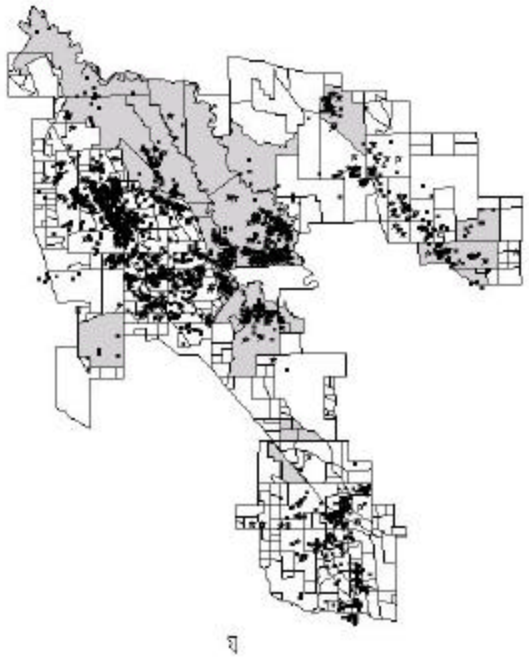


GREEN-WINGED TEAL DISTRIBUTION
IN THE GRASSLAND ECOLOGICAL AREA
1997-98, 1998-99, 1999-00



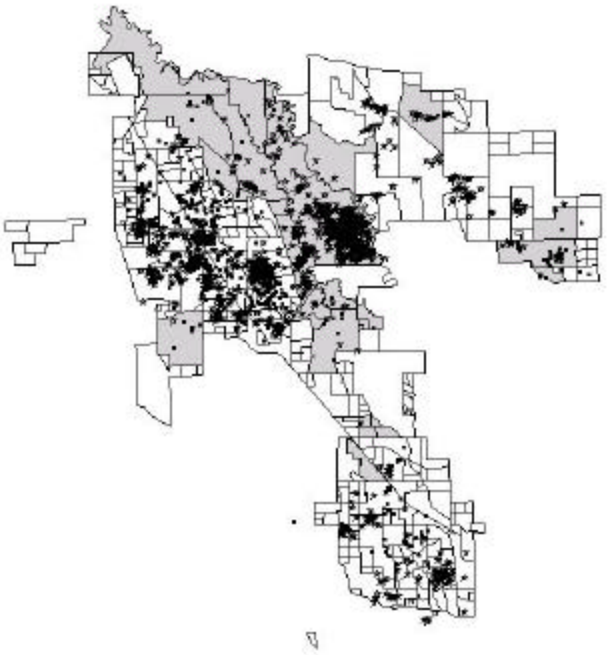
All Grassland Ecological Area locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



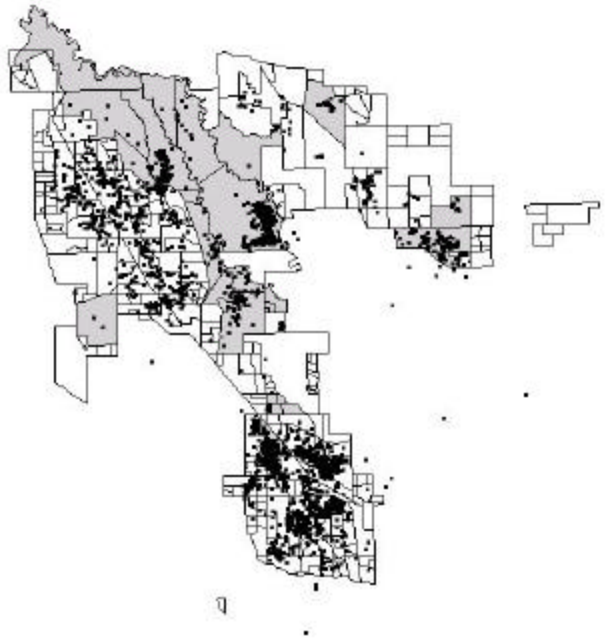
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

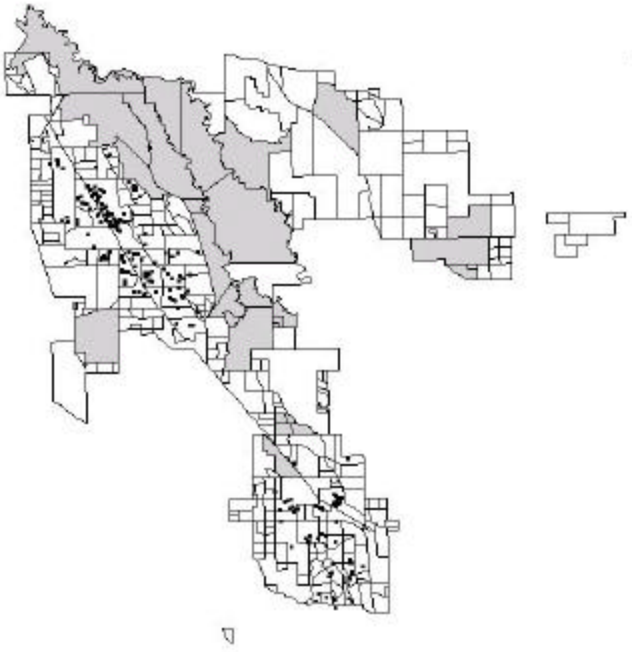
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

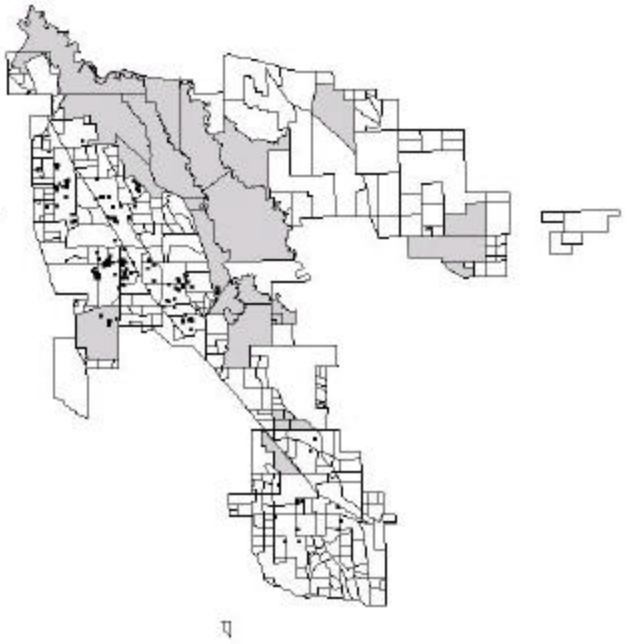
Prehunt Grassland Ecological Area night locations of Green-winged Teal radio - tagged during September in the San Joaquin Valley

1997-1998



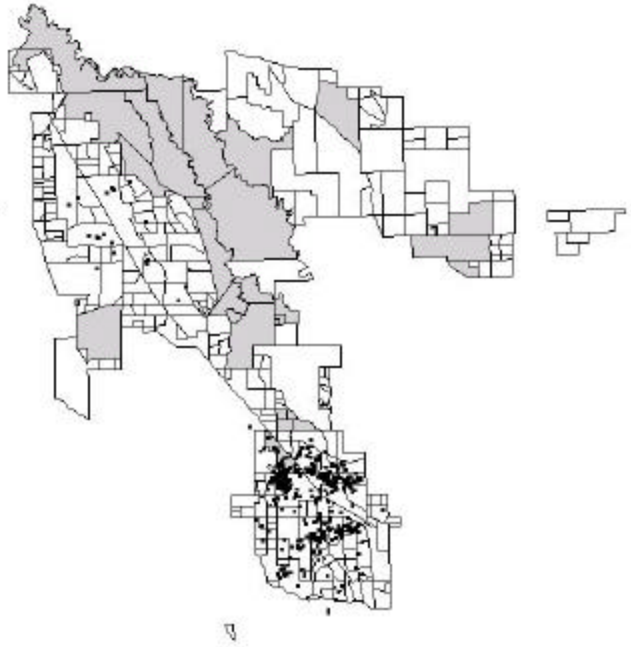
• Radio-tagged in September in North and South Grasslands

1998-99



• Radio-tagged in September in North and South Grasslands and Mendota WA

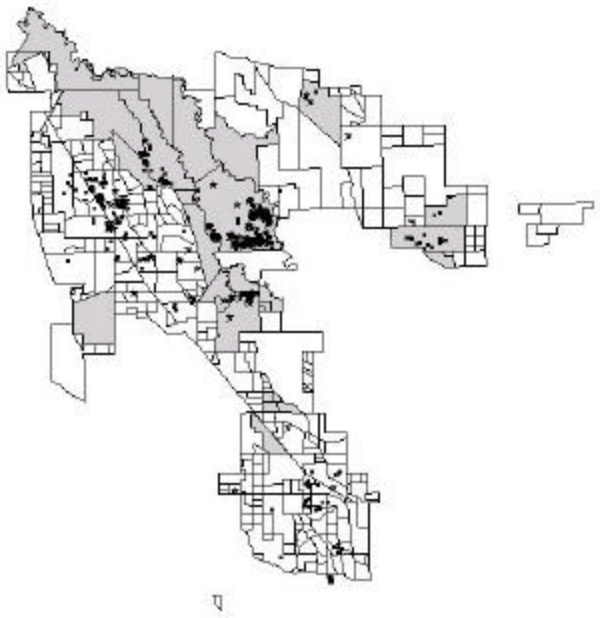
1999-00



• Radio-tagged in September in Grasslands and Mendota WA

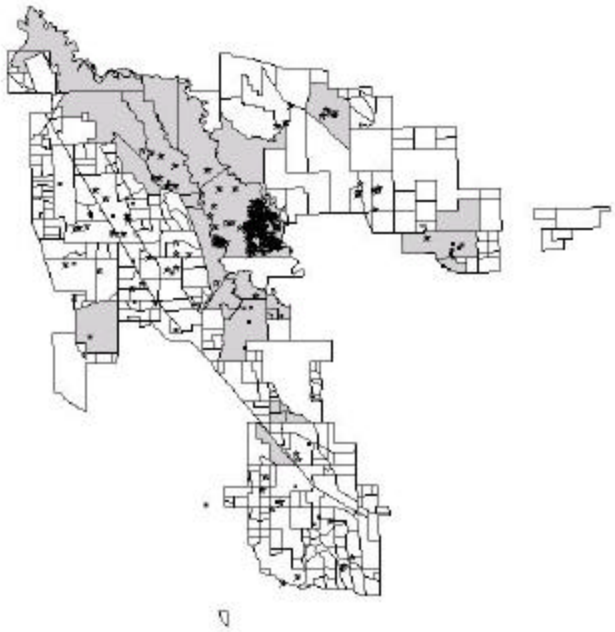
Hunt Grassland Ecological Area shoot day locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



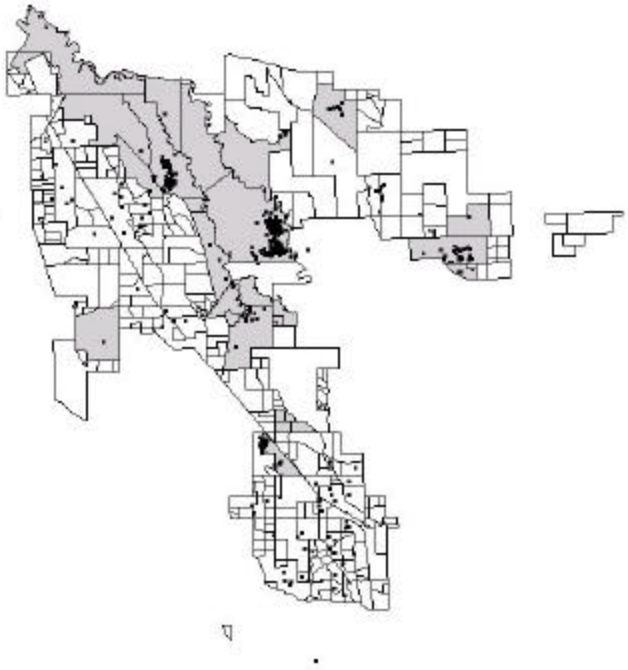
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

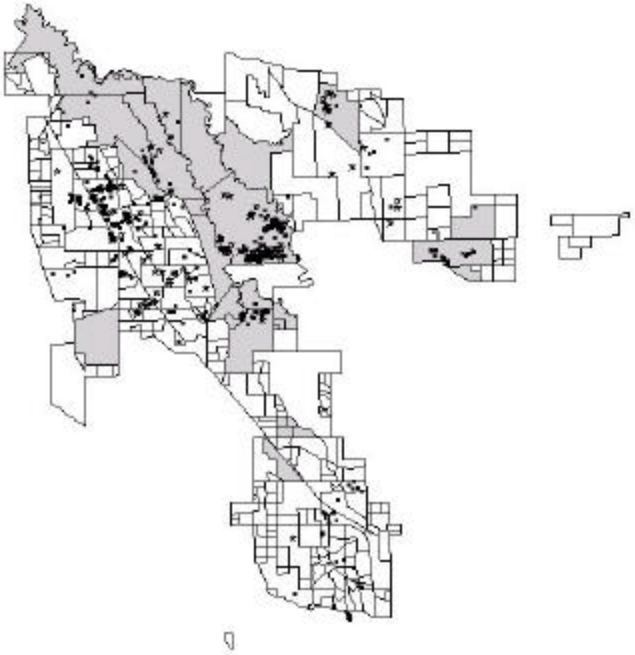
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

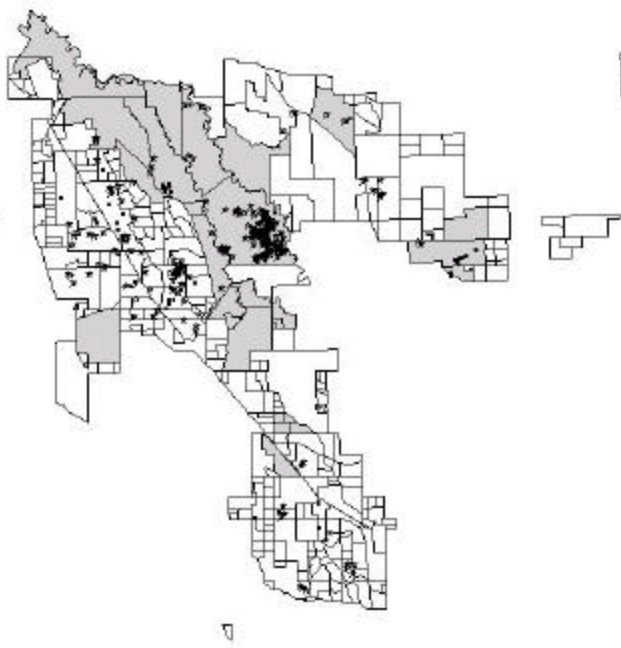
Hunt Grassland Ecological Area nonshoot day locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



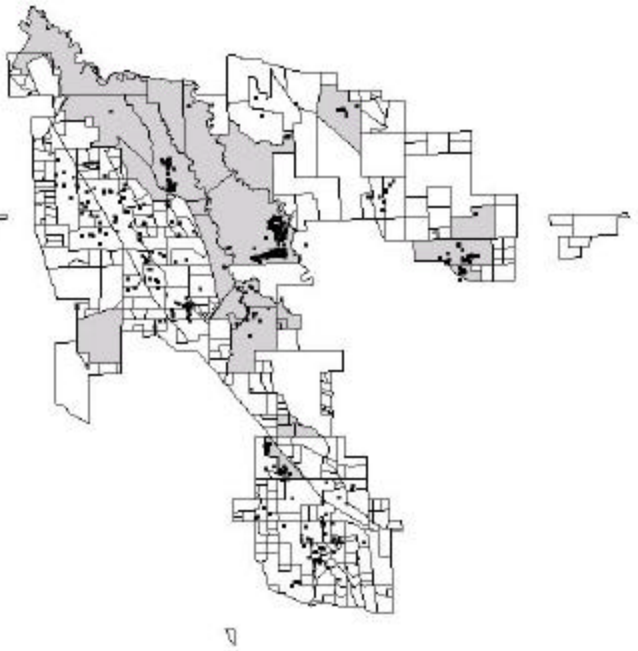
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

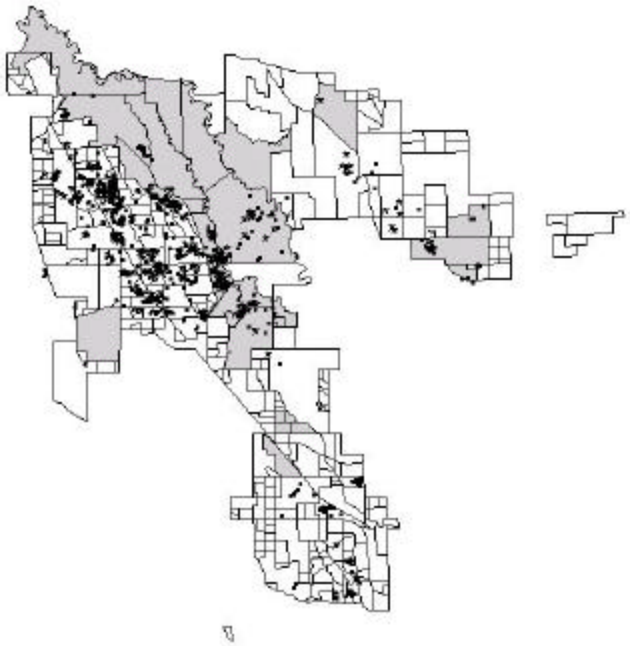
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

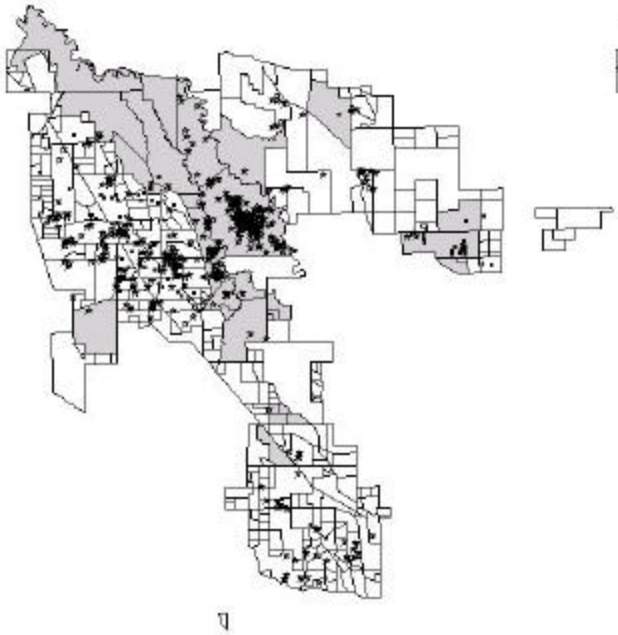
Hunt Grassland Ecological Area night locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



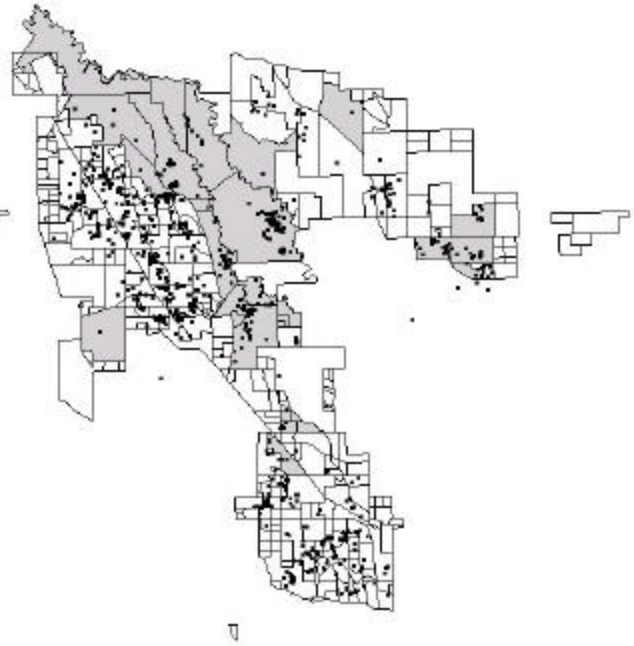
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

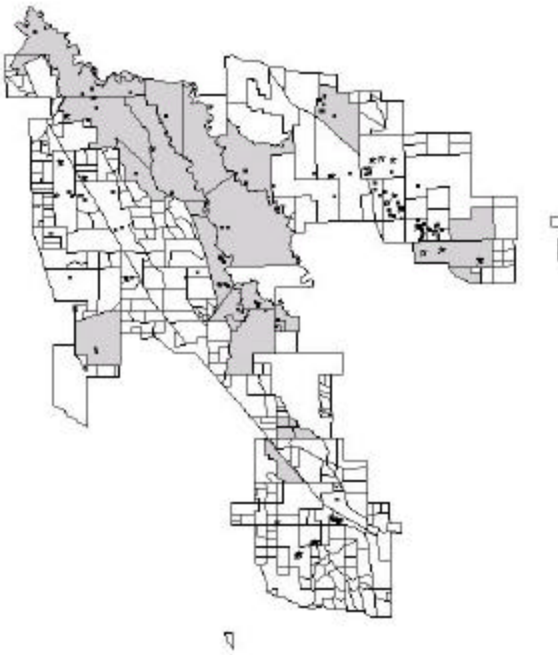
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

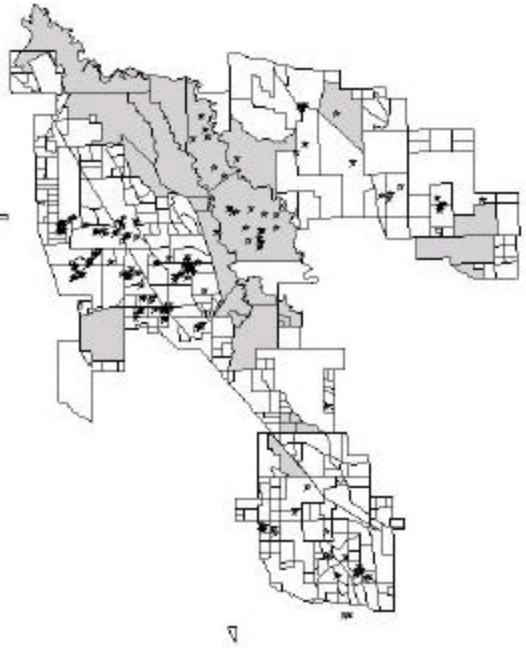
Posthunt Grassland Ecological Area day locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



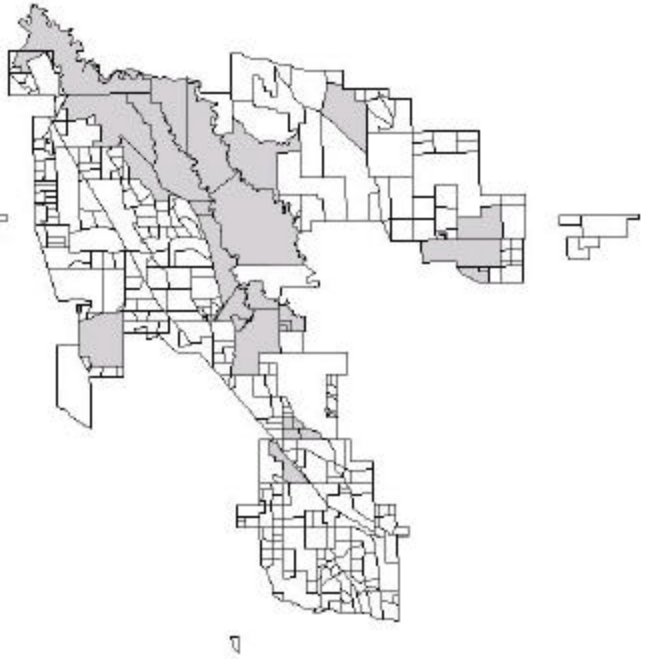
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

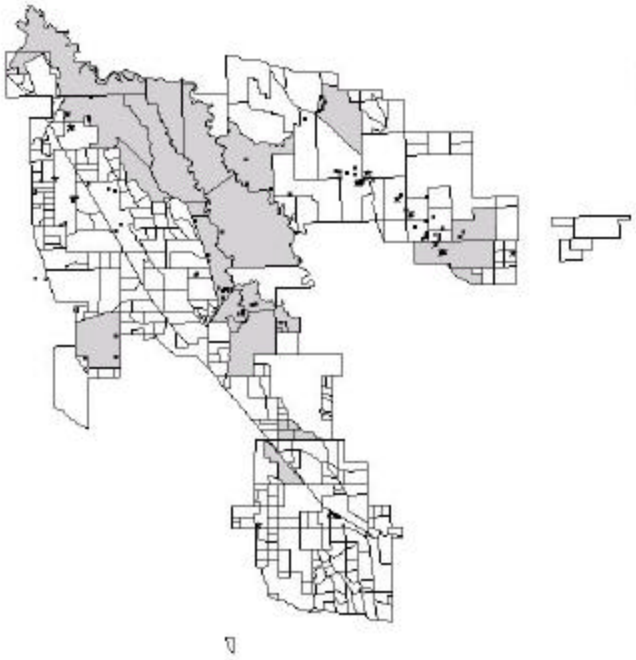
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

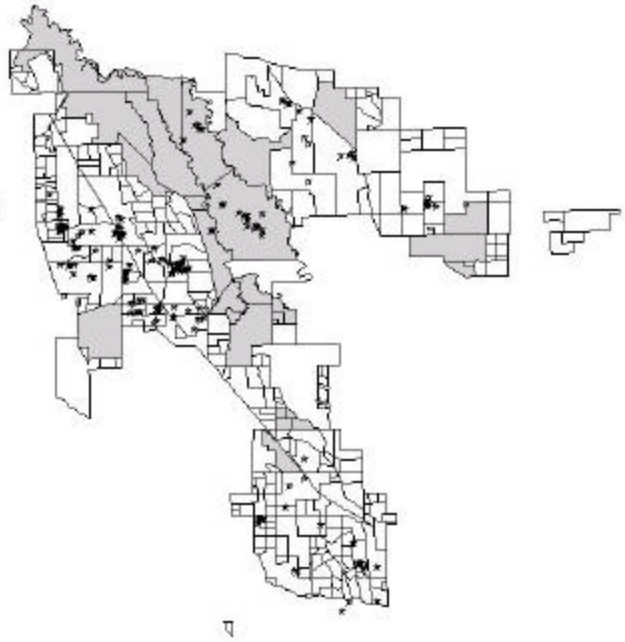
Posthunt Grassland Ecological Area night locations of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



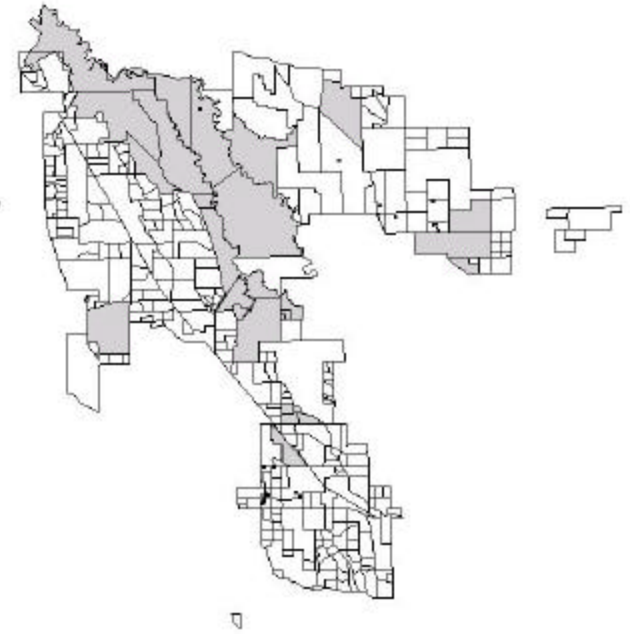
- Radio-tagged in September in North and South Grasslands
- ☆ Radio-tagged in December in San Luis NWR

1998-99



- Radio-tagged in September in North and South Grasslands and Mendota WA
- ☆ Radio-tagged in December in San Luis NWR

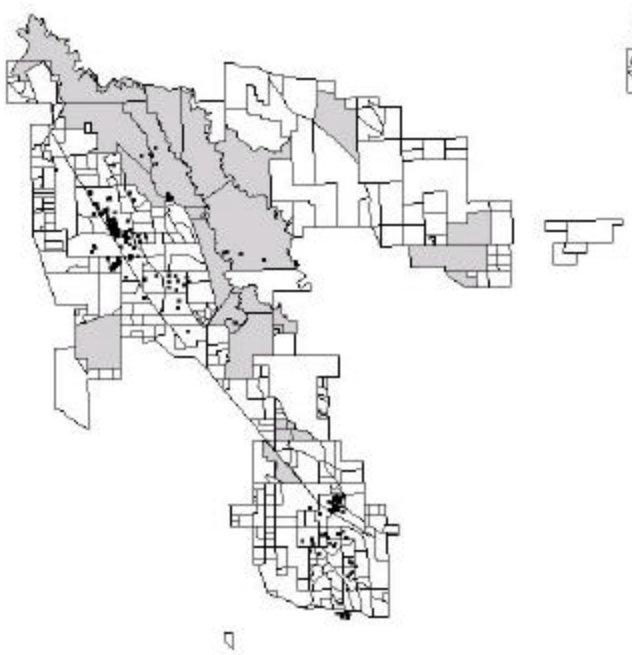
1999-00



- Radio-tagged in September in Grasslands and Mendota WA

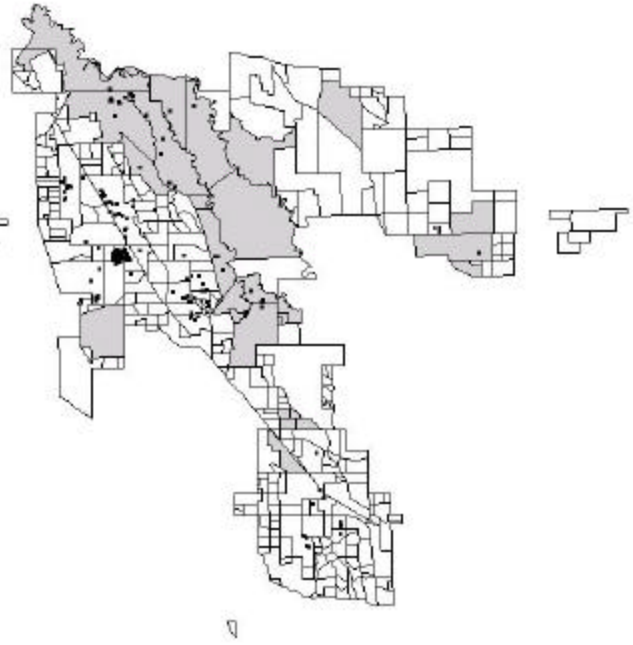
Prehunt Grassland Ecological Area day locations of Green-winged Teal radio - tagged during September in the San Joaquin Valley

1997-1998



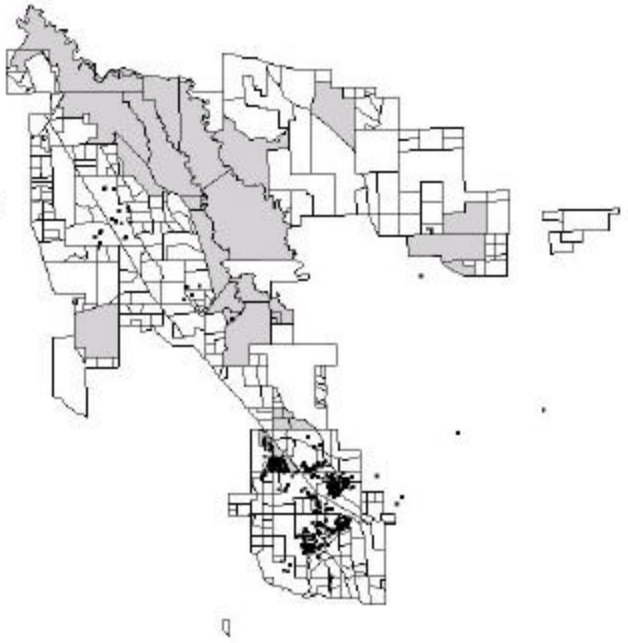
• Radio-tagged in September in North and South Grasslands

1998-99



• Radio-tagged in September in North and South Grasslands and Mendota WA

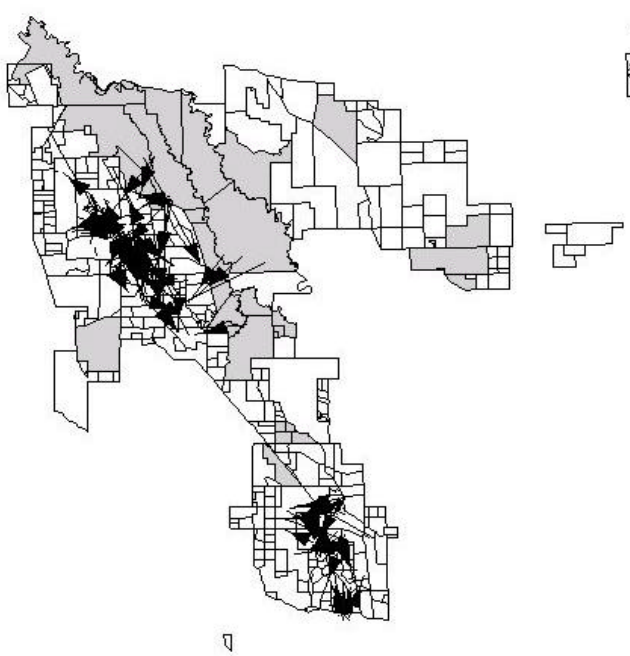
1999-00



• Radio-tagged in September in Grasslands and Mendota WA

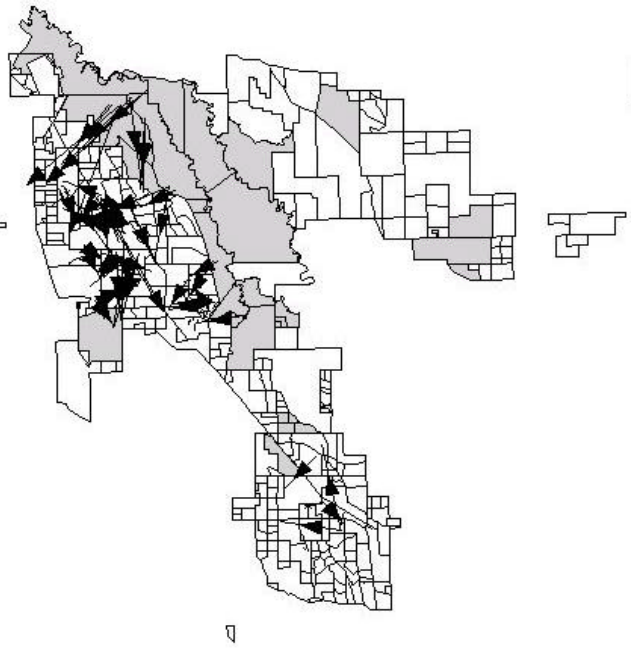
Prehunt Grassland Ecological Area day-night movements of Green-winged Teal radio - tagged during September in the San Joaquin Valley

1997-1998



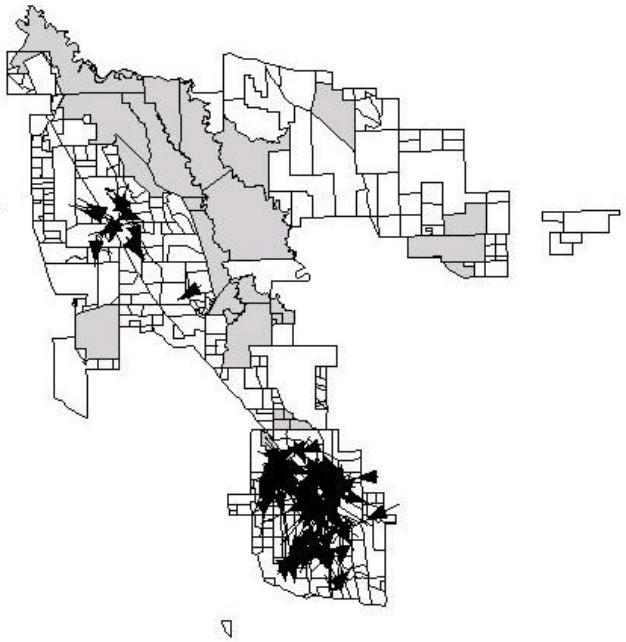
Radio-tagged in September

1998-99



Radio-tagged in September

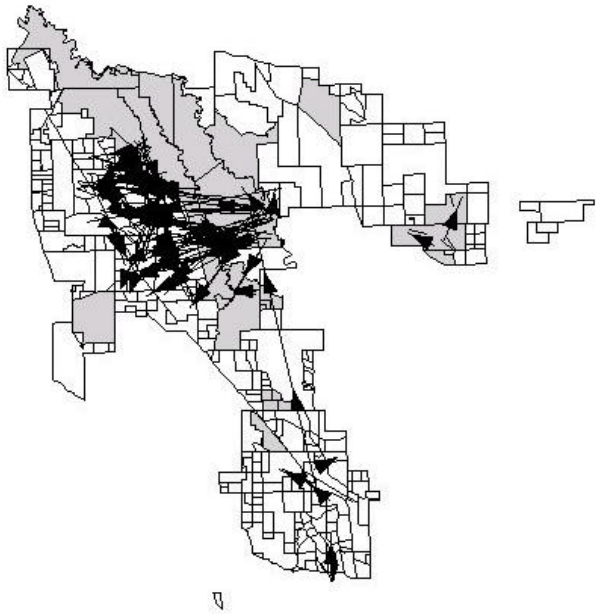
1999-00



Radio-tagged in September

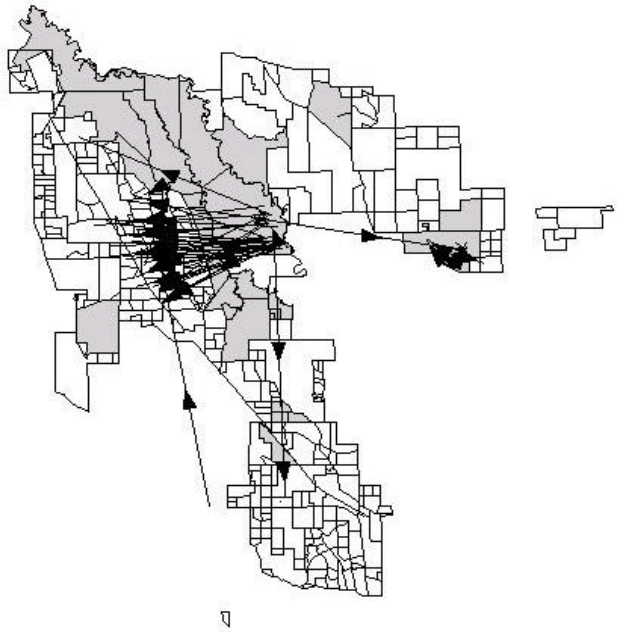
Early hunt Grassland Ecological Area shoot day-night movements of Green-winged Teal radio - tagged during September in the San Joaquin Valley

1997-1998



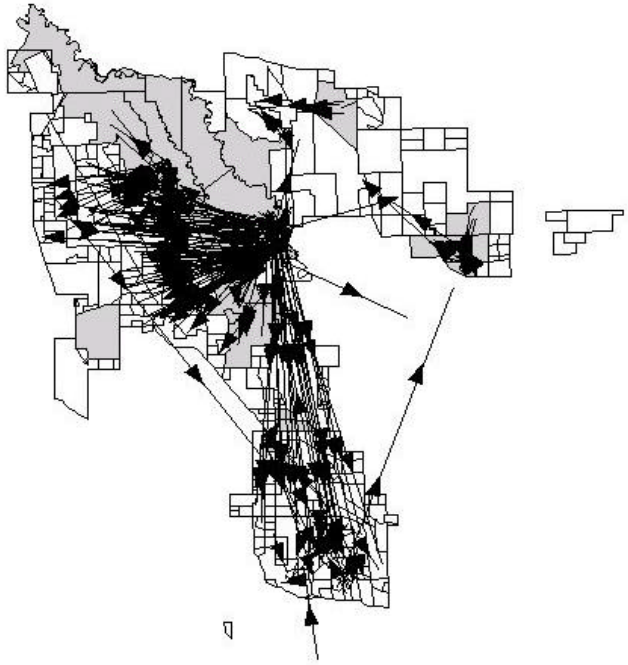
Radio-tagged in September

1998-99



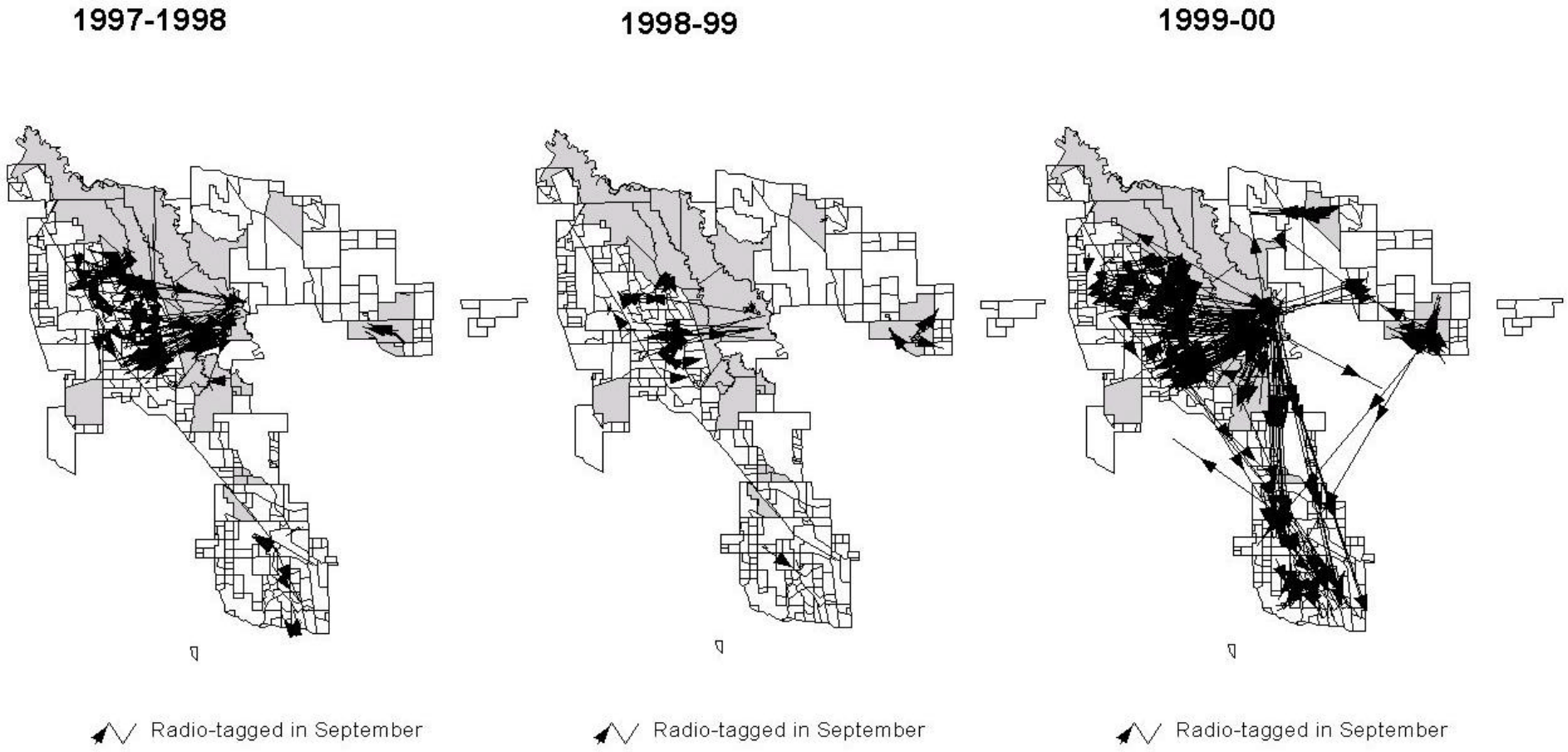
Radio-tagged in September

1999-00



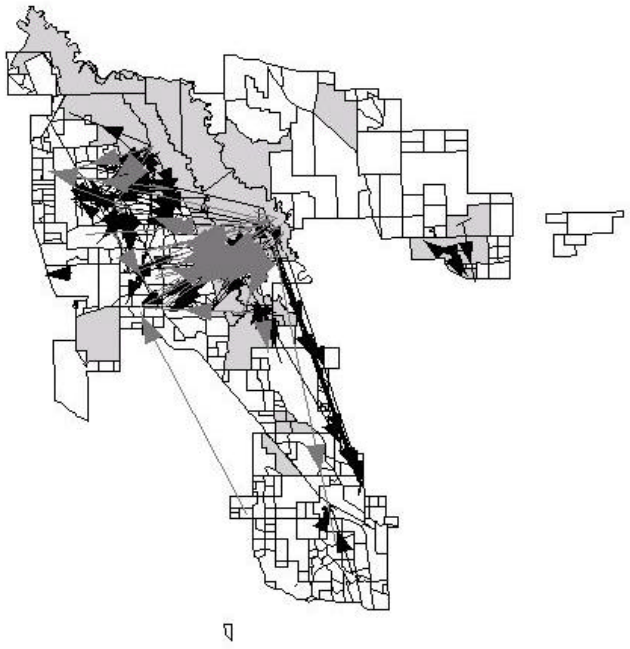
Radio-tagged in September

Early hunt Grassland Ecological Area nonshoot day-night movements of Green-winged Teal radio - tagged during September in the San Joaquin Valley



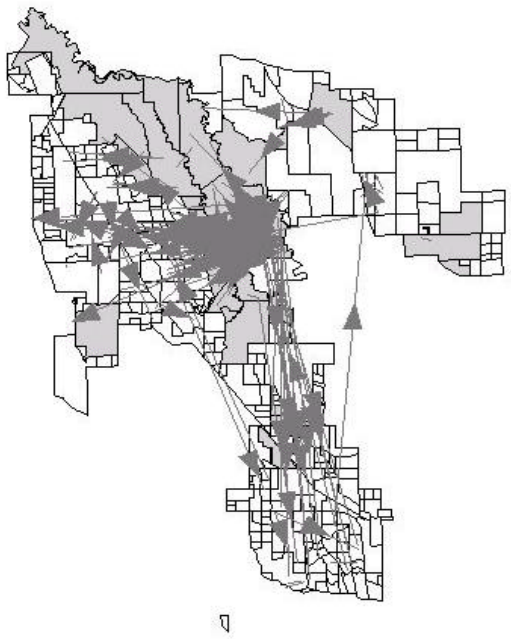
Late hunt Grassland Ecological Area shoot day-night movements of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



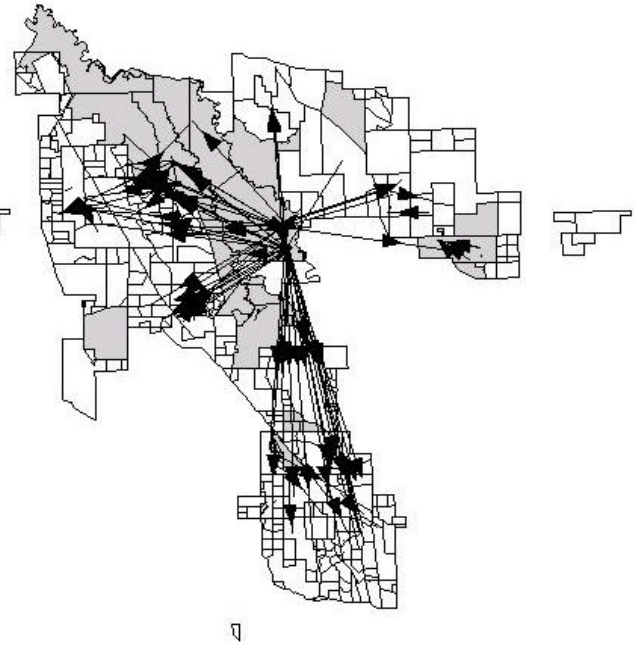
Radio-tagged in September
Radio-tagged in December

1998-99



Radio-tagged in December

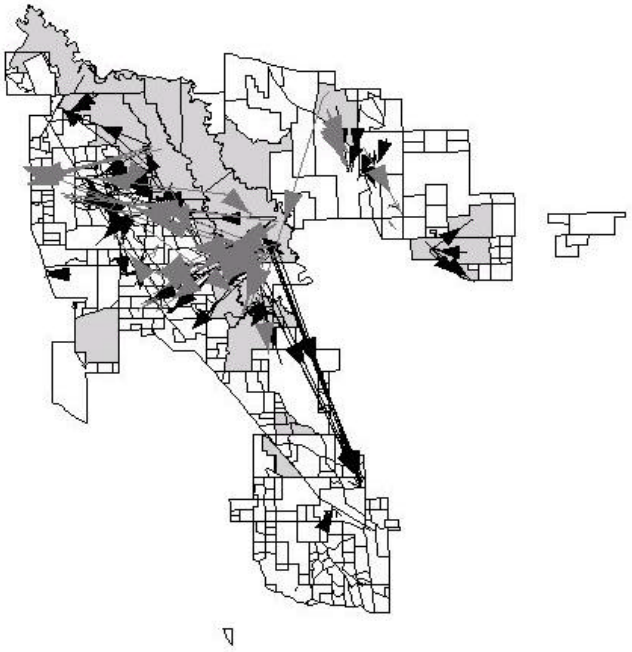
1999-00



Radio-tagged in September

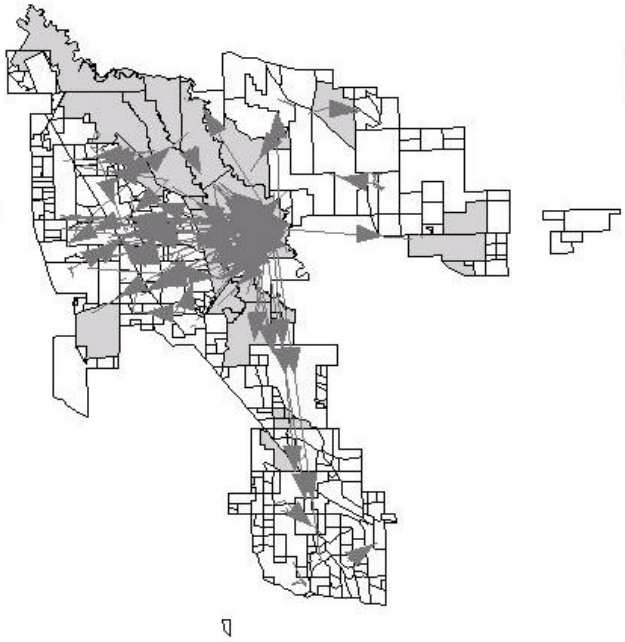
Late hunt Grassland Ecological Area nonshoot day-night movements of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley

1997-1998



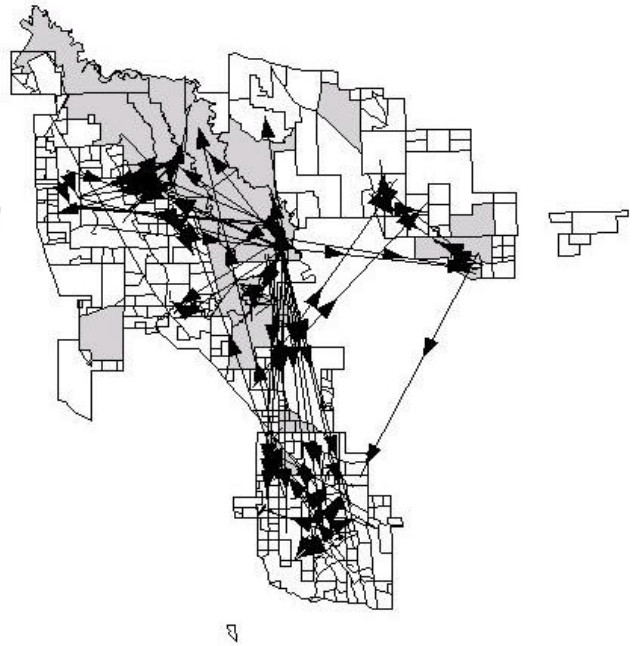
Radio-tagged in September
Radio-tagged in December

1998-99



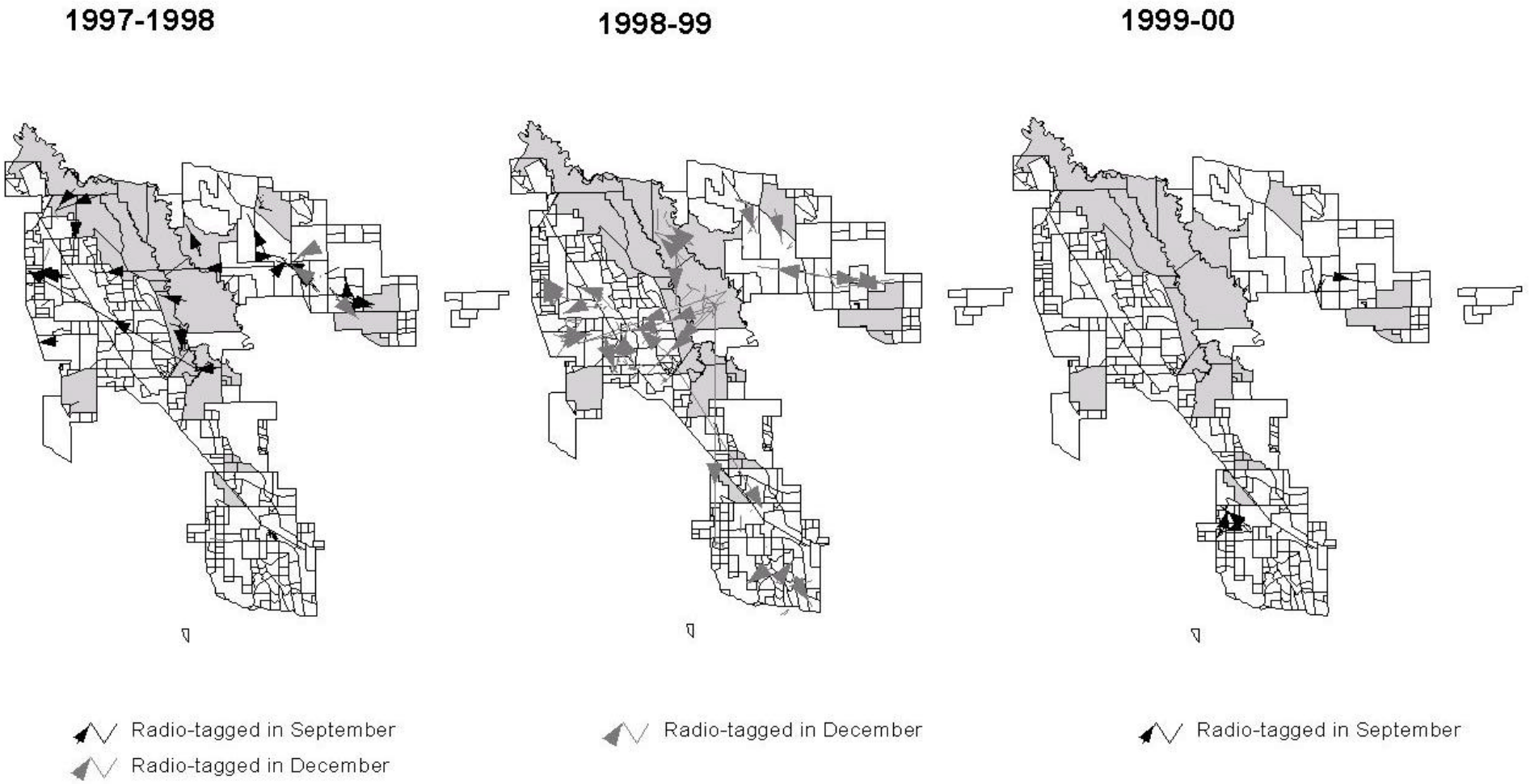
Radio-tagged in December

1999-00

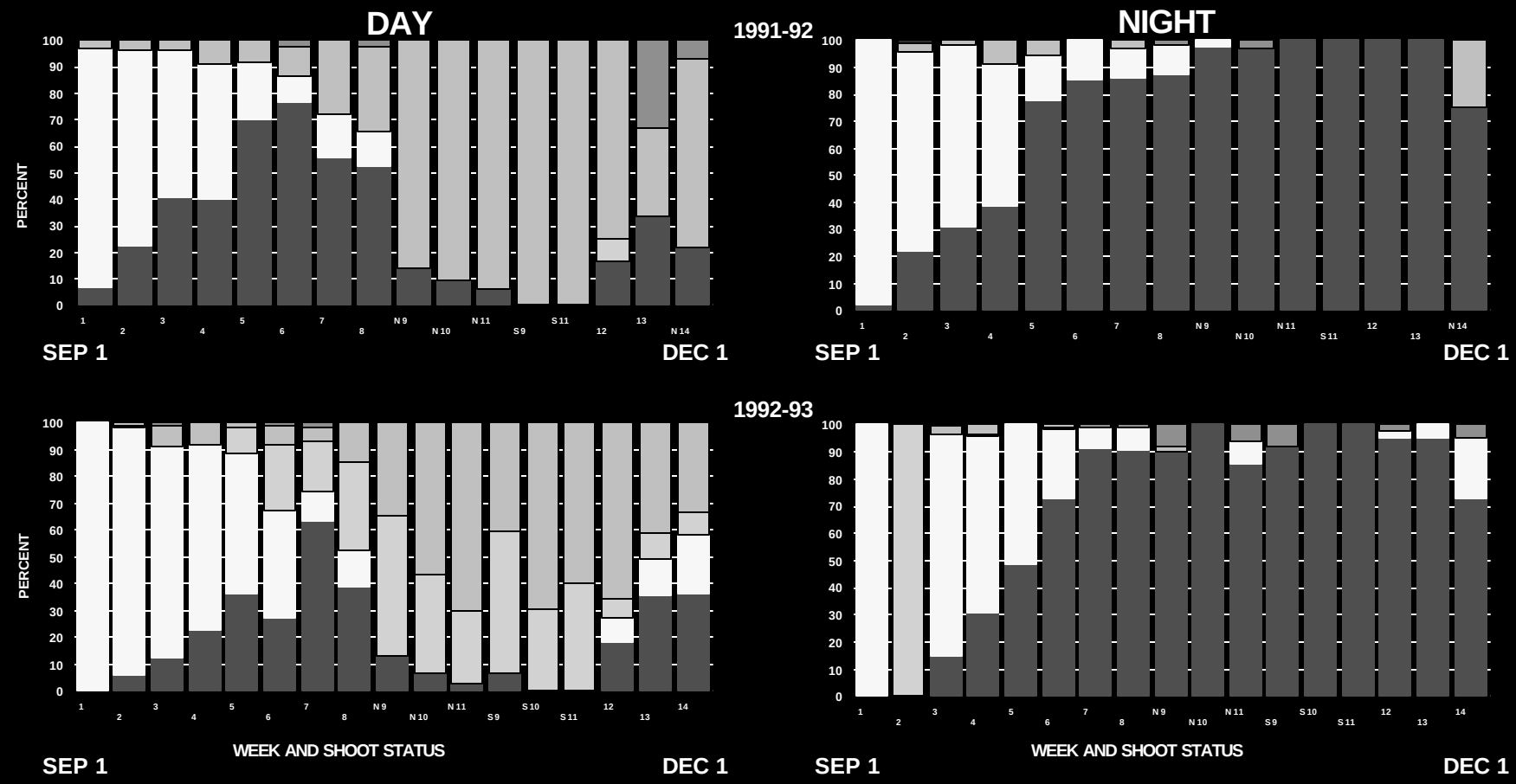


Radio-tagged in September

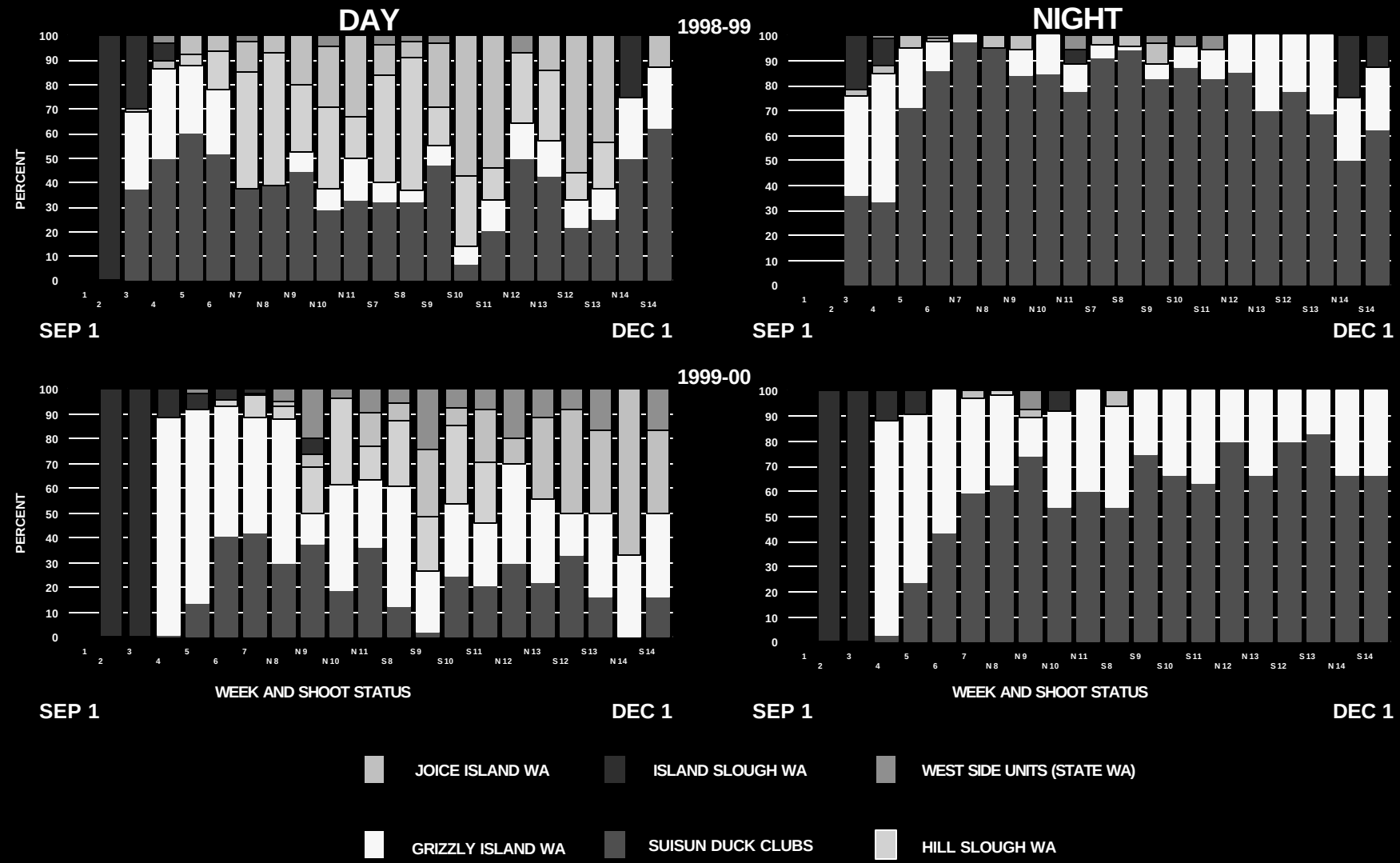
Posthunt Grassland Ecological Area day-night movements of Green-winged Teal radio - tagged during September and December in the San Joaquin Valley



ADULT FEMALE NORTHERN PINTAIL DISTRIBUTION IN THE SUISUN MARSH
1991-92, 1992-93



ADULT FEMALE NORTHERN PINTAIL DISTRIBUTION IN THE SUISUN MARSH
1998-99, 1999-00



Adult Female Pintail Daytime Locations
Suisun Marsh 1991-93, 1998-00

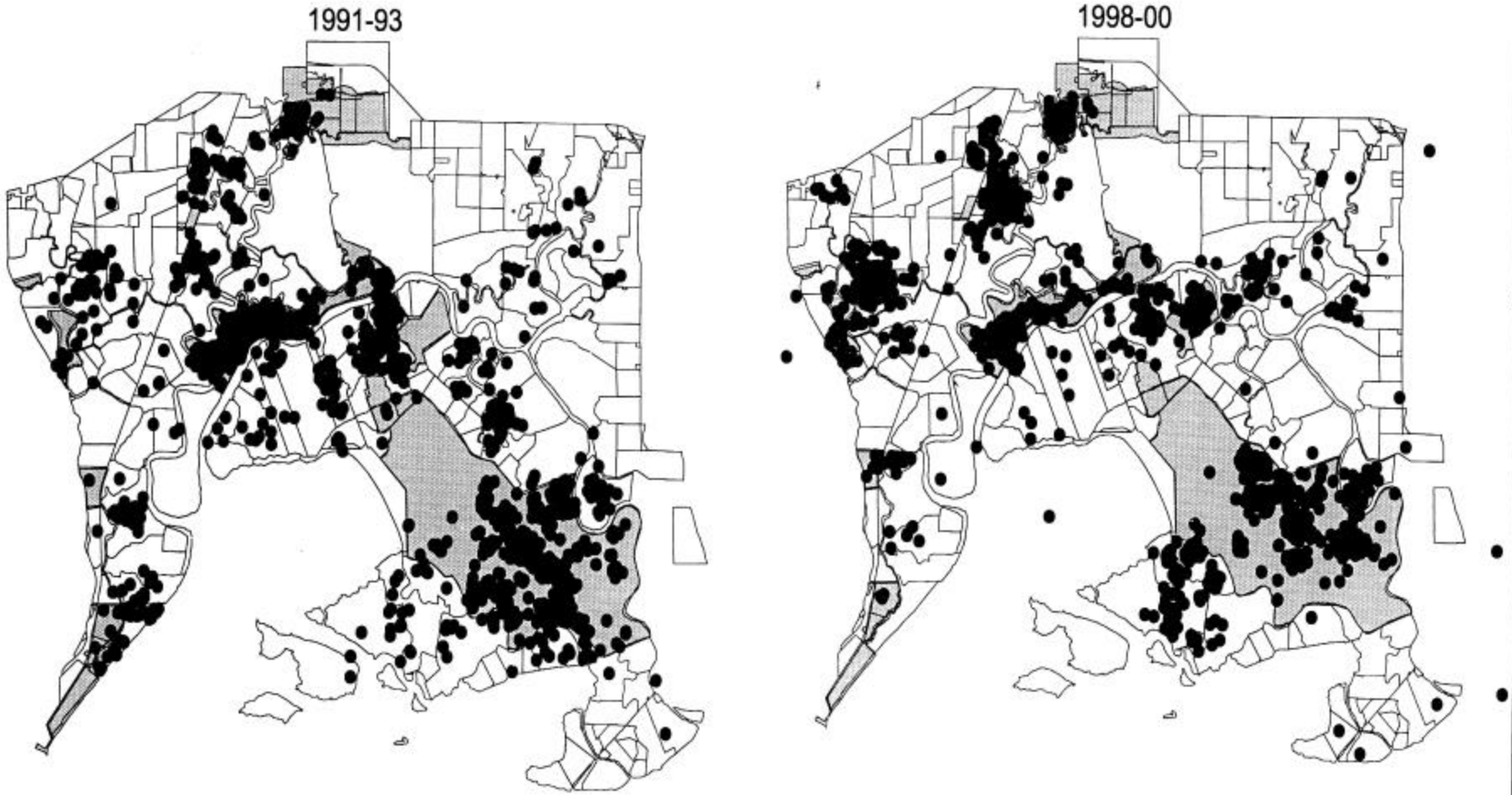


Figure 56

Adult Female Pintail Nighttime Locations
Suisun Marsh 1991-93, 1998-00

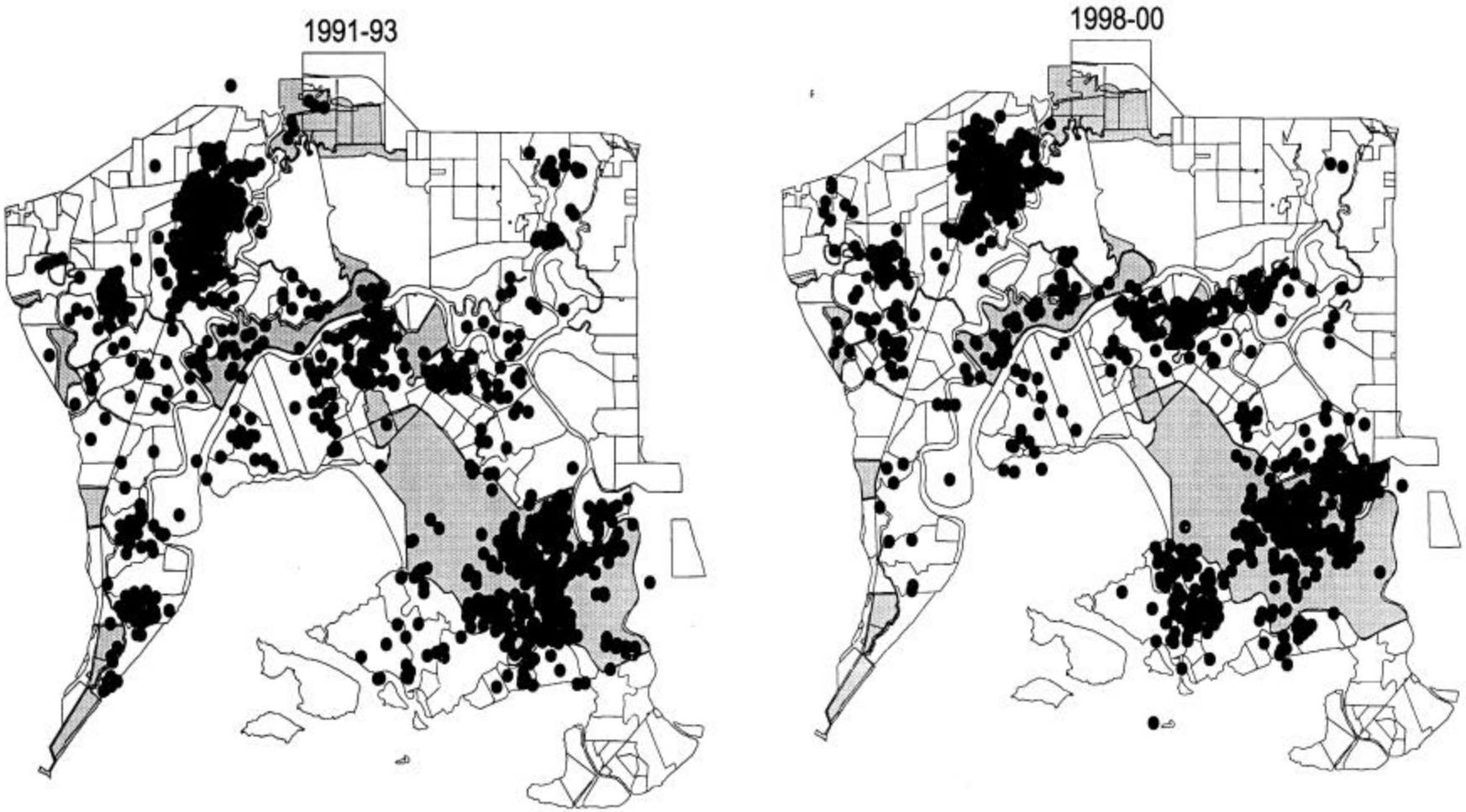
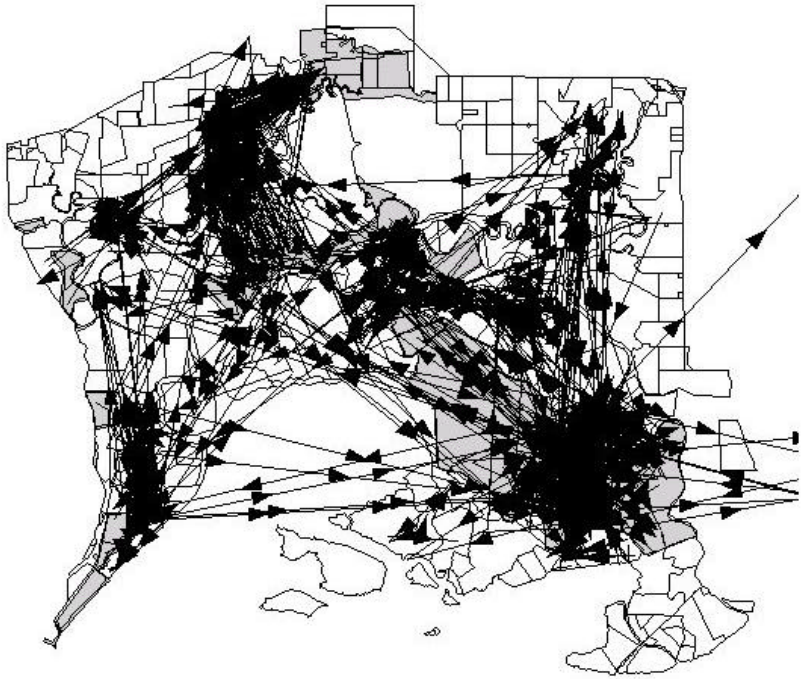


Figure 57

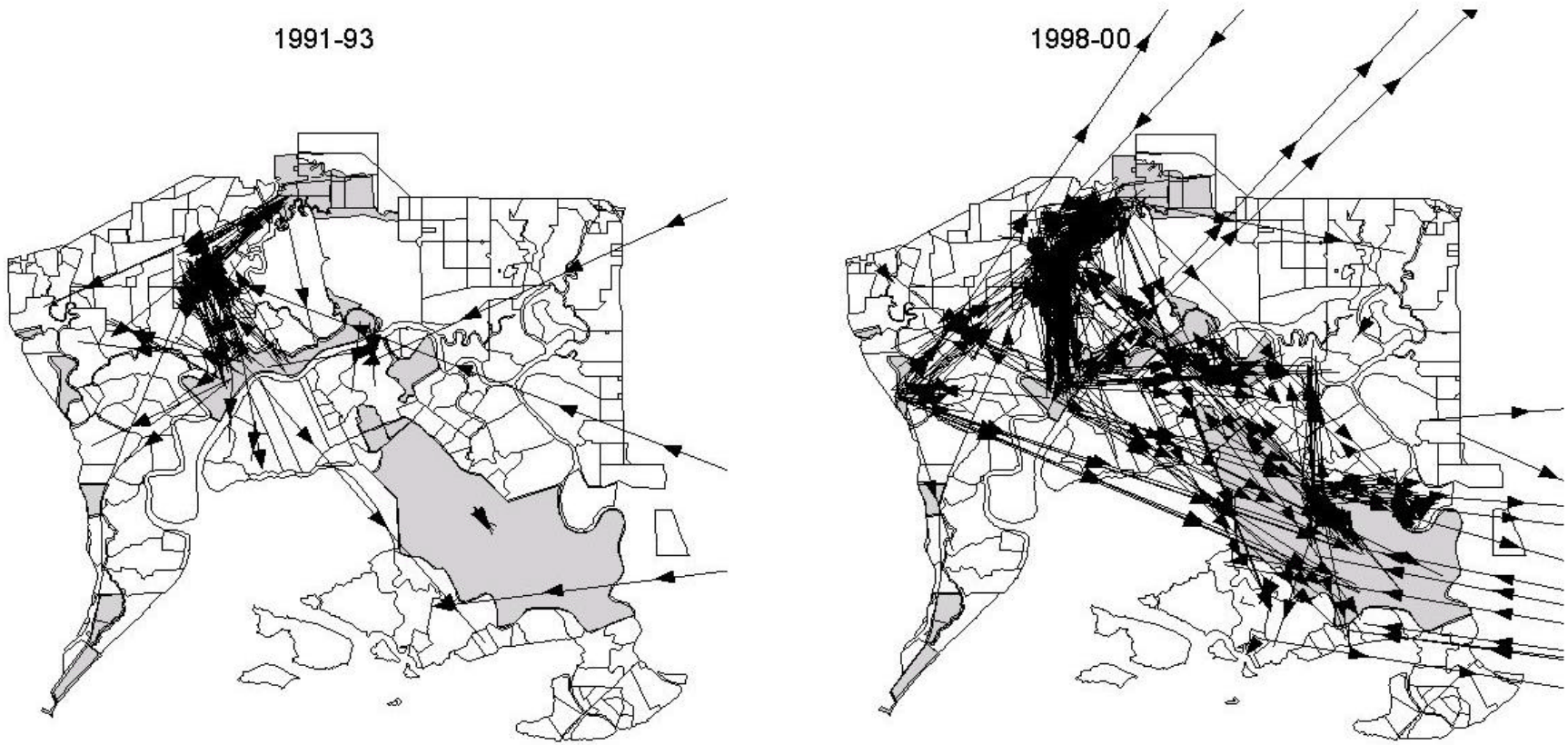
Prehunt Suisun Marsh day-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

1991-93

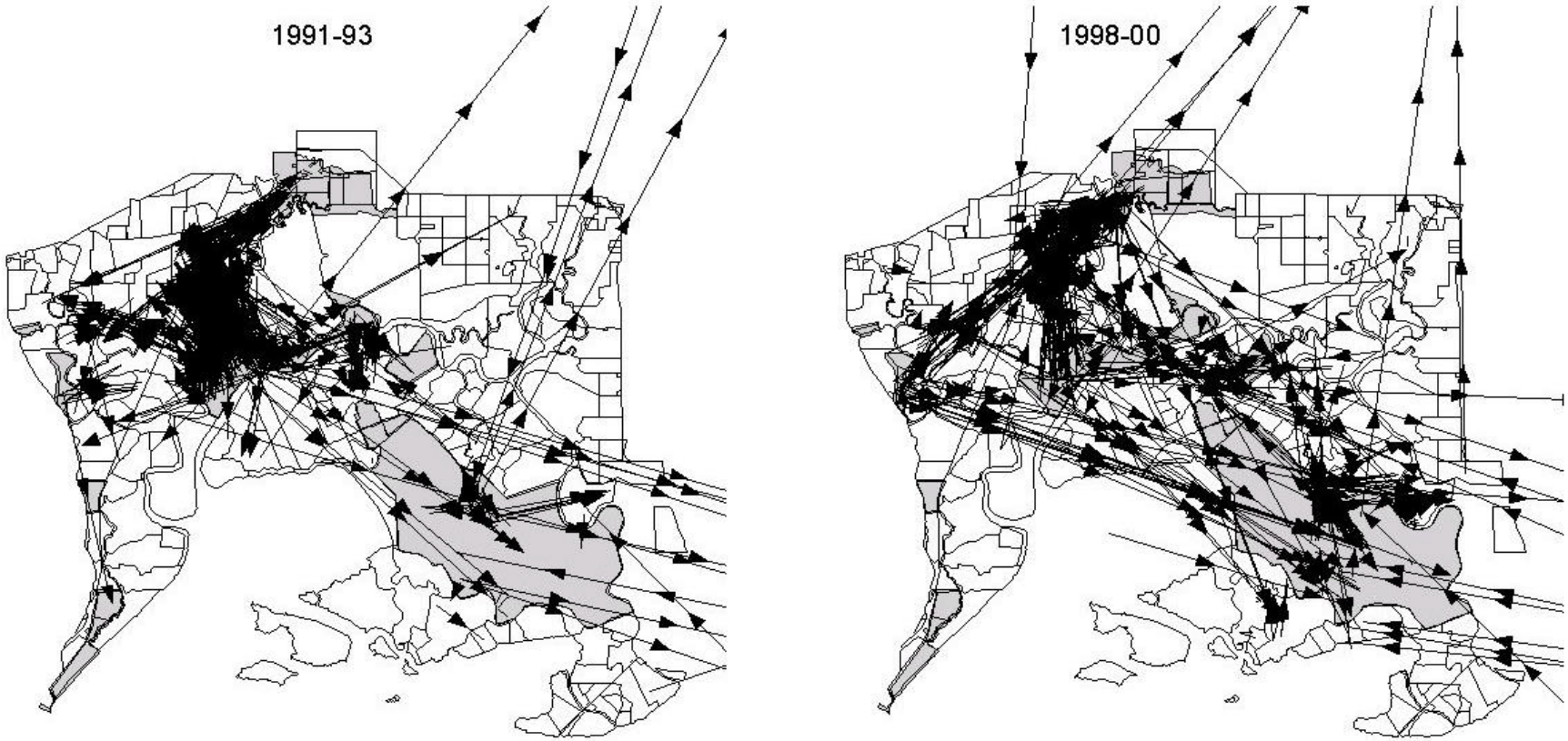


1998-00

Hunt Suisun Marsh shootday-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

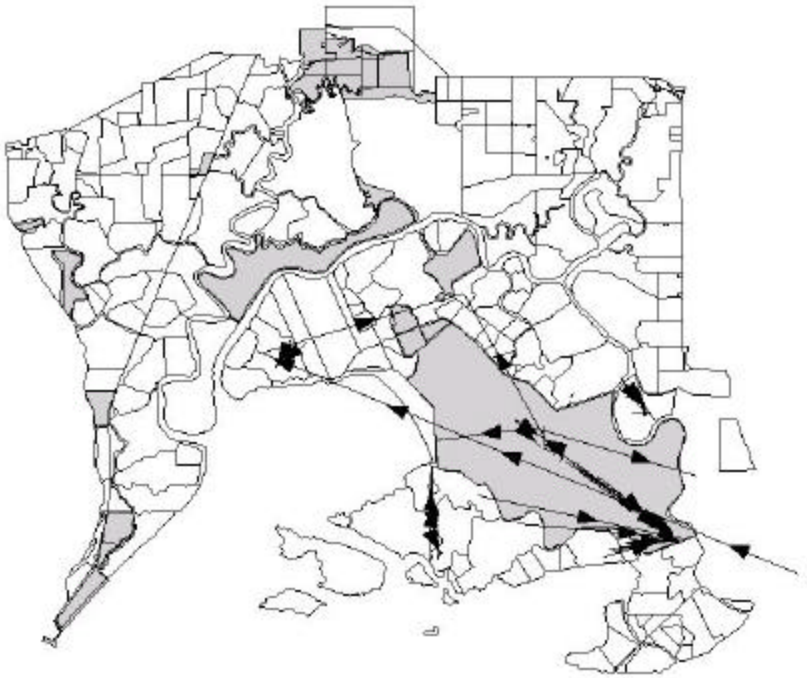


Hunt Suisun Marsh nonshootday-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

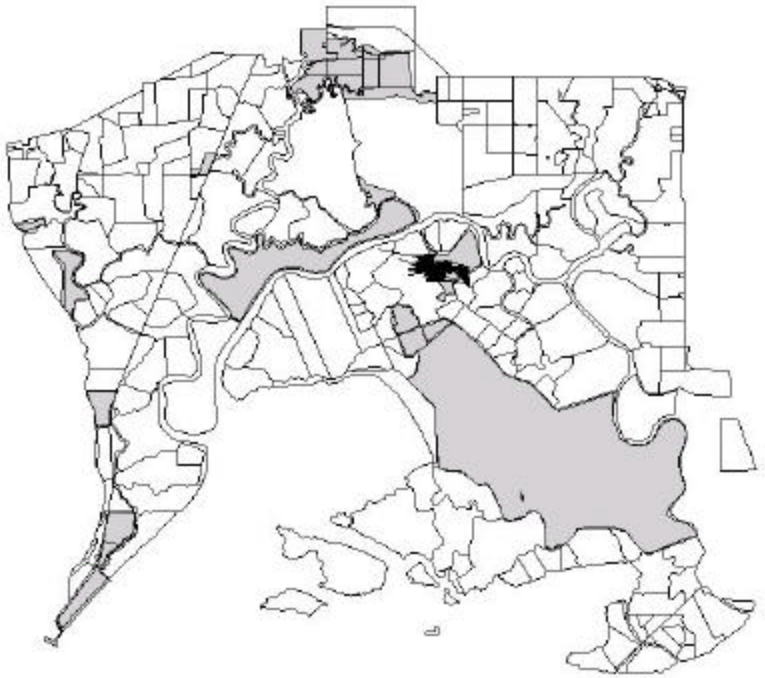


Posthunt Suisun Marsh day-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

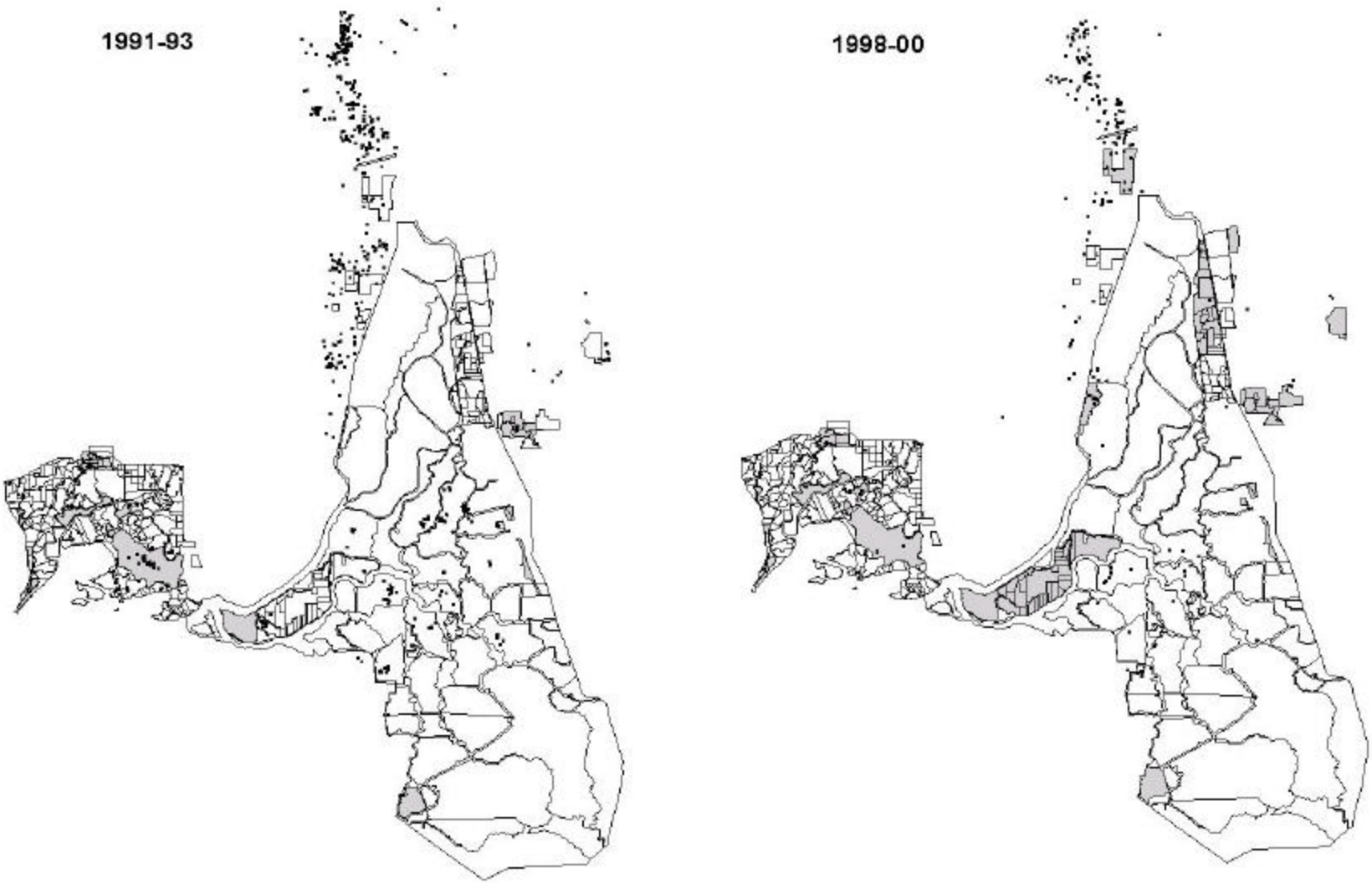
1991-93



1998-00

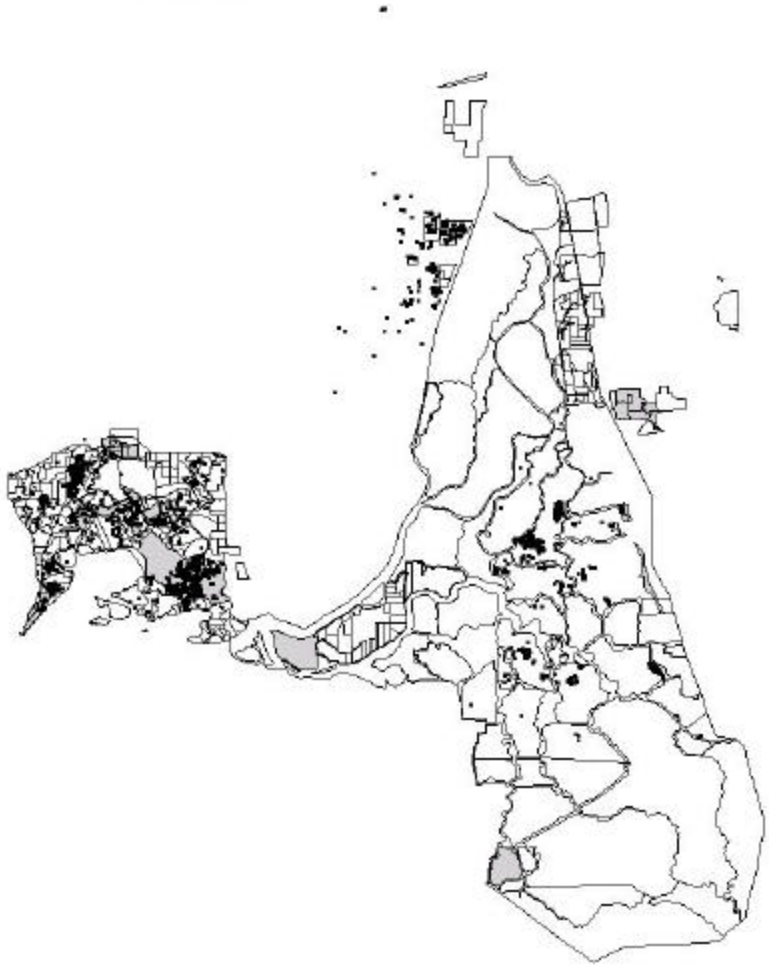


Posthunt Delta Region day locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

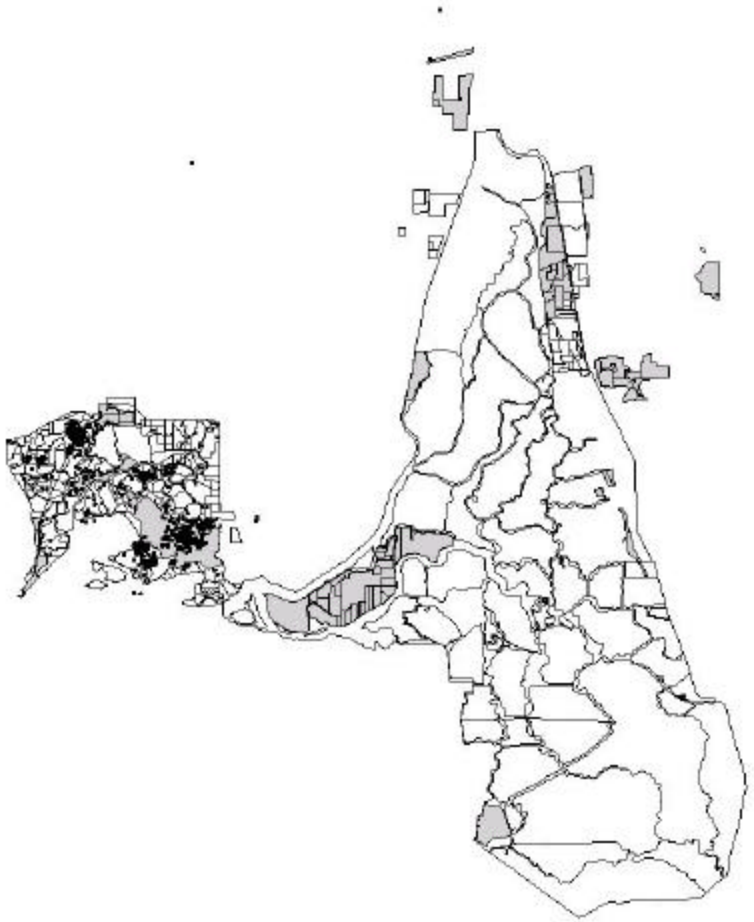


Prehunt Delta Region night locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

1991-93

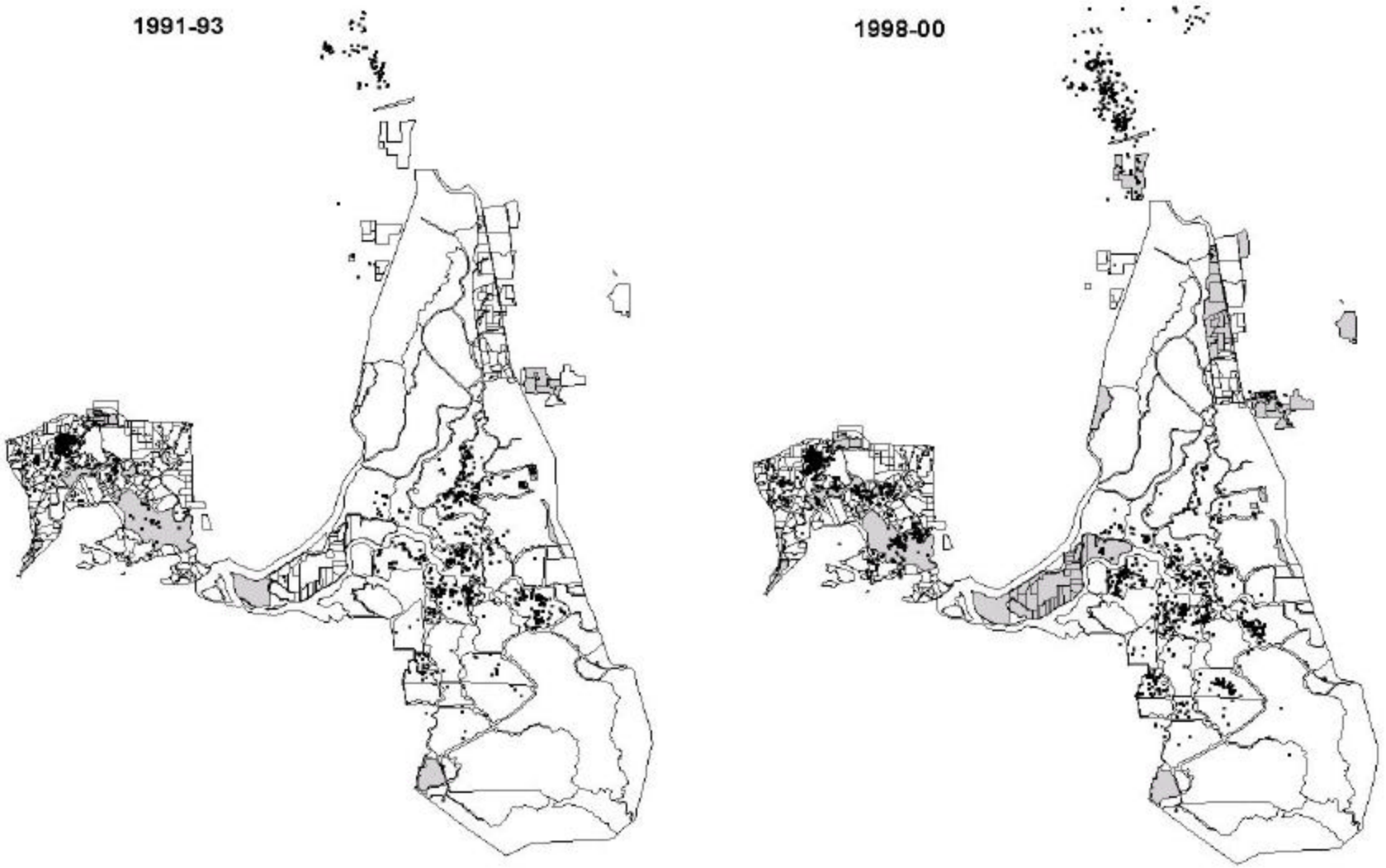


1998-00

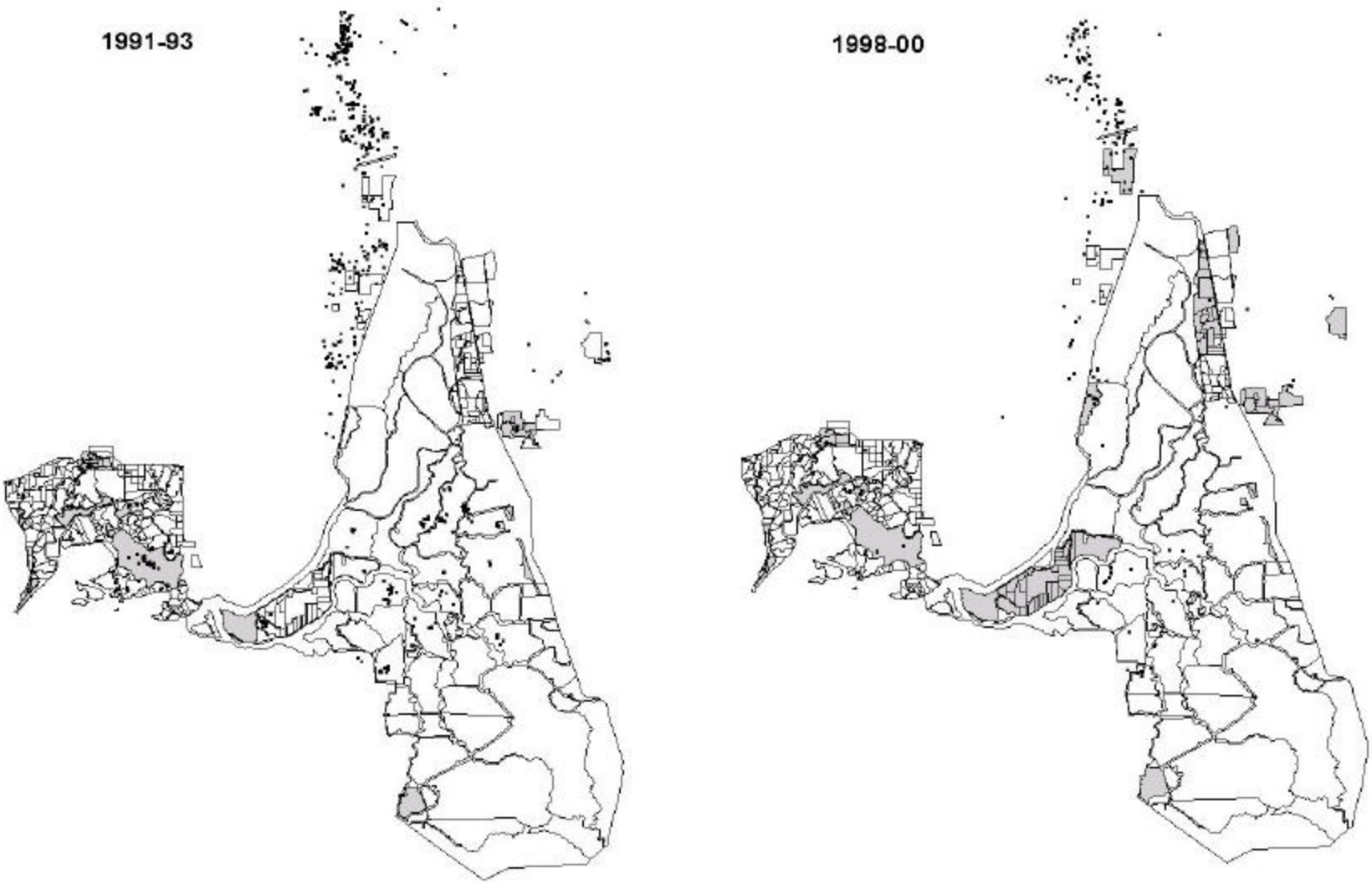


Hunt Delta Region day locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

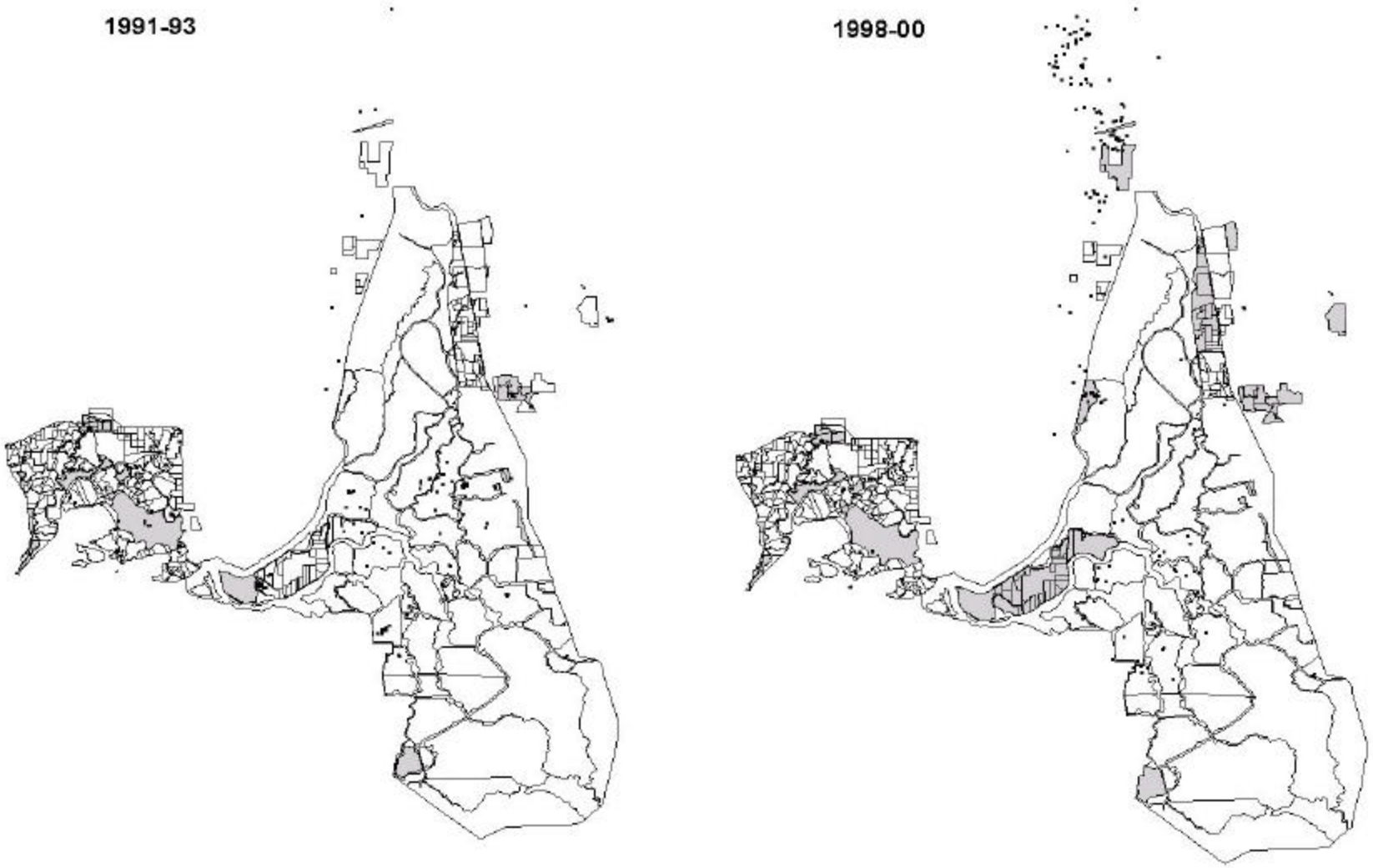
Hunt Delta Region night locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley



Posthunt Delta Region day locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

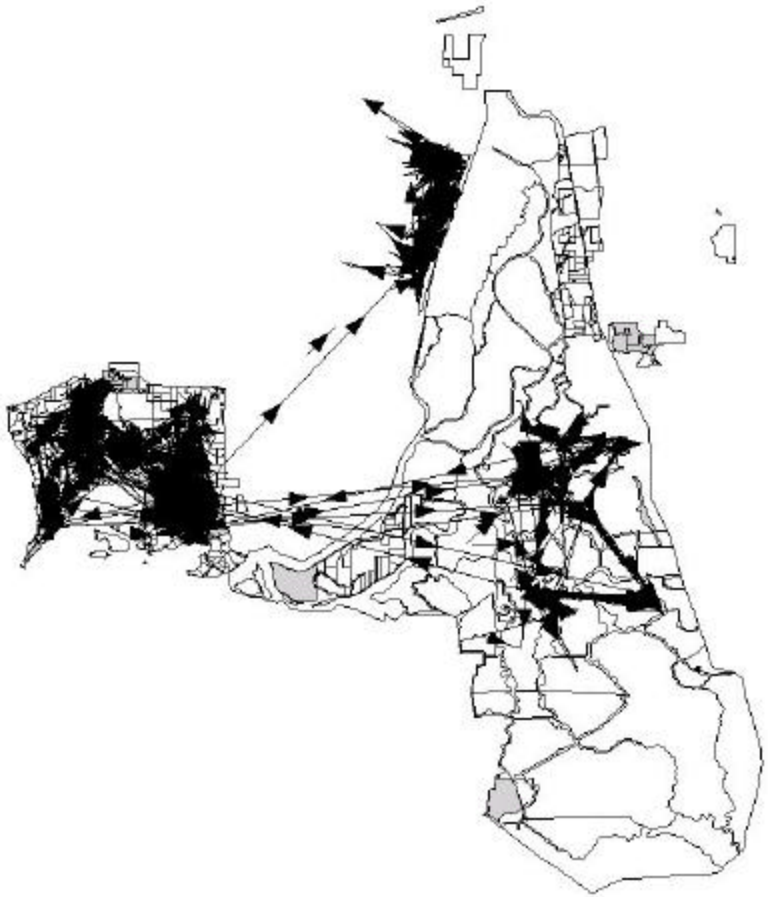


Posthunt Delta Region night locations of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

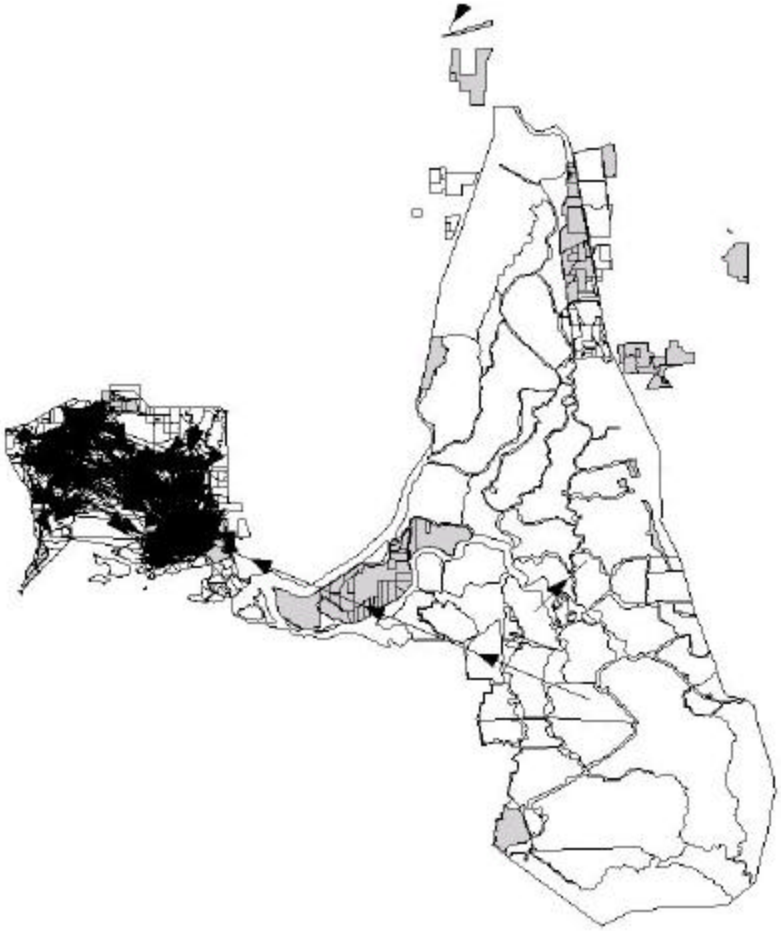


Prehunt Delta Region day-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

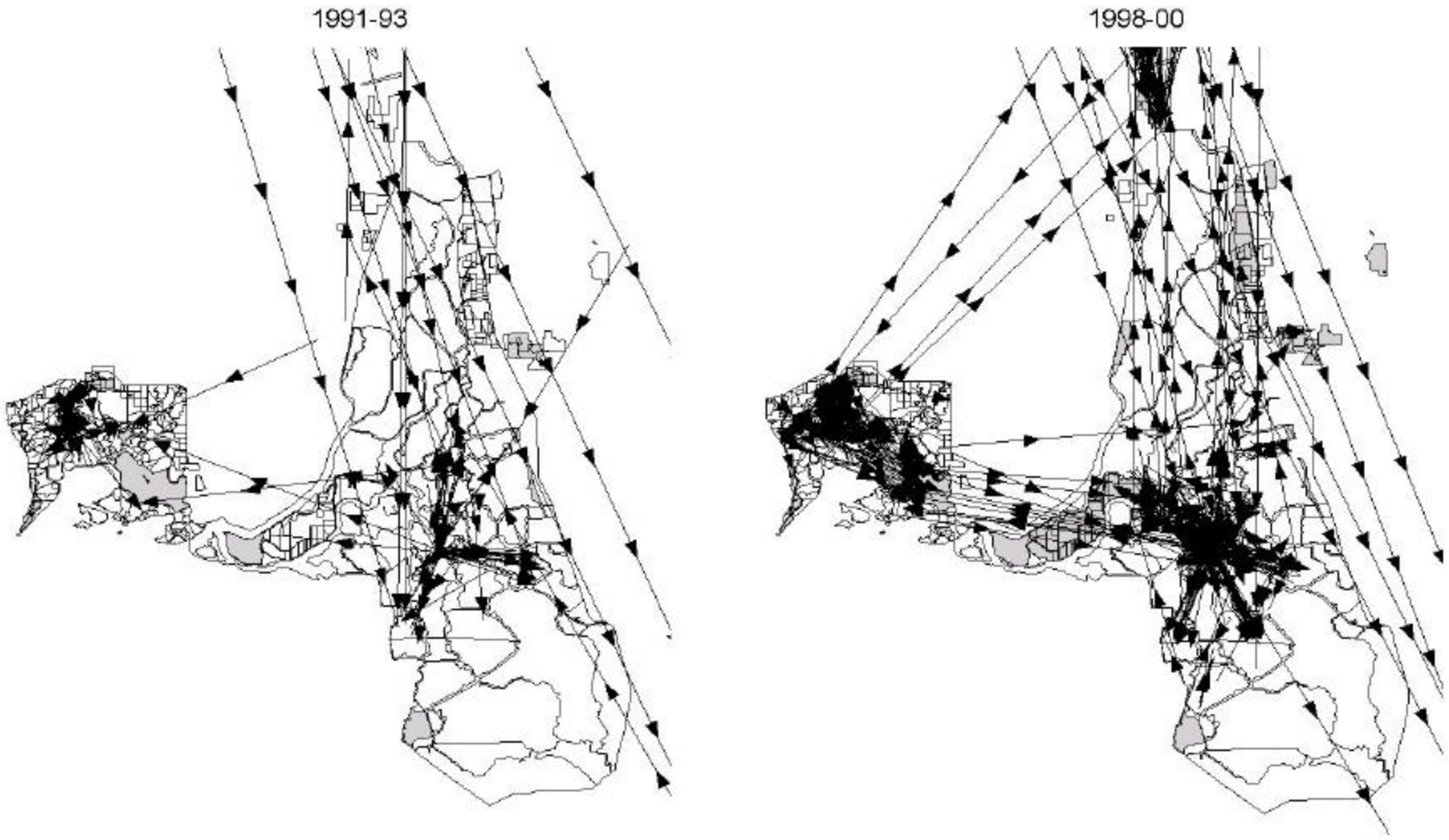
1991-93



1998-00

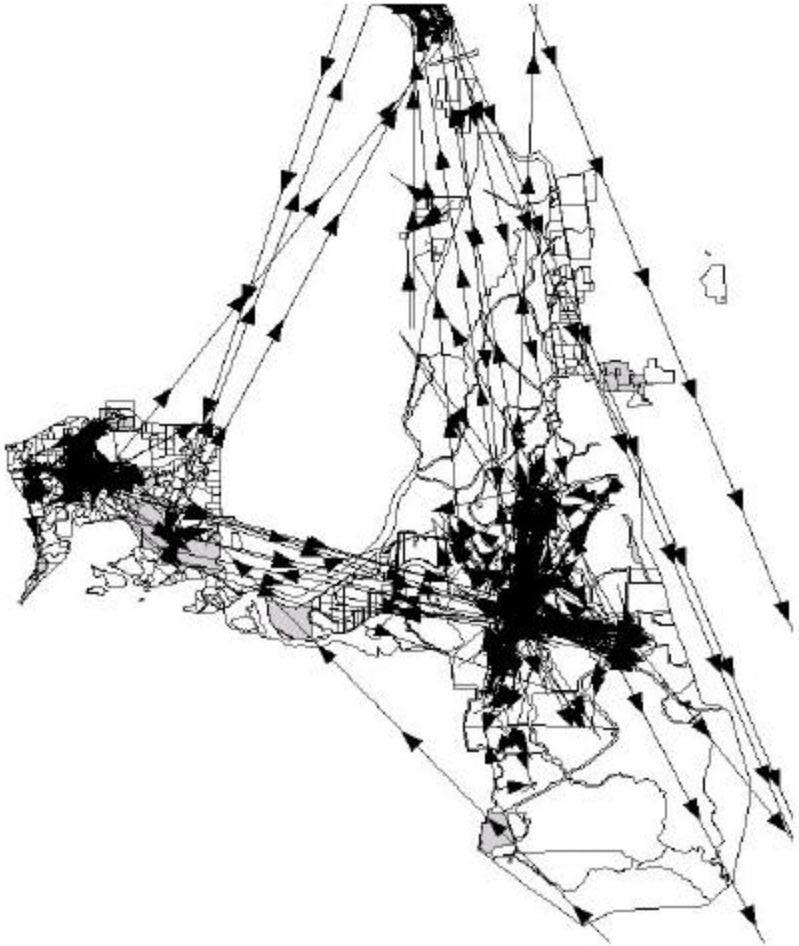


Hunt Delta Region shootday-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

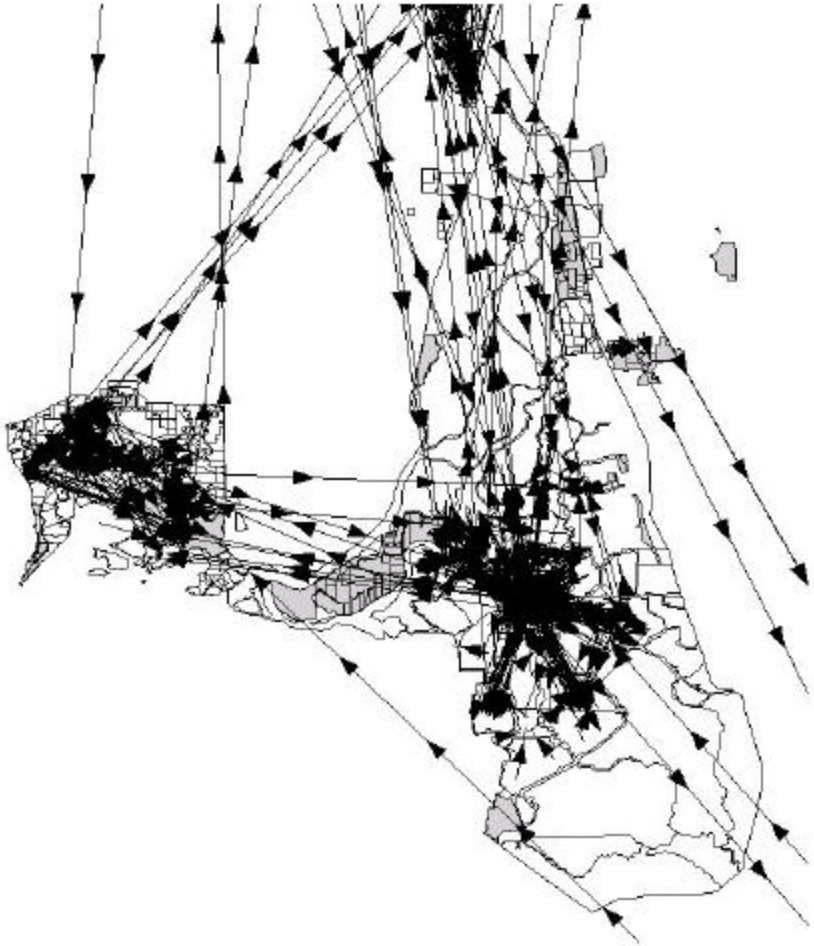


Hunt Delta Region nonshootday-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

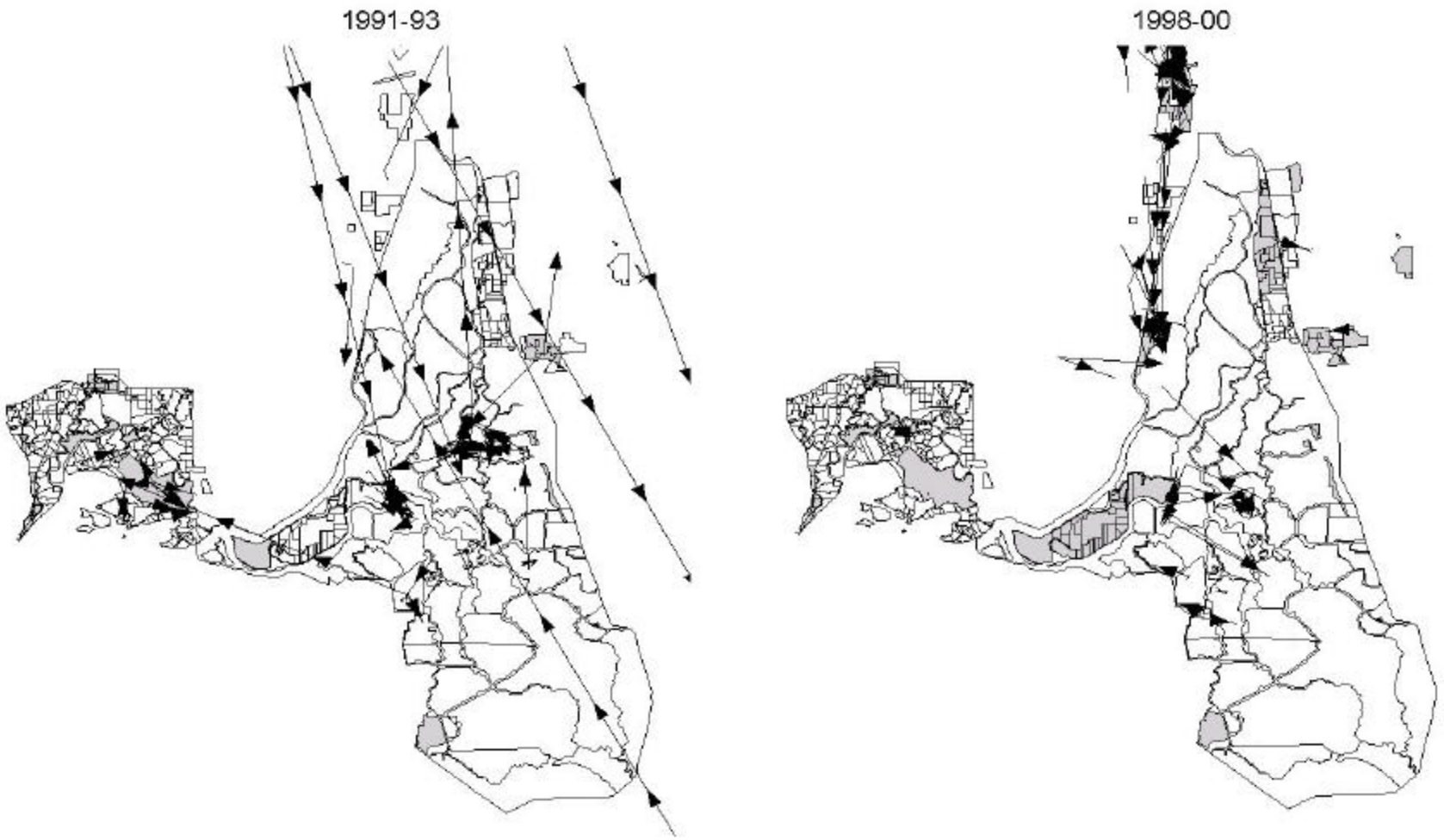
1991-93



1998-00

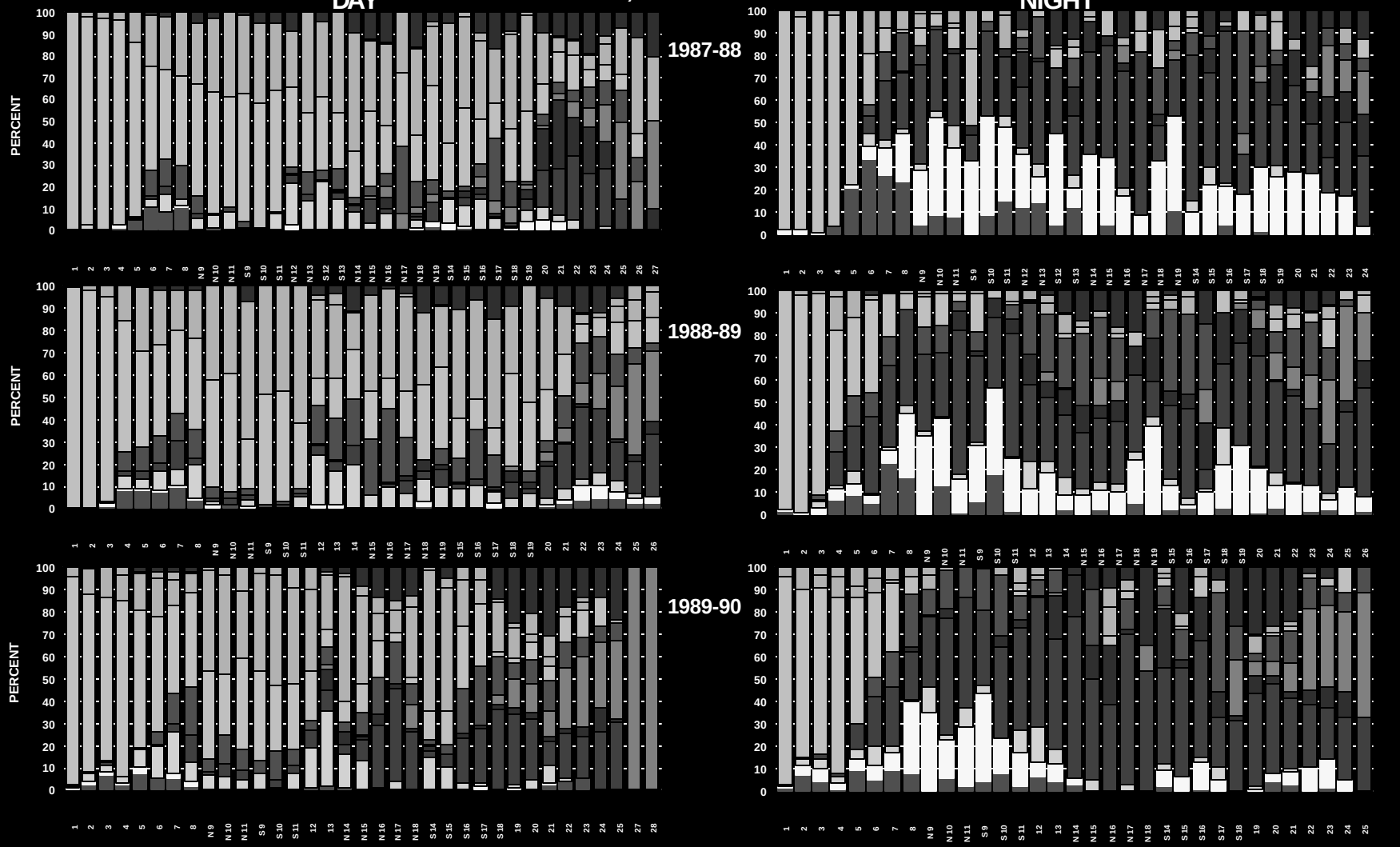


Posthunt Delta Region day-night movements of adult female pintails radio-tagged during August-October in the Suisun Marsh and San Joaquin Valley

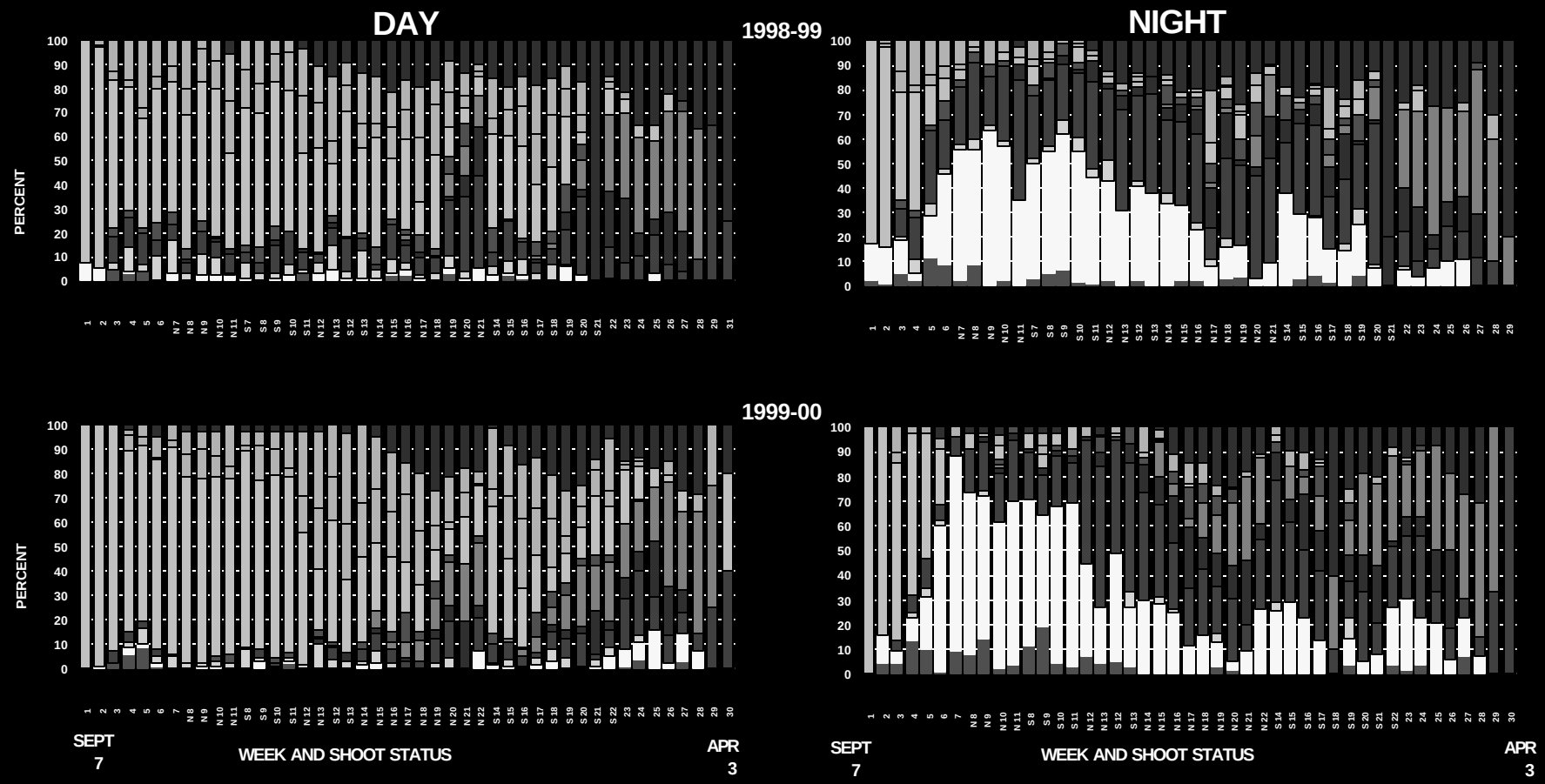


DISTRIBUTION OF ADULT FEMALE PINTAILS RADIO-TAGGED IN THE SACRAMENTO VALLEY AMONG SACRAMENTO VALLEY AREAS AND THE YOLO-DELTA-SUISUN REGION

1987-88, 1988-89 & 1989-90



DISTRIBUTION OF ADULT FEMALE PINTAILS RADIO-TAGGED IN THE SACRAMENTO VALLEY AMONG SACRAMENTO VALLEY AREAS AND THE YOLO-DELTA-SUISUN REGION 1998-99, 1999-00



COLUSA BASIN NATIONAL WILDLIFE REFUGES (SACRAMENTO, DELEVAN AND COLUSA NWRS)

NWRs, WAs, & NGO AREAS ESTABLISHED IN 1990s (LLANO SECO, UPPER BUTTE CREEK WA, WATTIS)

OTHER BUTTE & SUTTER BASIN NWRs & WAs (GRAYLODGE WA, BUTTE SINK NWR, SUTTER NWR))

LURELINE & WILLOW CR DUCK CLUBS (COLUSA BASIN)

BUTTE SINK DUCK CLUBS

DISTRICT 10 DUCK CLUBS

YOLO BASIN, DELTA & SUISUN MARSH

OTHER CLUBS & PRIVATE LANDS IN MID & UPPER COLUSA BASIN

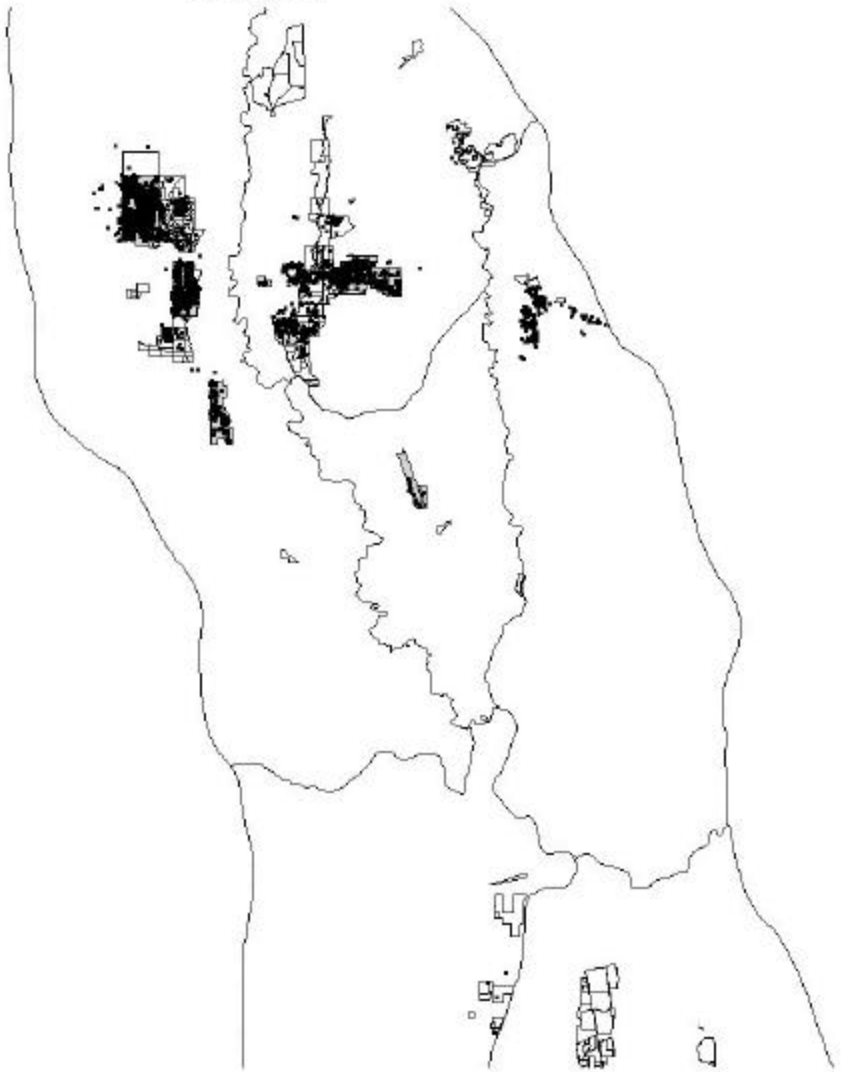
OTHER CLUBS & PRIVATE LANDS IN THE BUTTE BASIN

OTHER CLUBS & PRIVATE LANDS IN THE AMERICAN BASIN

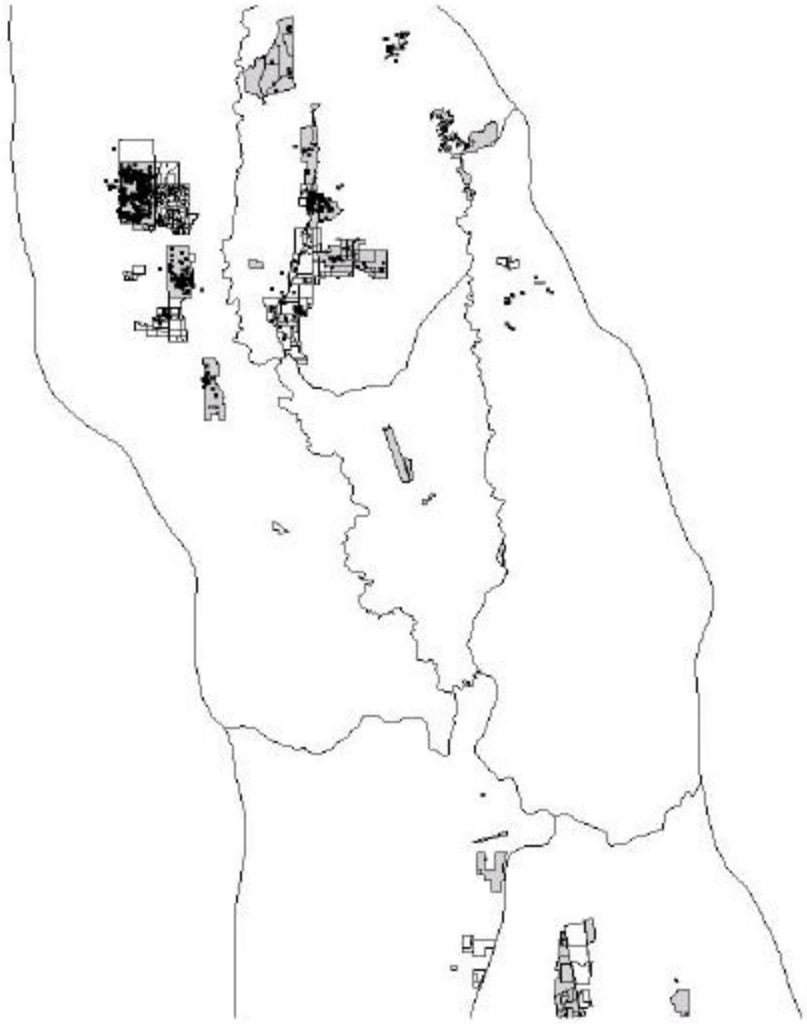
CLUBS & PRIVATE LANDS IN THE SUTTER & LOWER COLUSA BASINS

Prehunt Sacramento Valley day locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

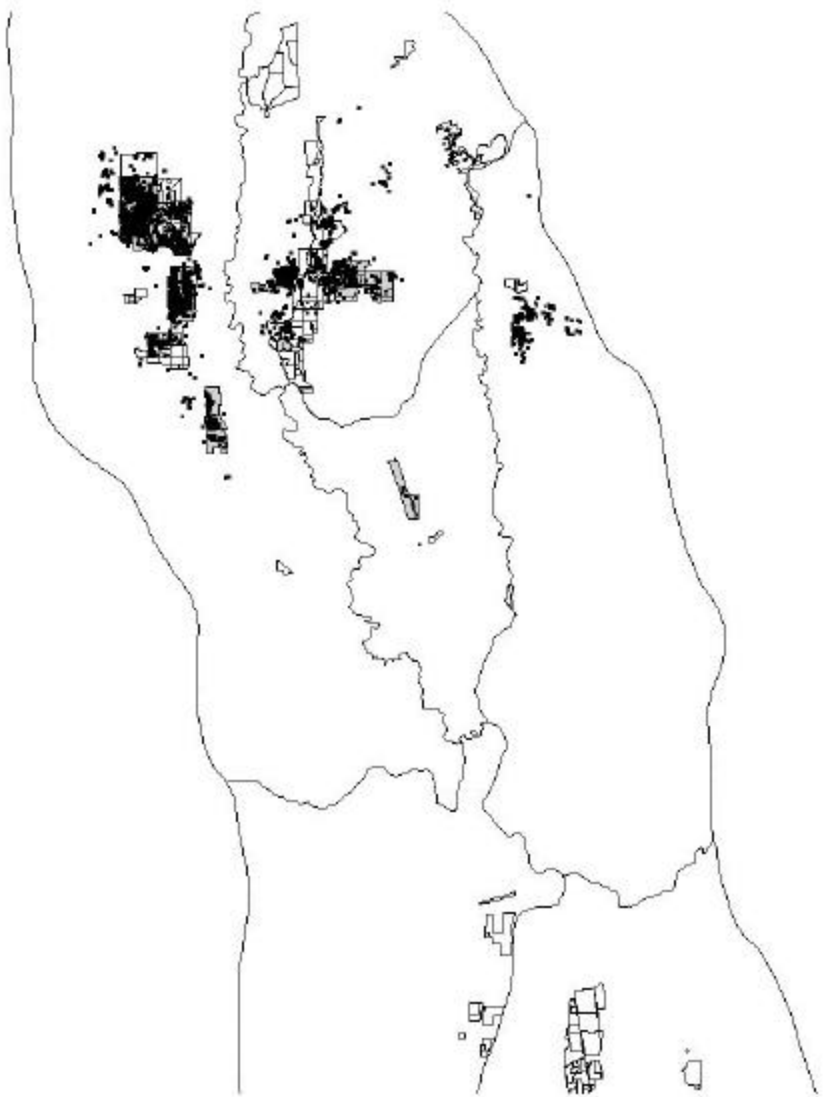


1998-00

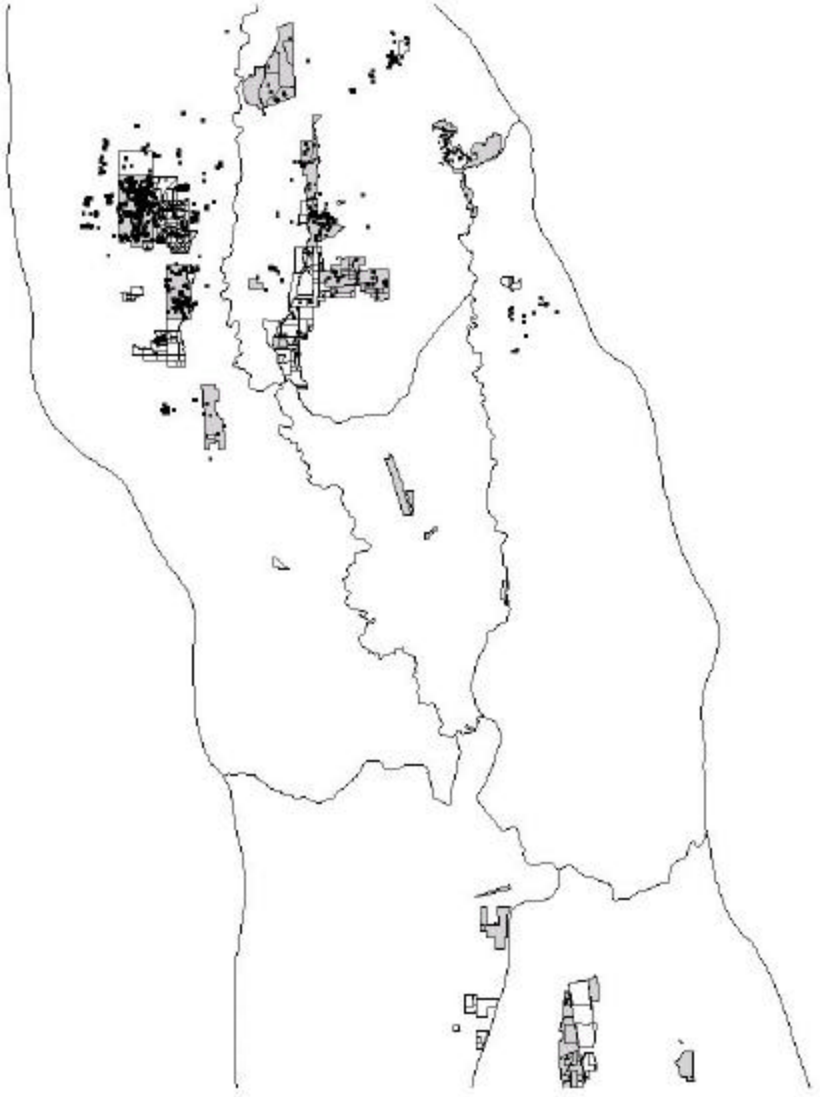


Prehunt Sacramento Valley night locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

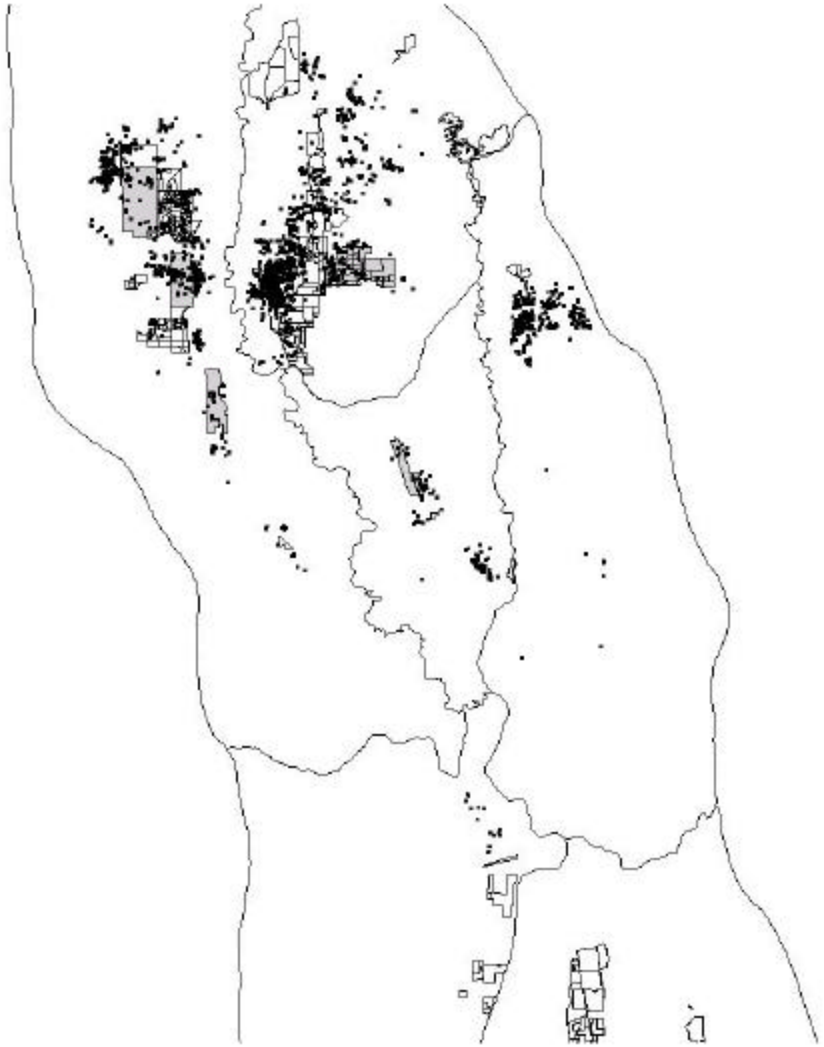


1998-00

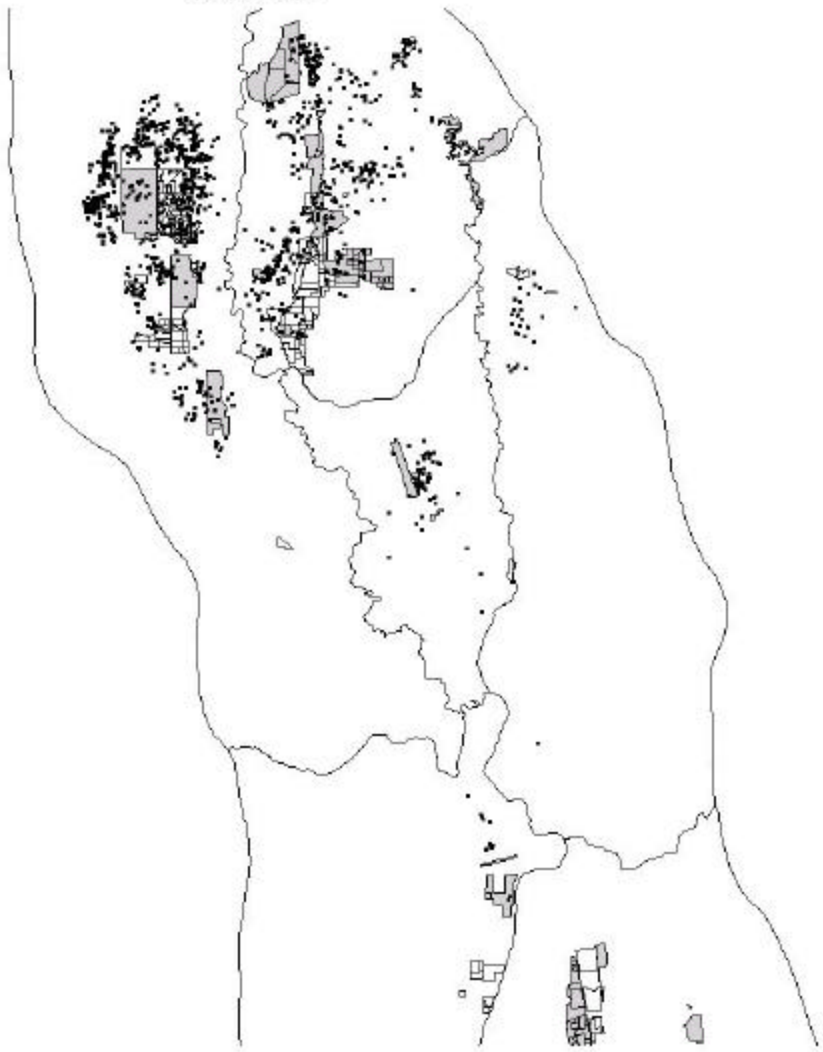


Early hunt Sacramento Valley night locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

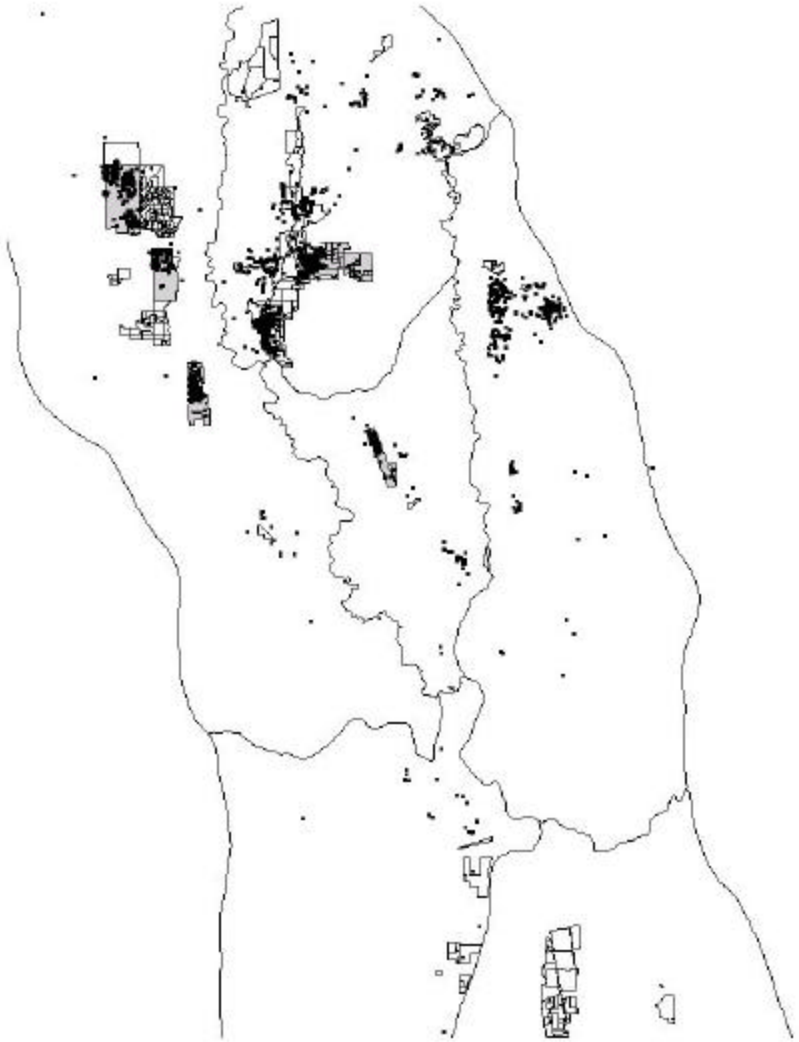


1998-00

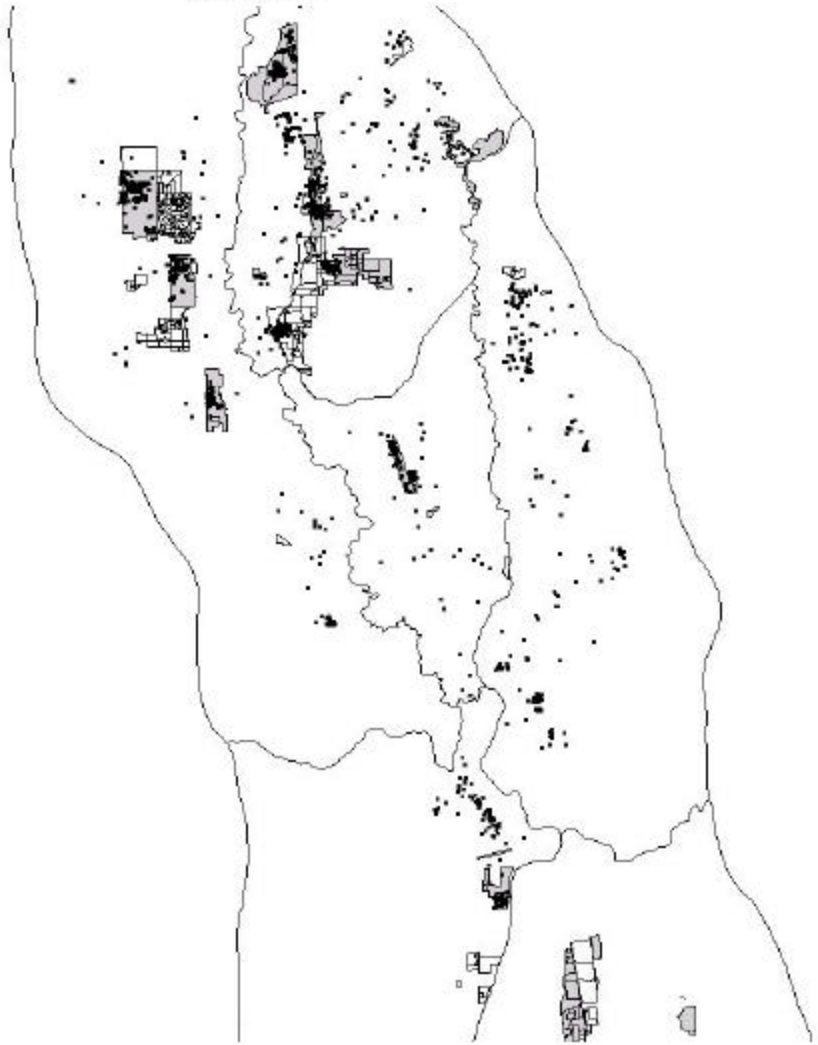


Late hunt Sacramento Valley day locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

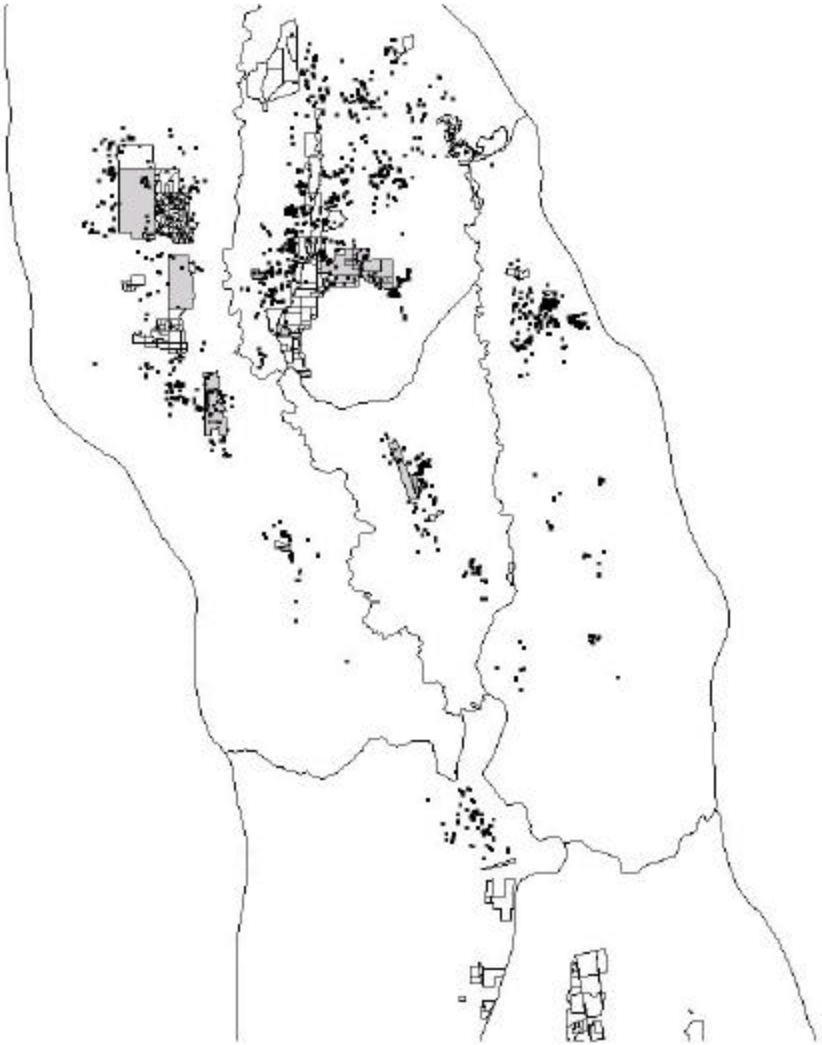


1998-00

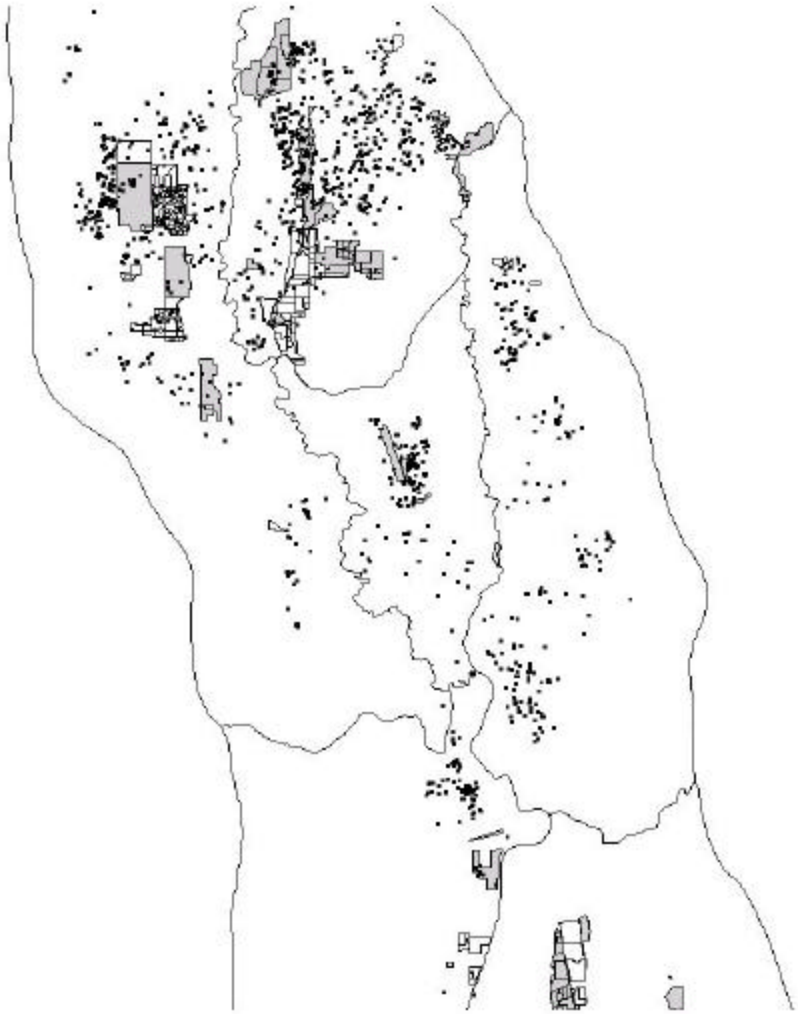


Late hunt Sacramento Valley night locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

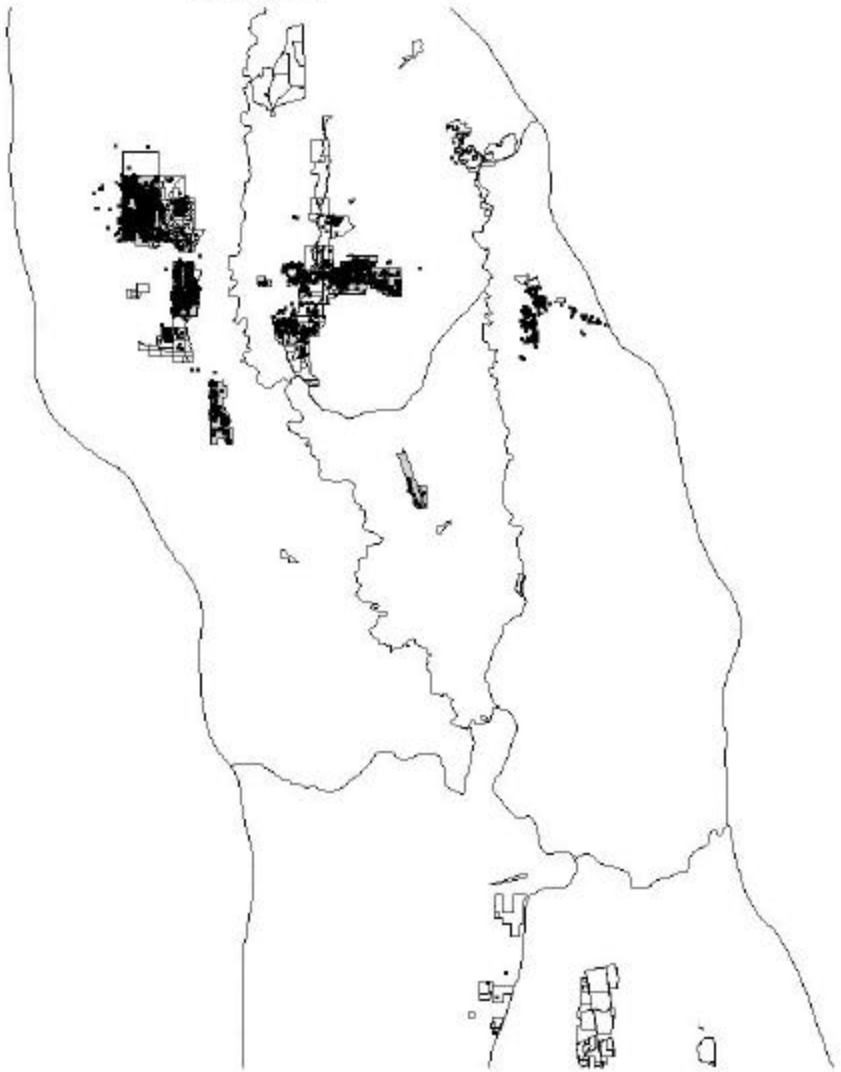


1998-00

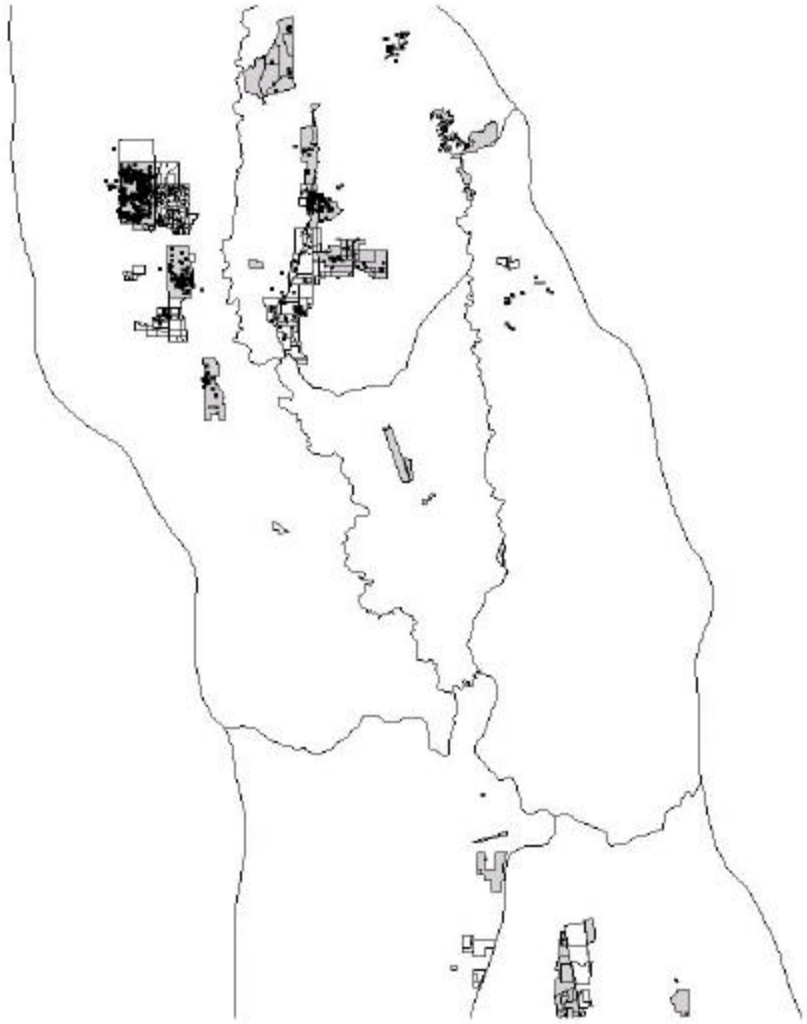


Prehunt Sacramento Valley day locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

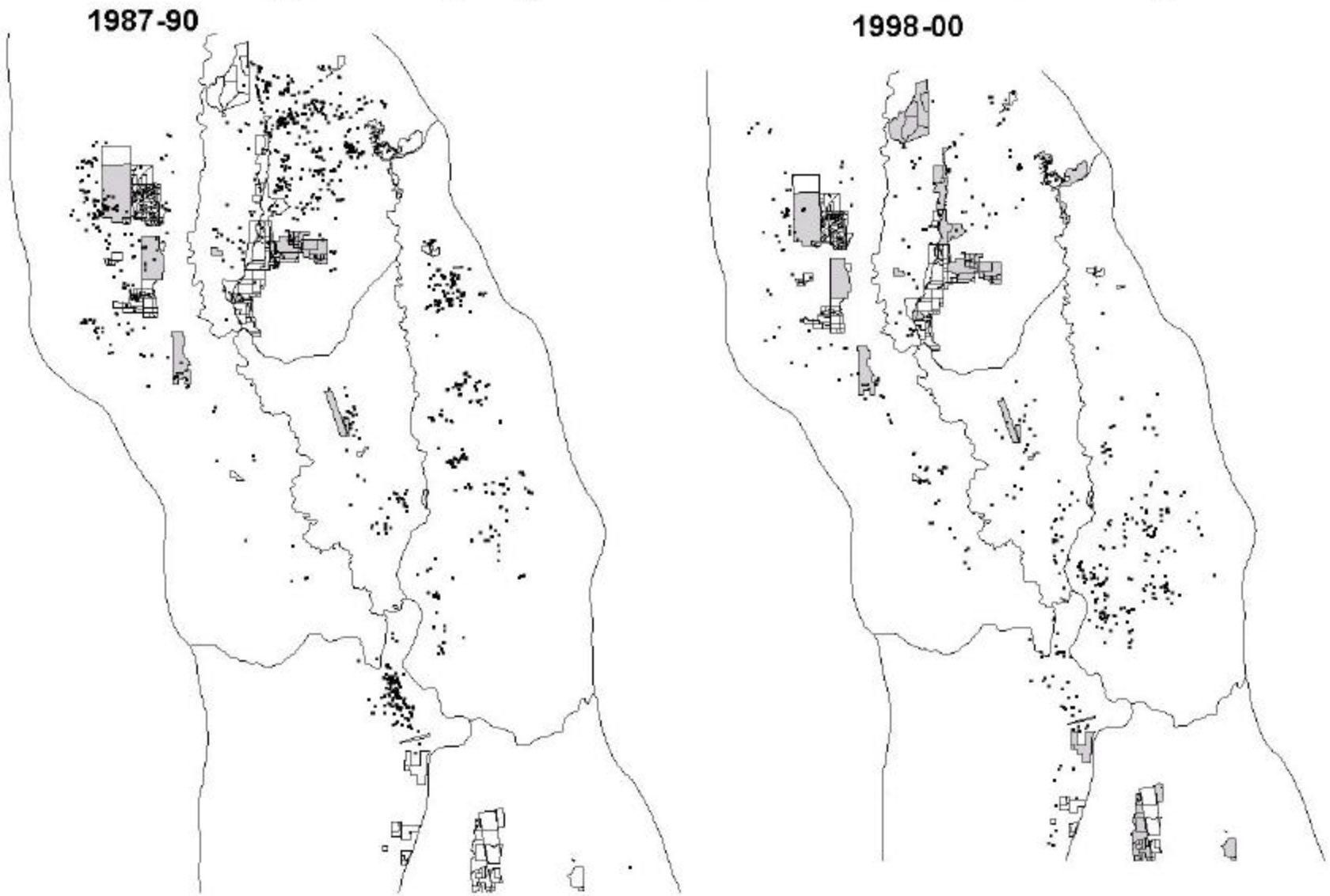
1987-90



1998-00

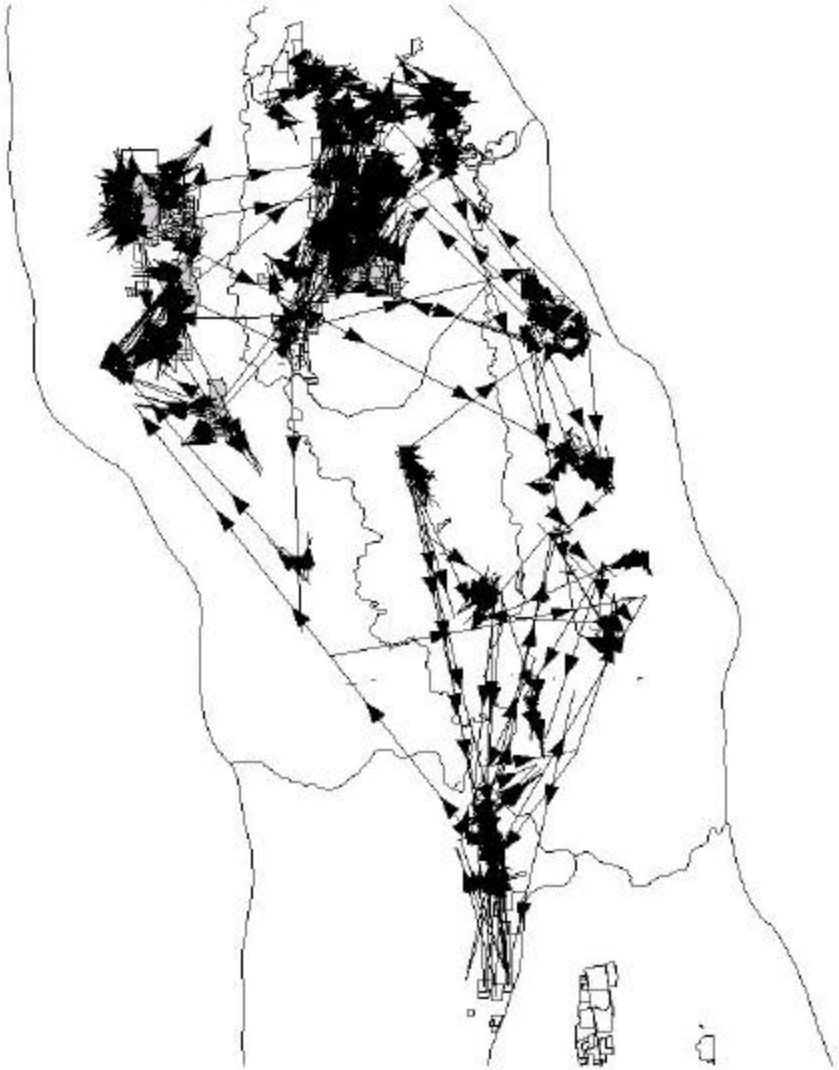


Posthunt Sacramento Valley night locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

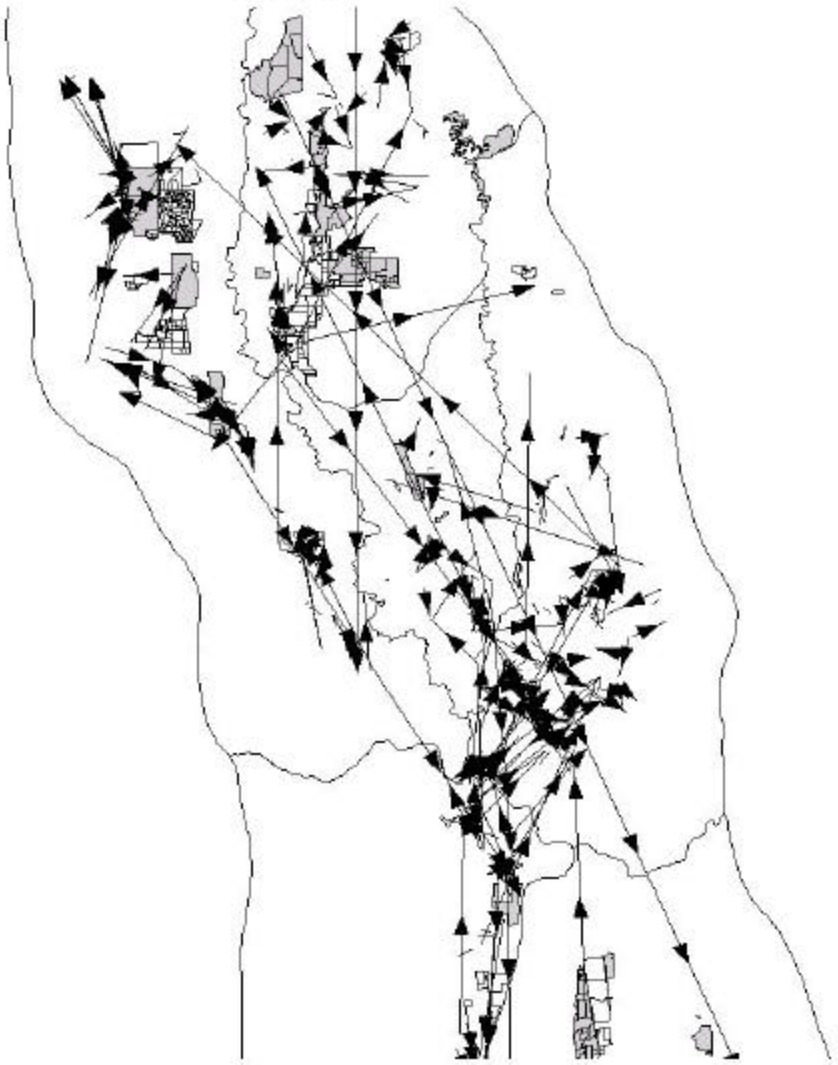


Posthunt Sacramento Valley day-night movements of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

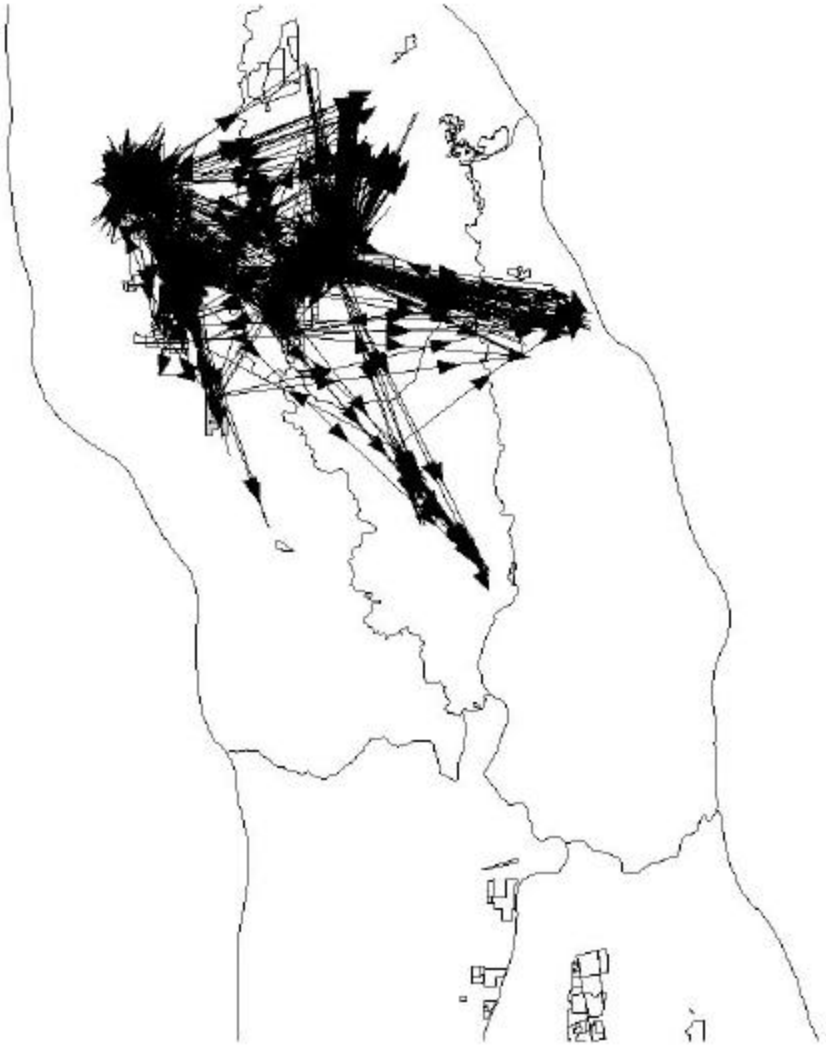


1998-00

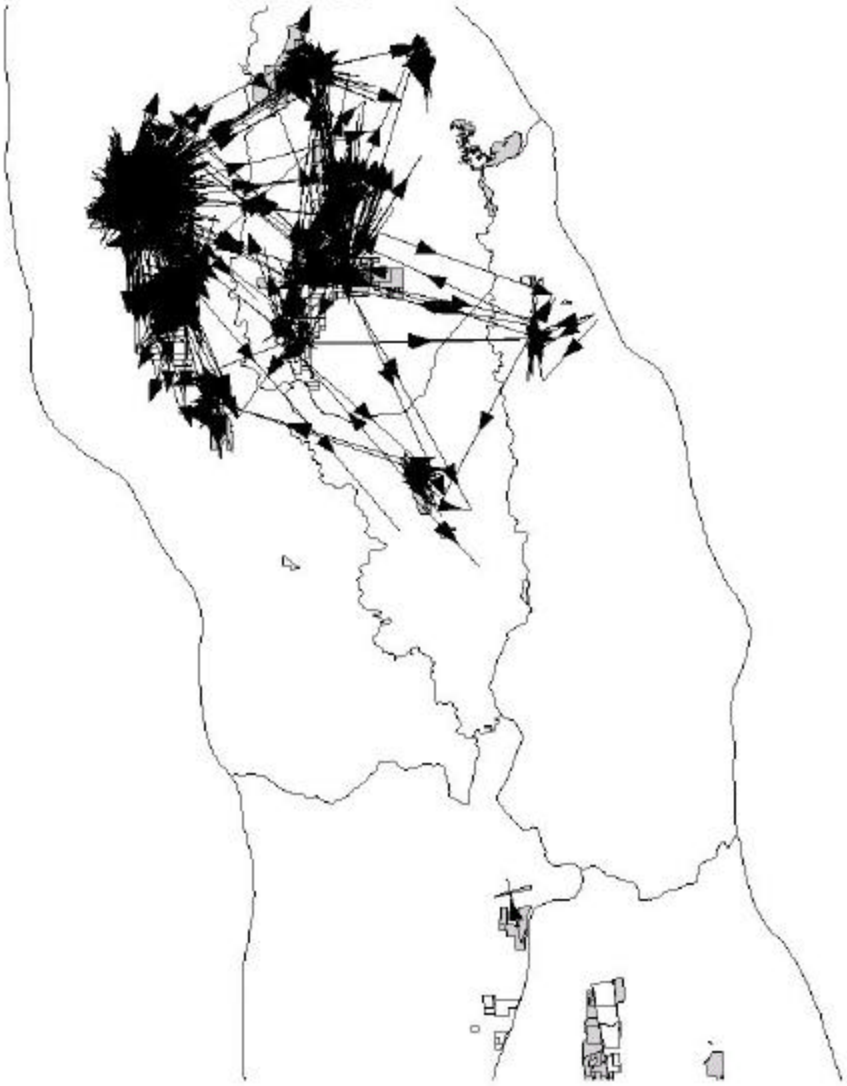


Early hunt Sacramento Valley day-night movements of adult female pintails radio - tagged during August - October in the Sacramento Valley

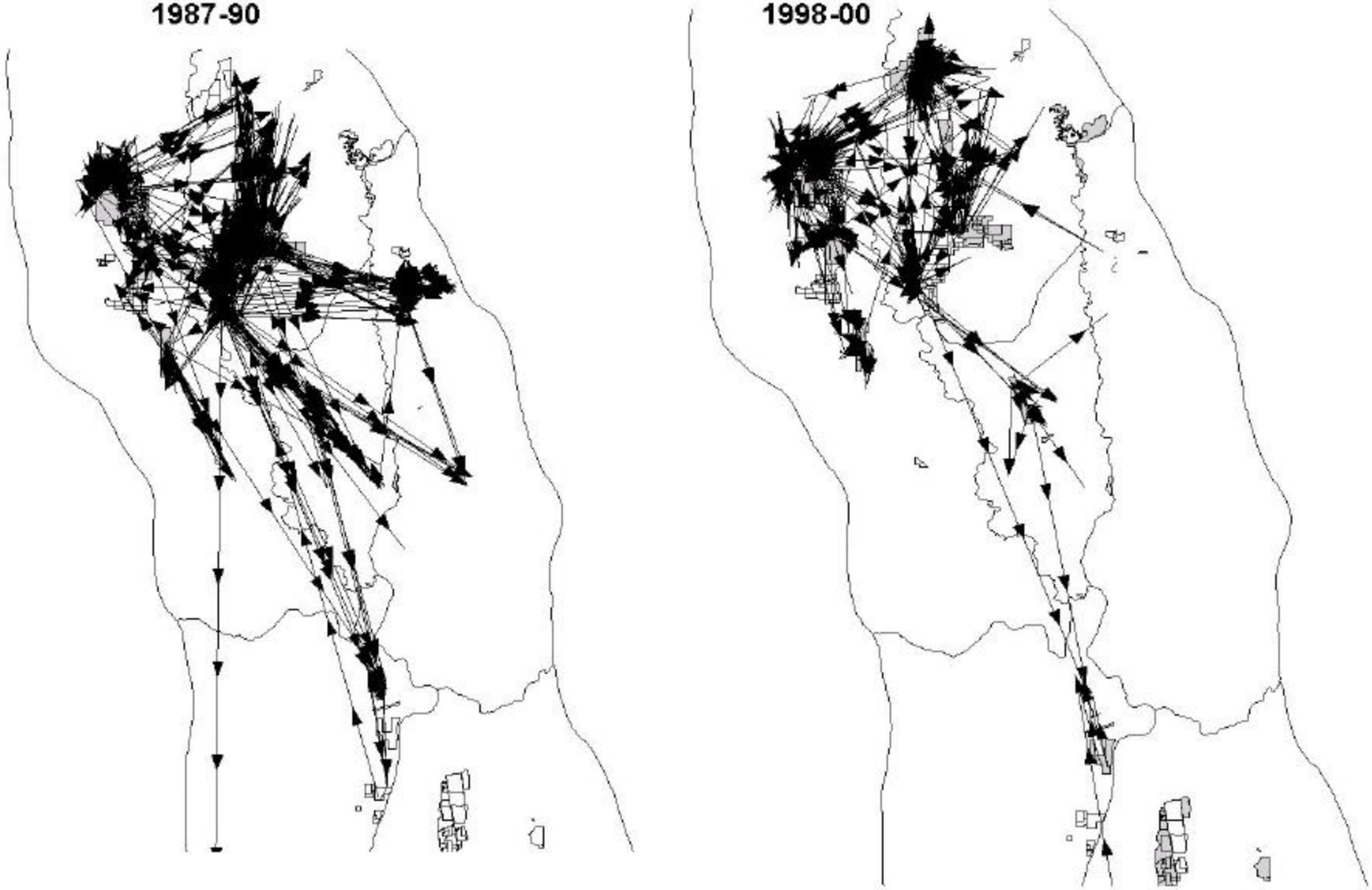
1987-90



1998-00

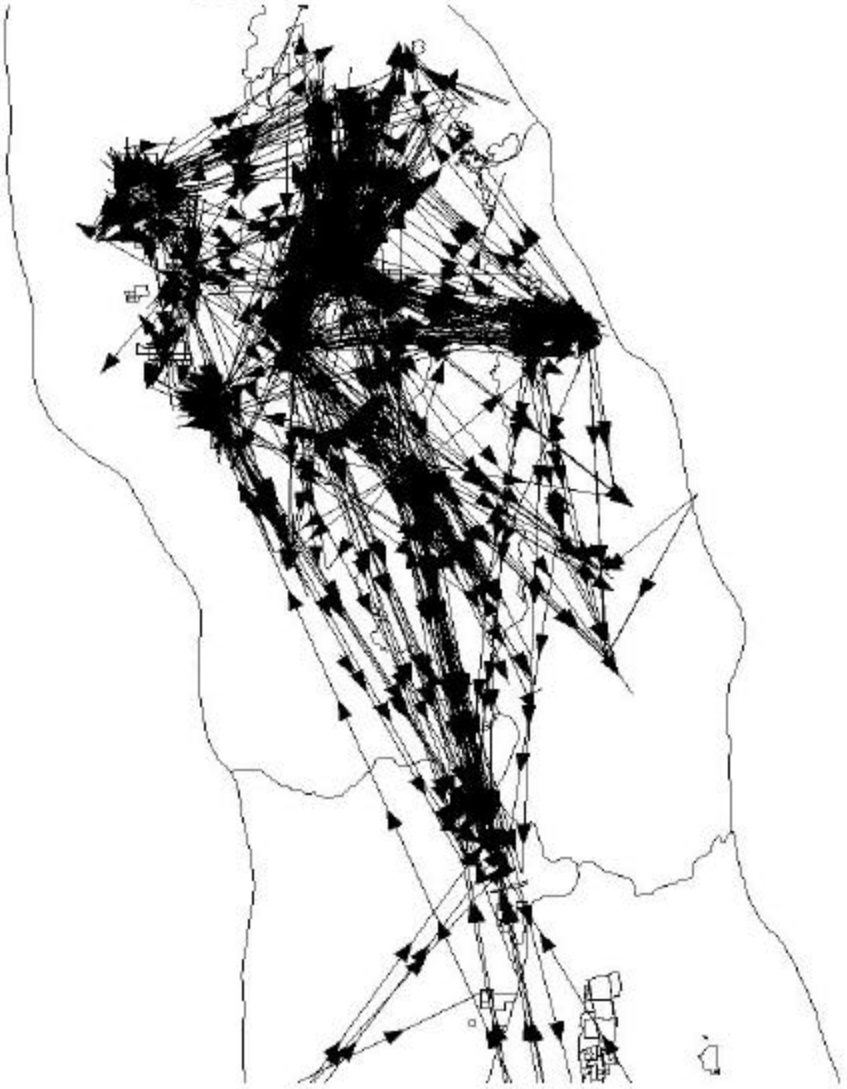


Split Sacramento Valley day-night movements of adult female pintails radio - tagged during August - October in the Sacramento Valley

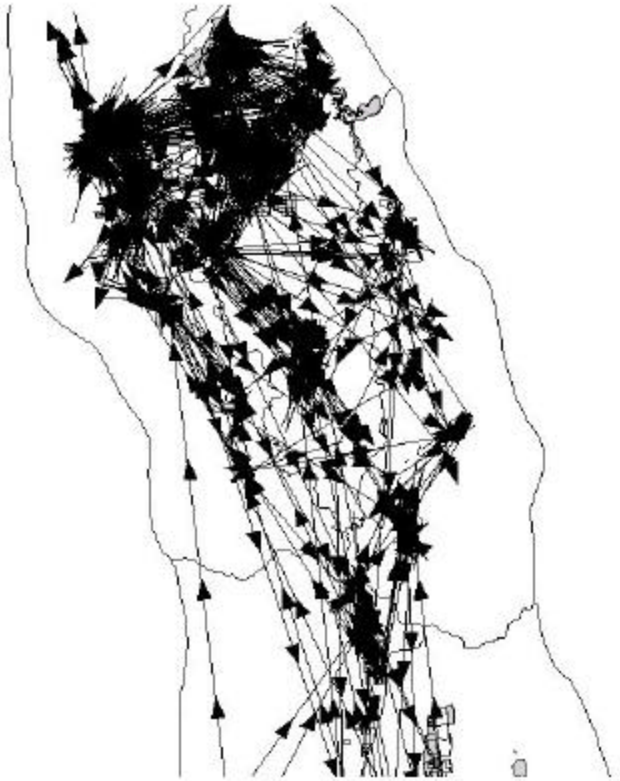


Late hunt Sacramento Valley day-night movements of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

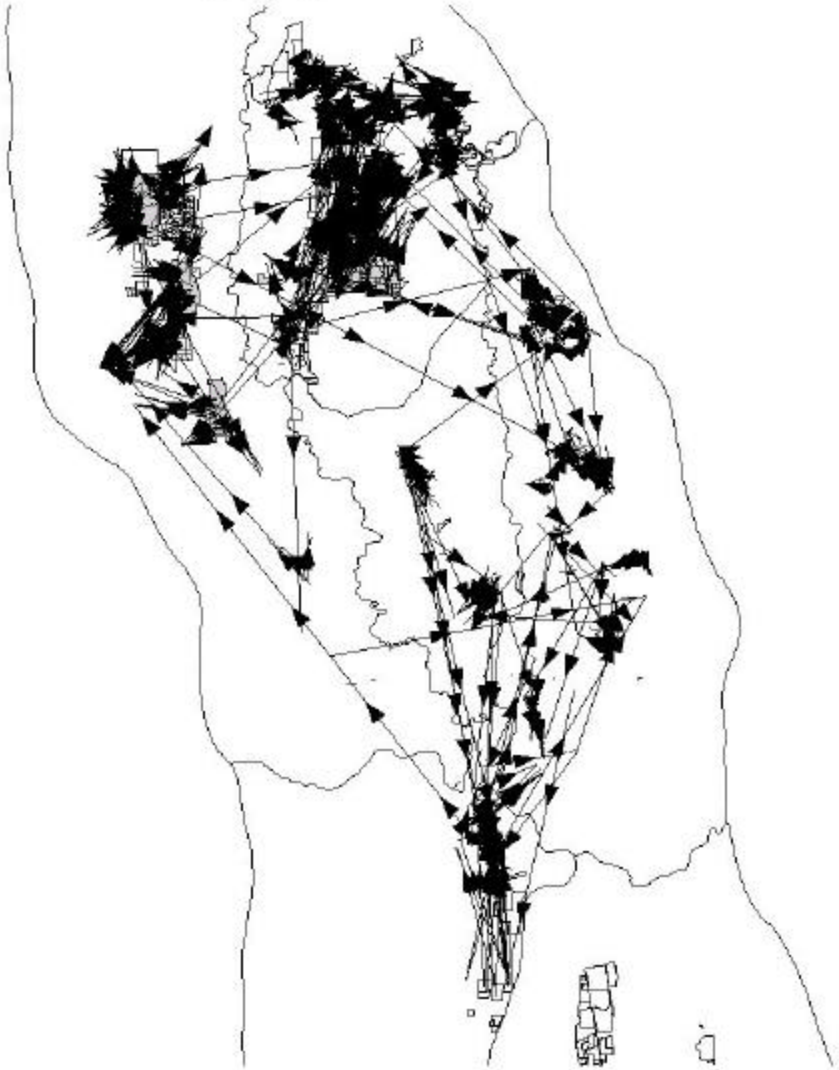


1998-00

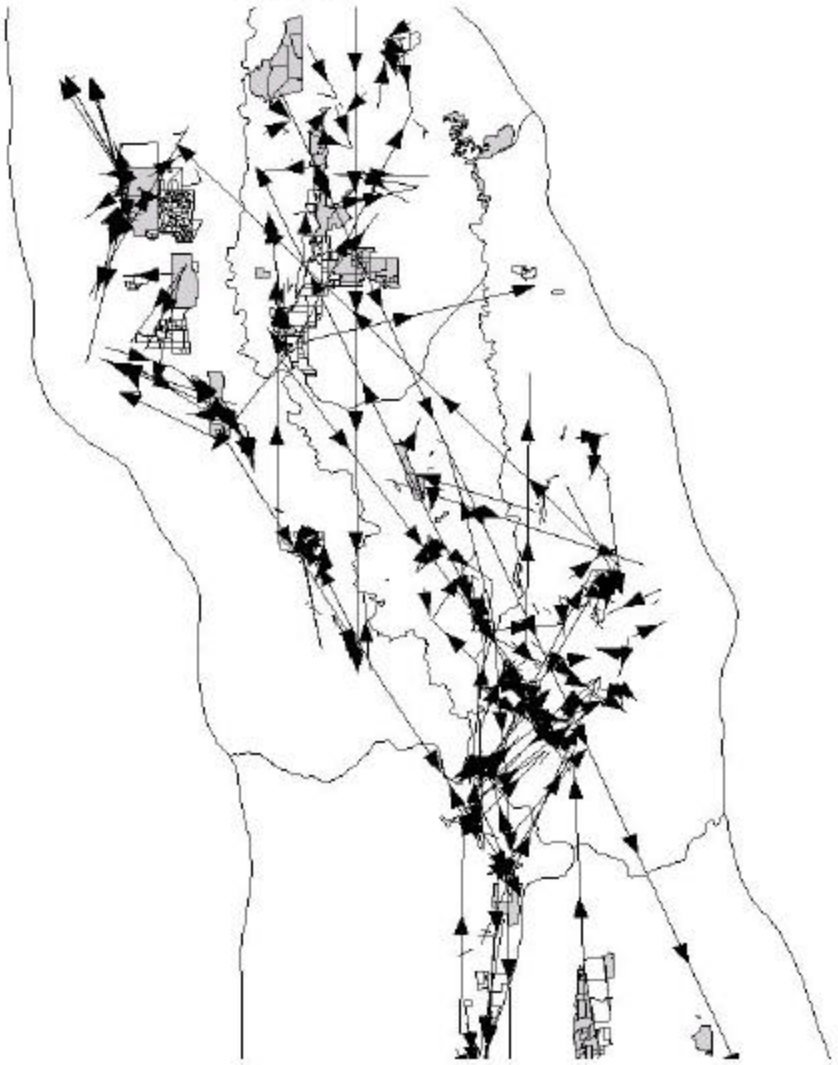


Posthunt Sacramento Valley day-night movements of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

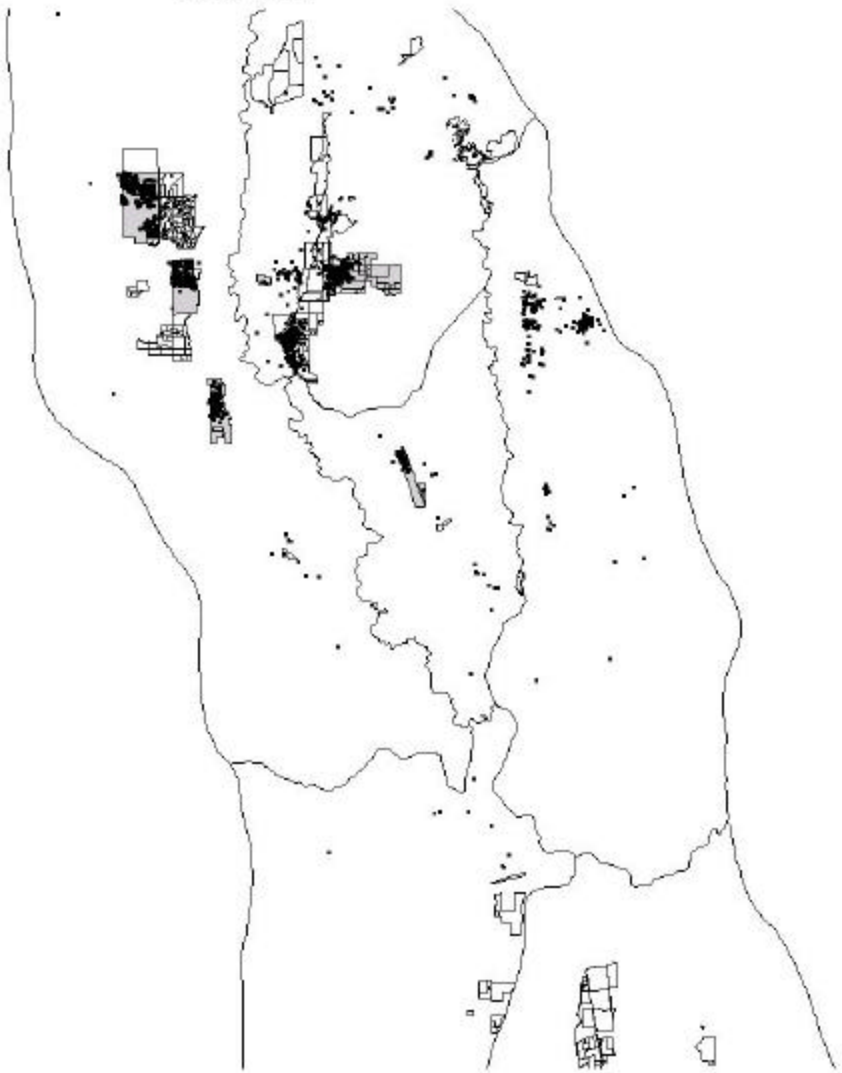


1998-00

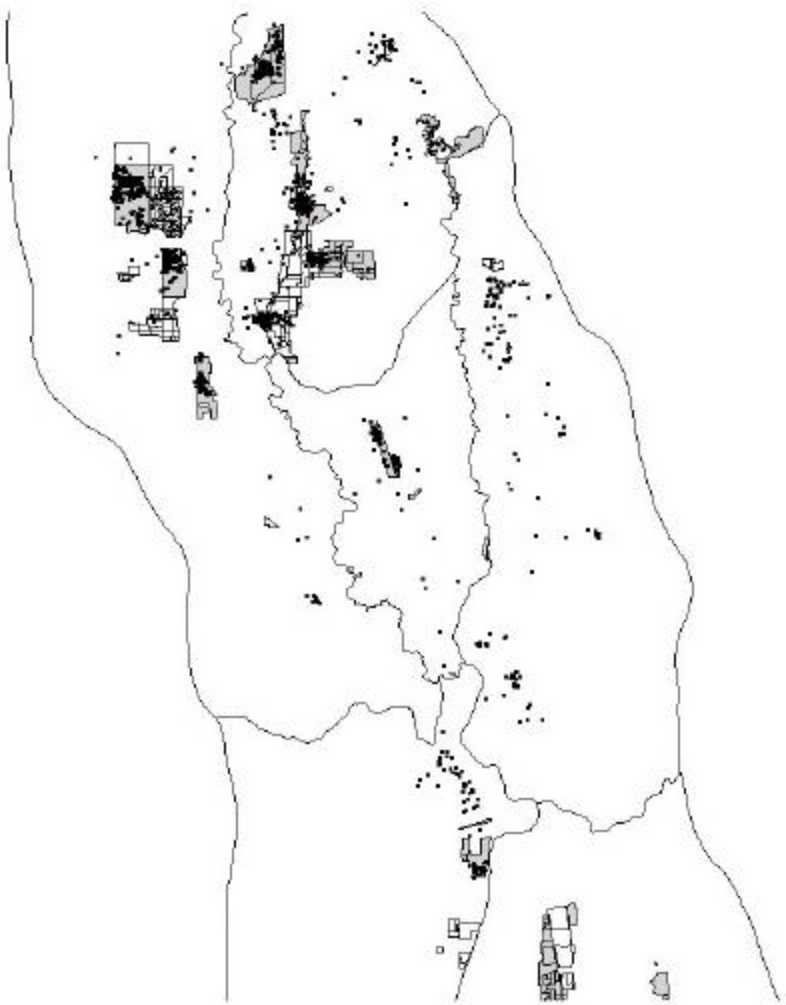


Sacramento Valley shootday locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

1987-90

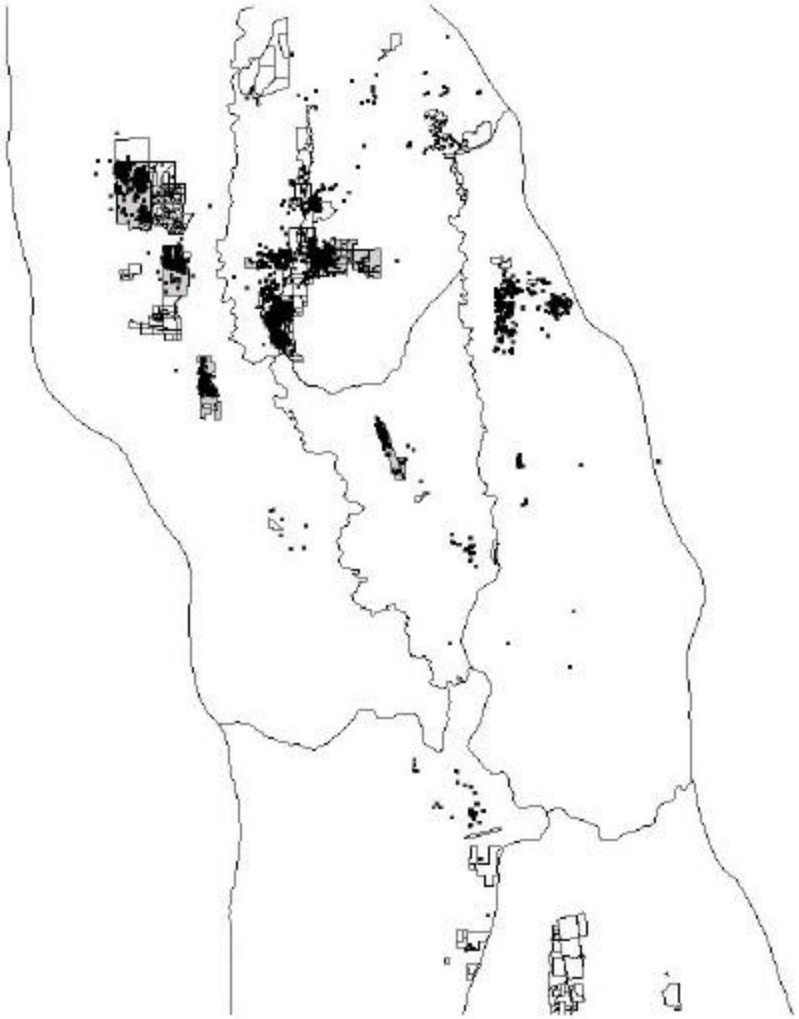


1998-00

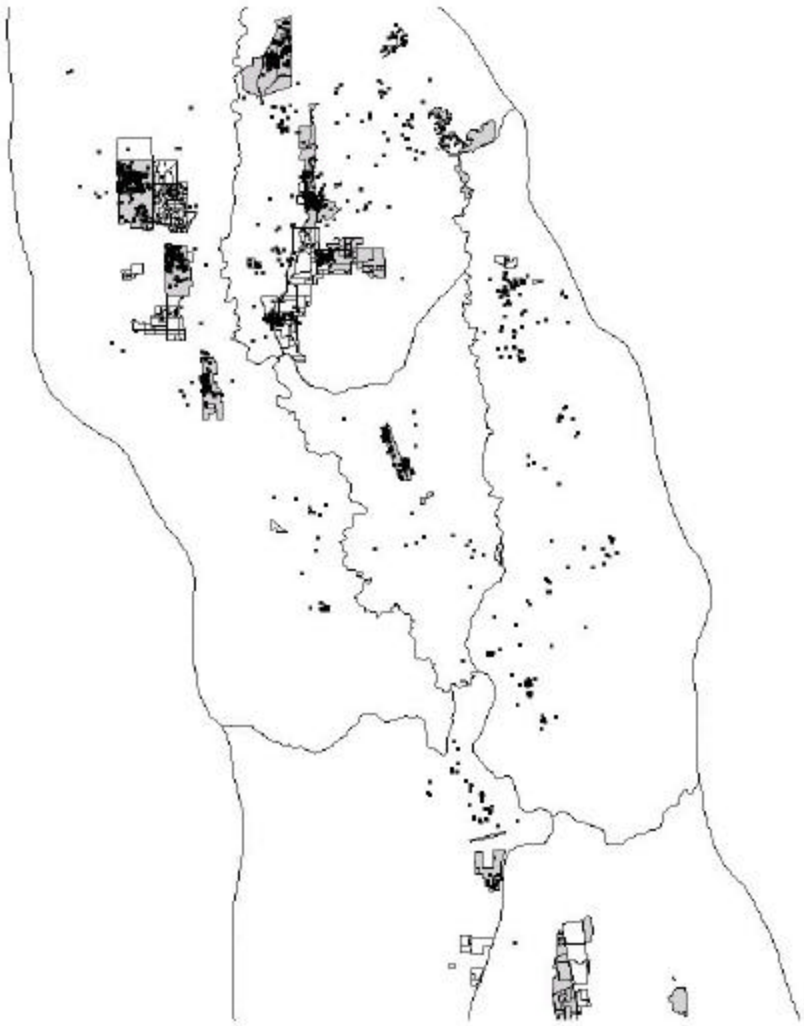


Sacramento Valley nonshootday locations of adult female pintails radio - tagged during August - October in the Sacramento Valley

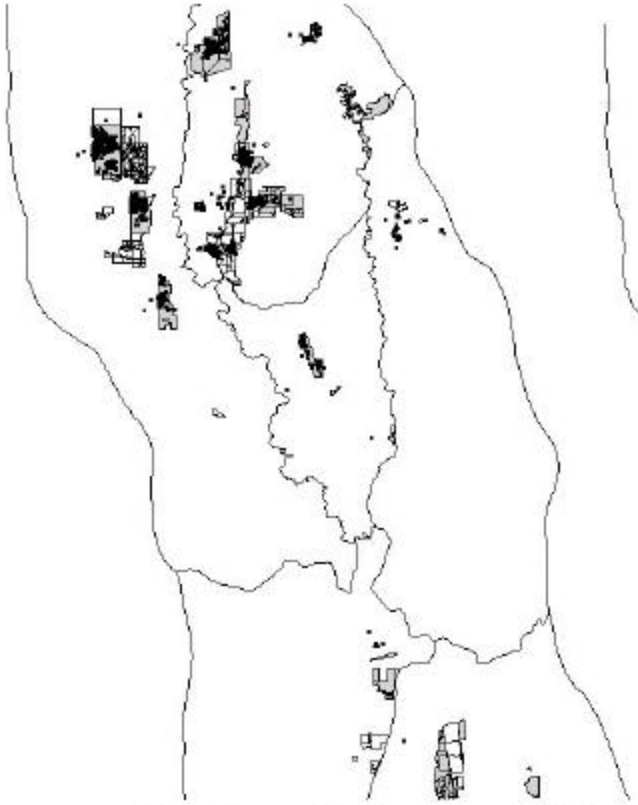
1987-90



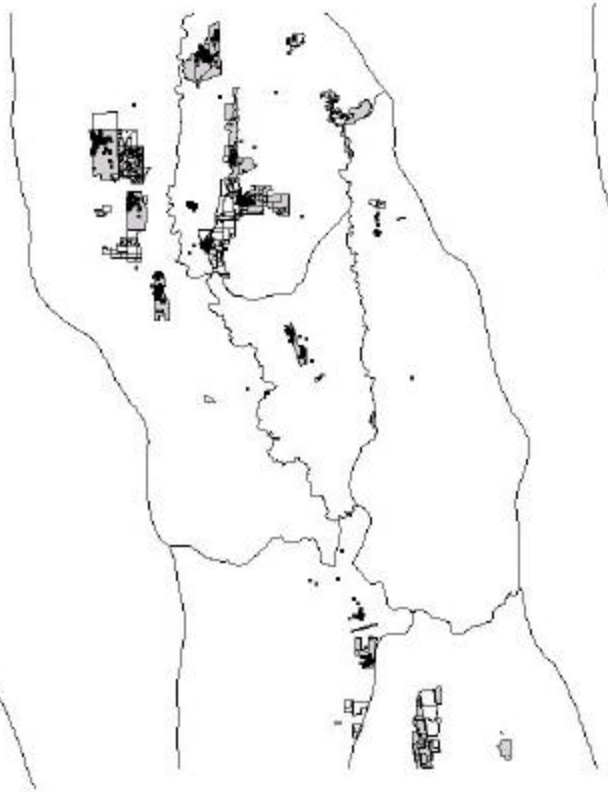
1998-00



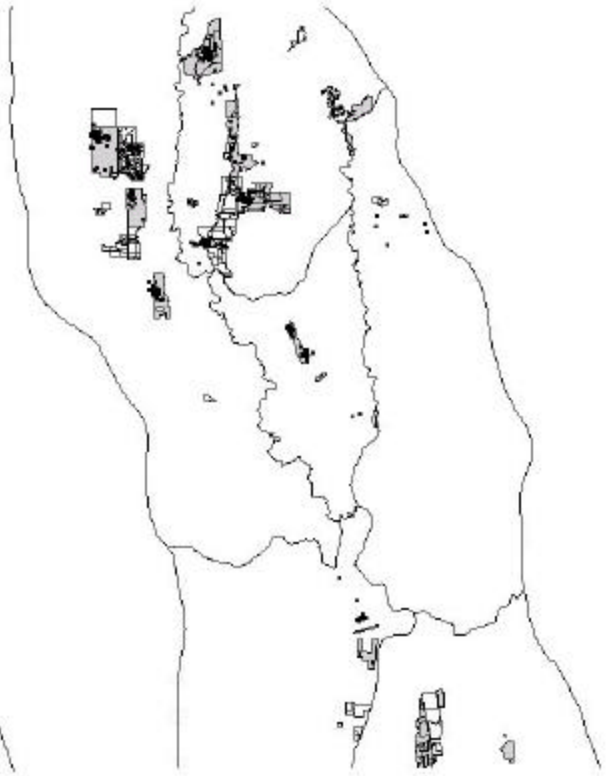
Early hunt 1998-00 Sacramento Valley day locations of adult female pintails radio-tagged during August-October by capture location



Radio-tagged in Sacramento Valley

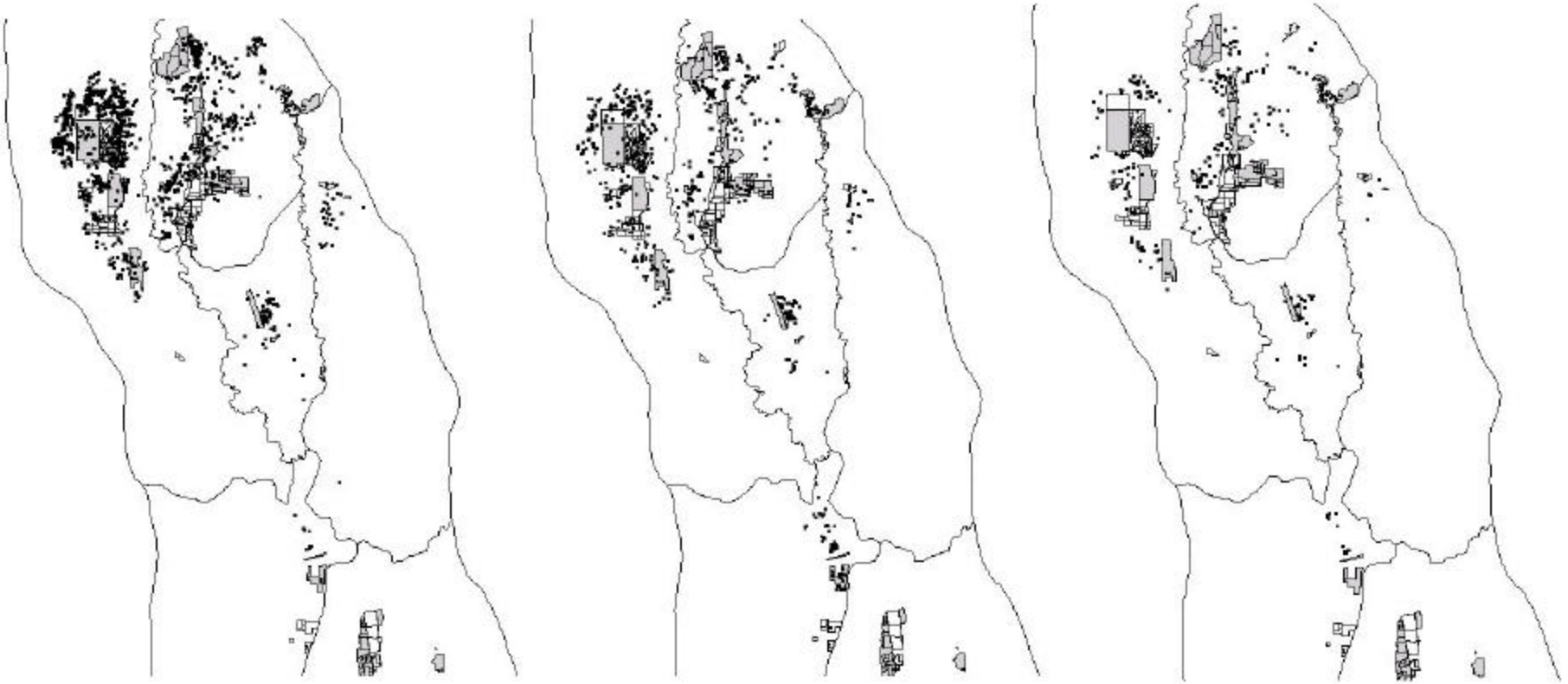


Radio-tagged in Suisun Marsh



Radio-tagged in San Joaquin Valley

Early hunt 1998-00 Sacramento Valley night locations of adult female pintails radio-tagged during August-October by capture location

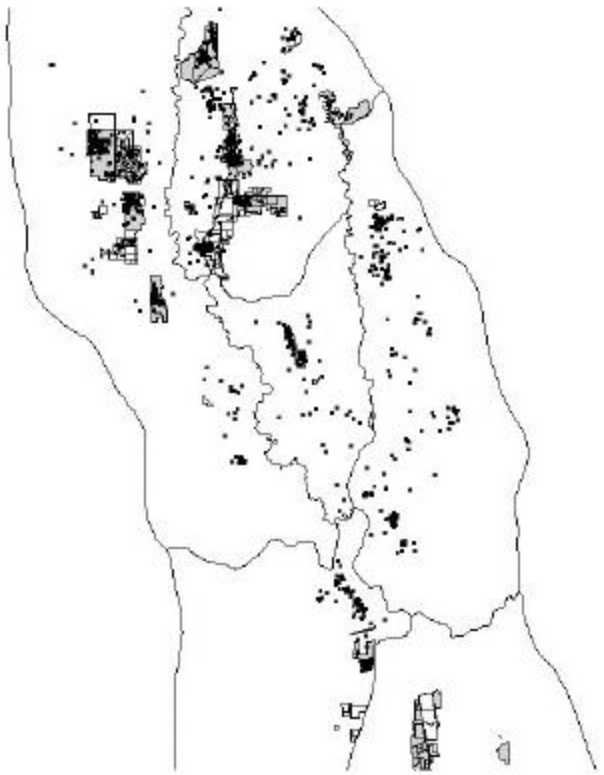


Radio-tagged in Sacramento Valley

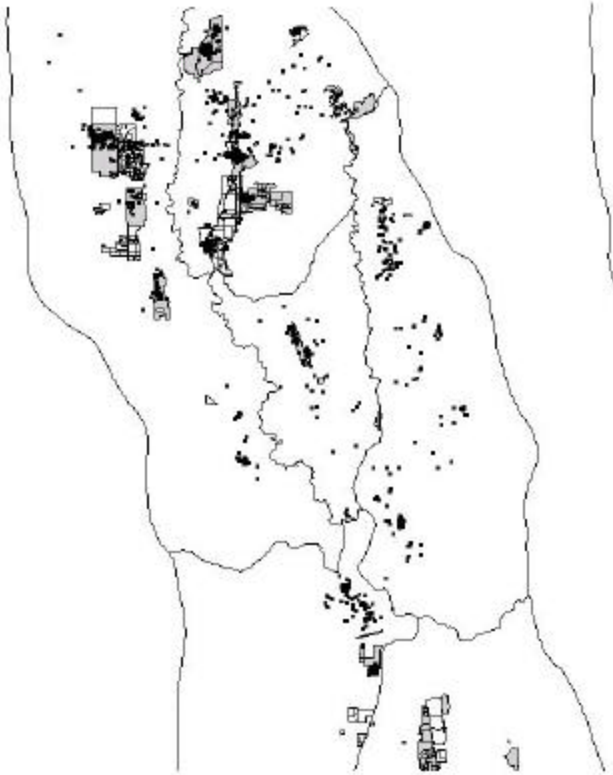
Radio-tagged in Suisun Marsh

Radio-tagged in San Joaquin Valley

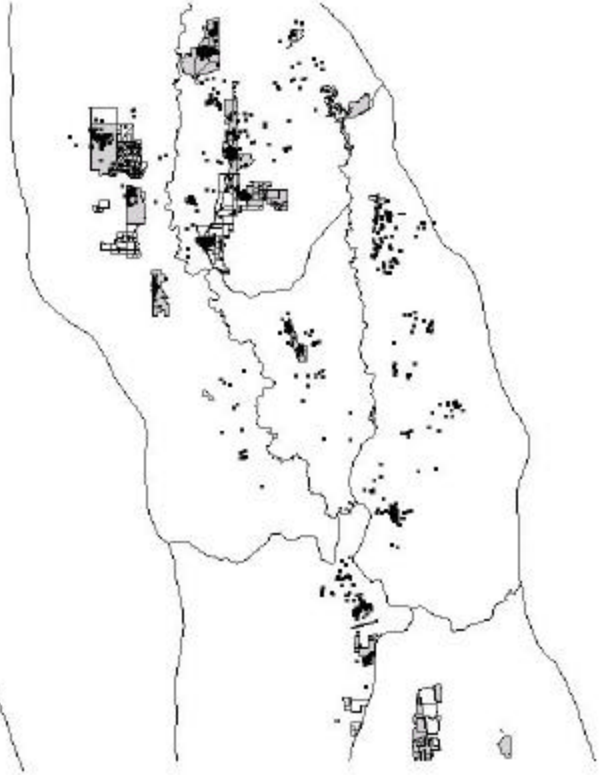
Late hunt 1998-00 Sacramento Valley day locations of adult female pintails radio-tagged during August-October by capture location



Radio-tagged in Sacramento Valley

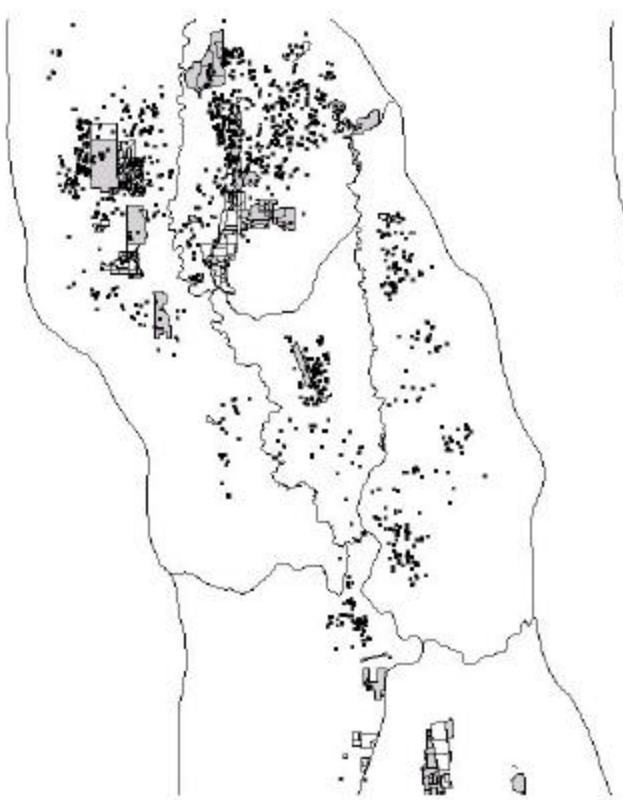


Radio-tagged in Suisun Marsh

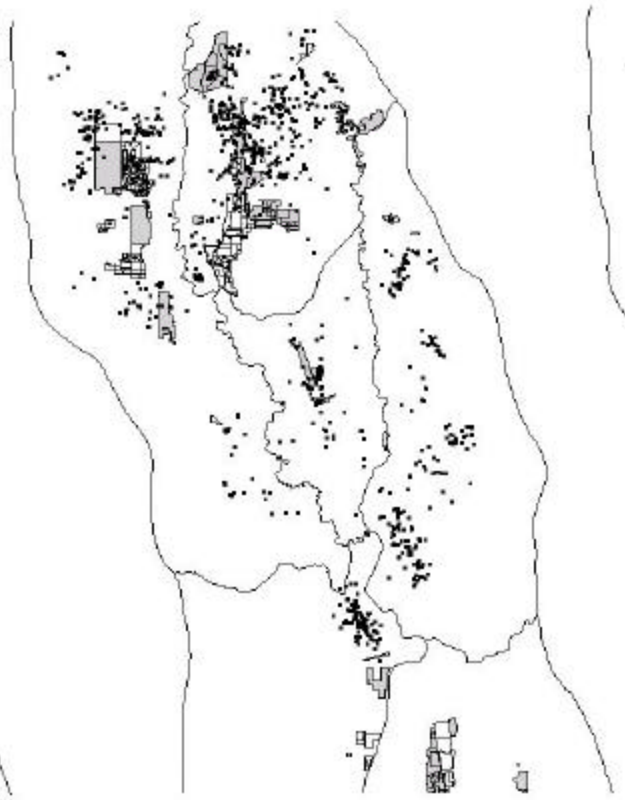


Radio-tagged in San Joaquin Valley

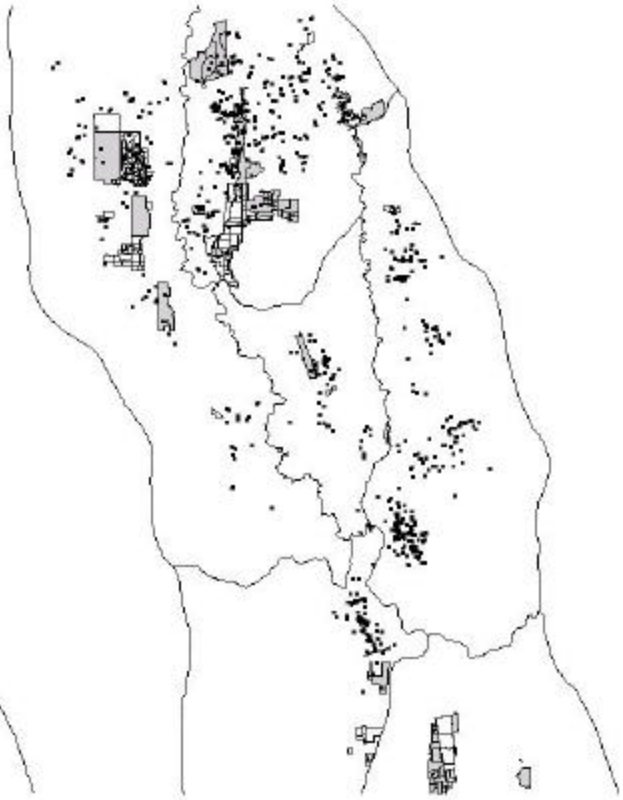
Late hunt 1998-00 Sacramento Valley night locations of adult female pintails radio-tagged during August-October by capture location



Radio-tagged in Sacramento Valley

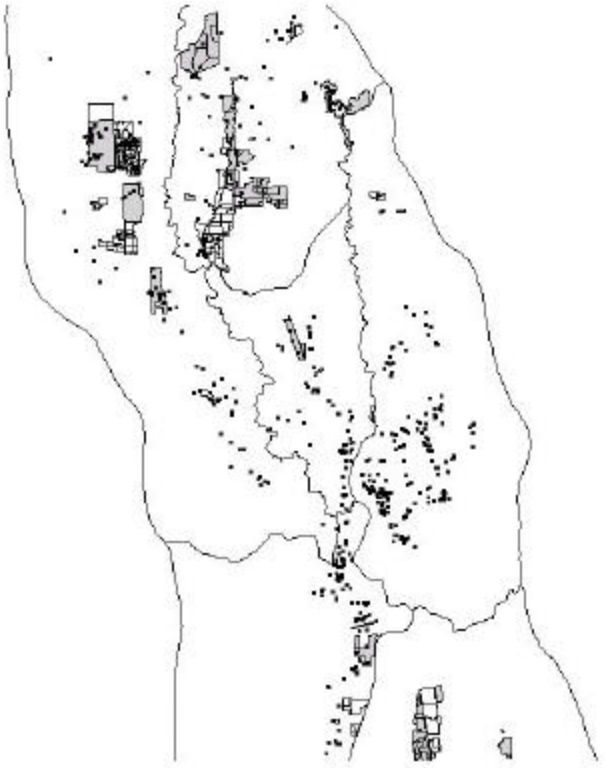


Radio-tagged in Suisun Marsh

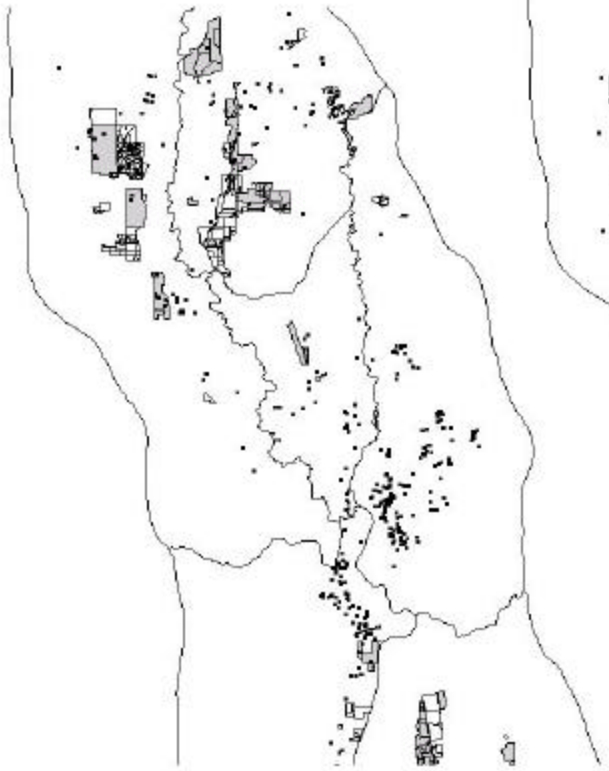


Radio-tagged in San Joaquin Valley

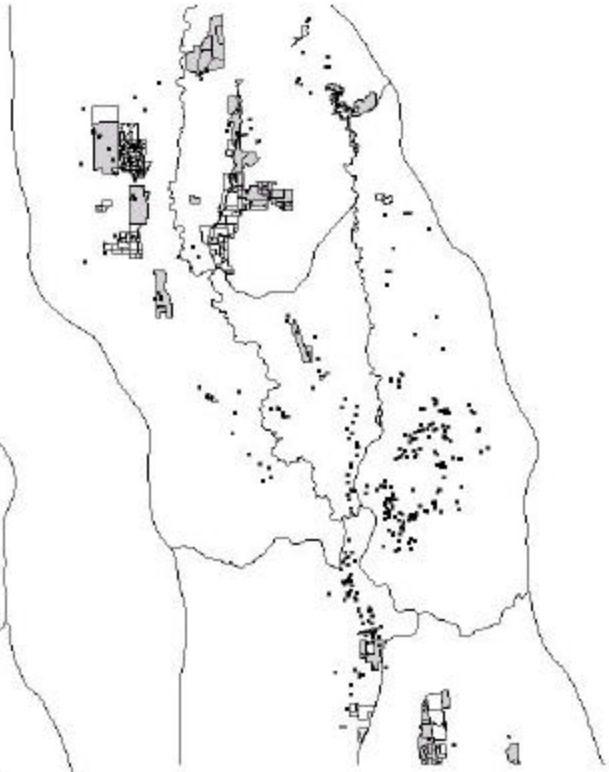
Posthunt 1998-00 Sacramento Valley day locations of adult female pintails radio-tagged during August-October by capture location



Radio-tagged in Sacramento Valley

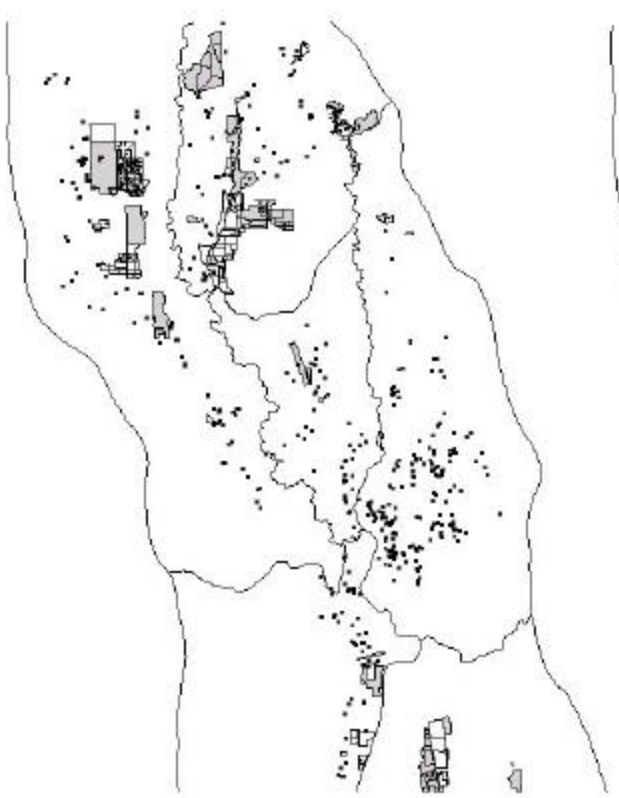


Radio-tagged in Suisun Marsh

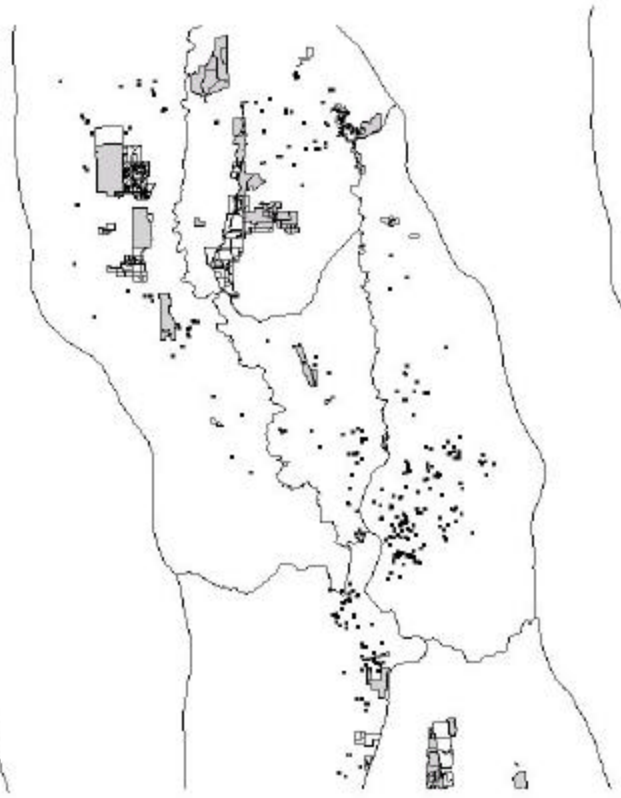


Radio-tagged in San Joaquin Valley

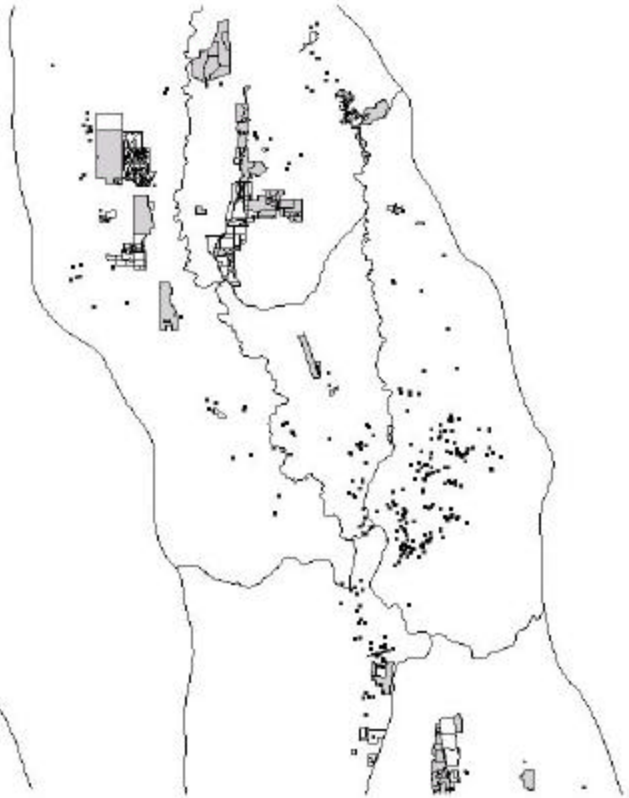
Posthunt 1998-00 Sacramento Valley night locations of adult female pintails radio-tagged during August-October by capture location



Radio-tagged in Sacramento Valley



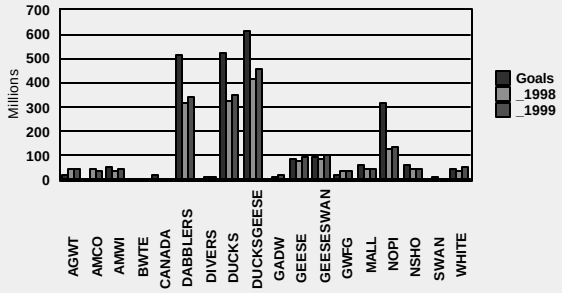
Radio-tagged in Suisun Marsh



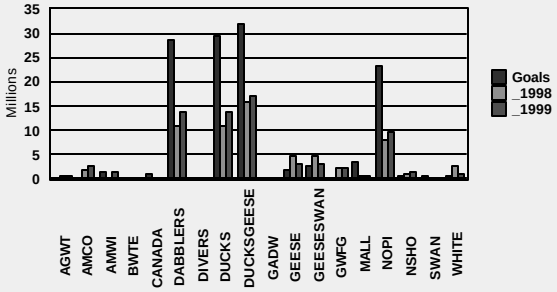
Radio-tagged in San Joaquin Valley

SEPT 15 - FEB 15 WATERFOWL USE DAYS
CVHJV GOALS VS 1998-99 & 1999-00

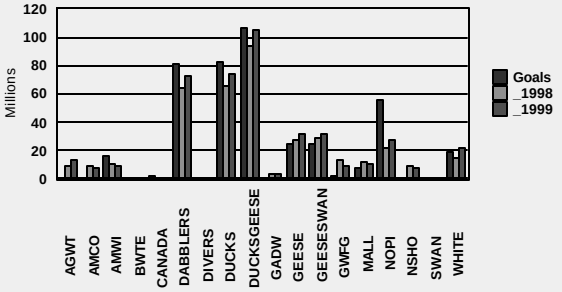
CENTRAL VALLEY TOTAL



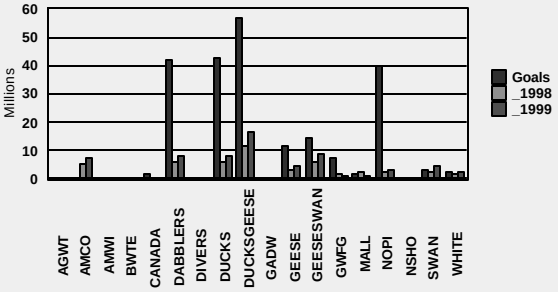
YOLO



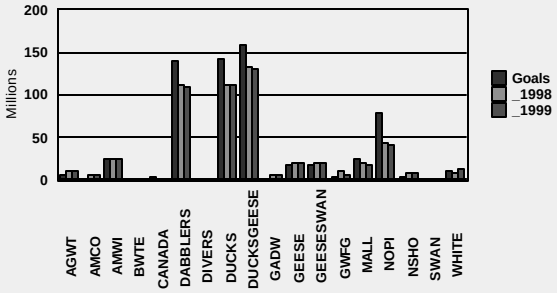
COLUSA



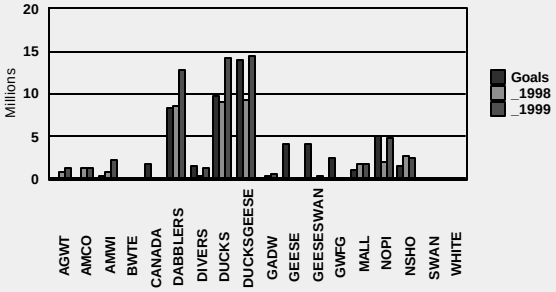
DELTA



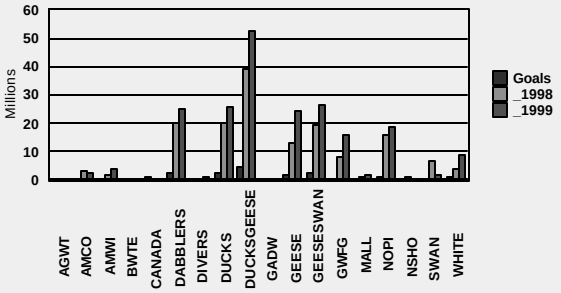
BUTTE



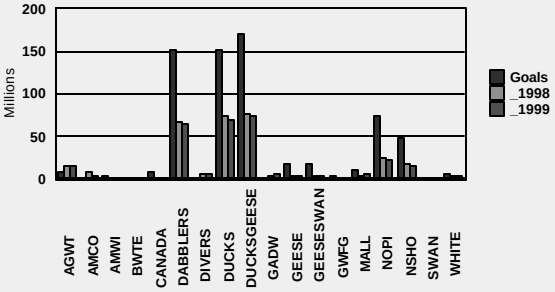
SUISUNMARSH



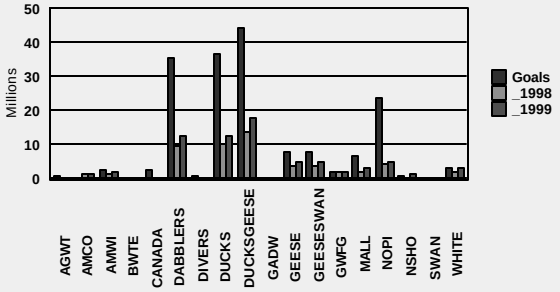
AMERD10



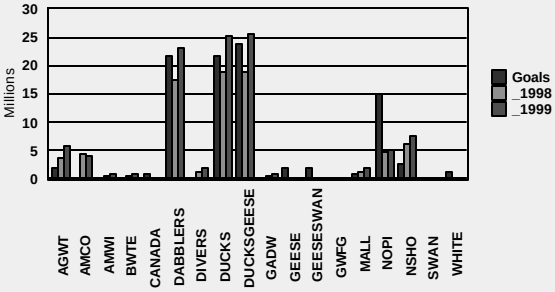
NSJV



SUTTER

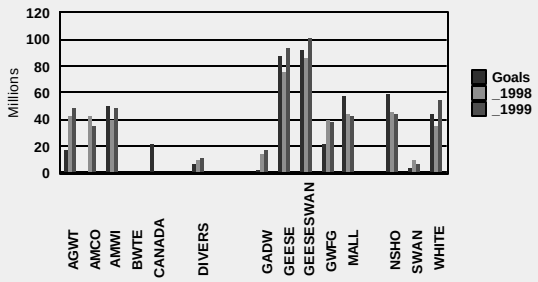


SSJV_MEN

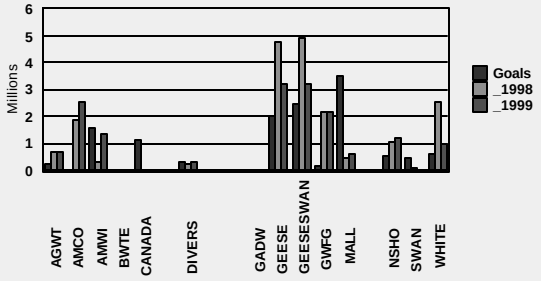


SEPT 15 - FEB 15 WATERFOWL USE DAYS
CVHJV GOAL VS 1998-99 & 1999-00 (Pintails & totals not shown)

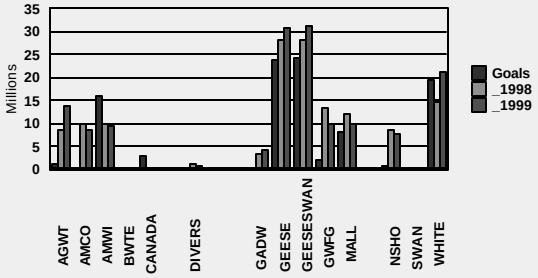
CENTRAL VALLEY TOTAL



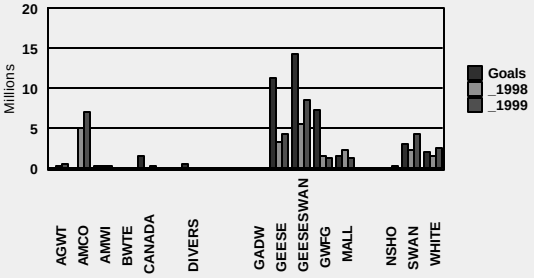
YOLO



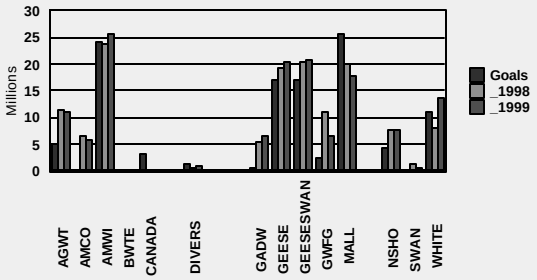
COLUSA



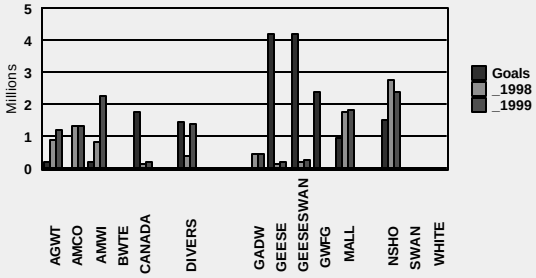
DELTA



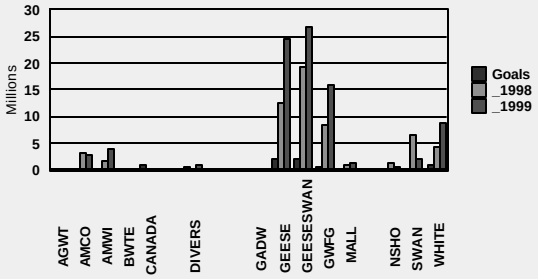
BUTTE



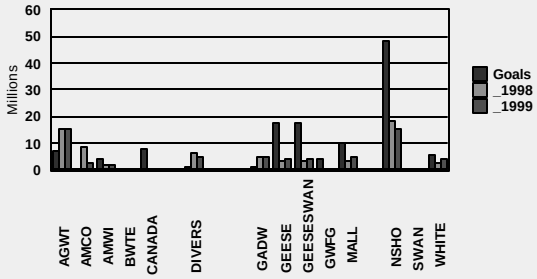
SUISUN MARSH



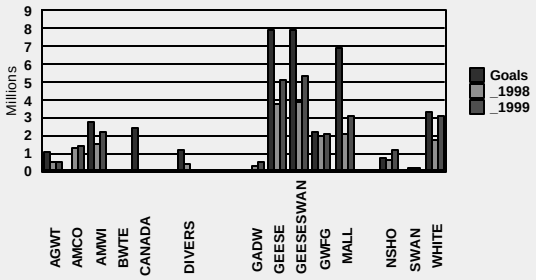
AMERICAN



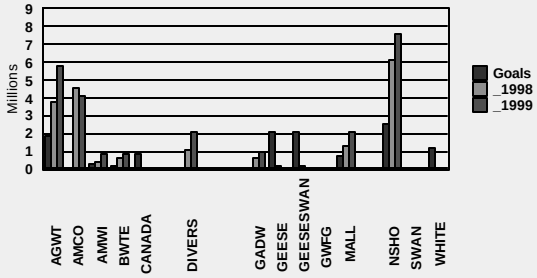
NSJV



SUTTER

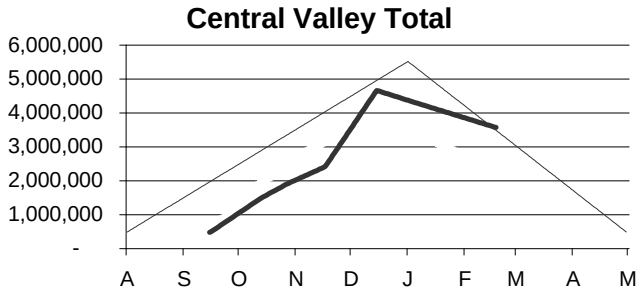


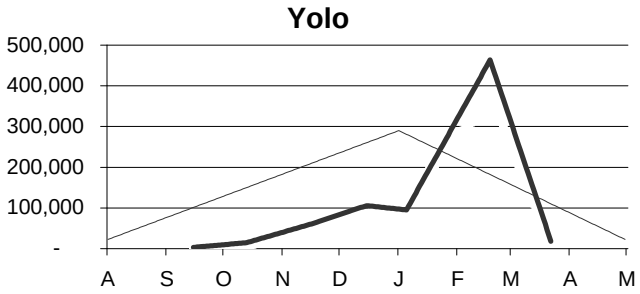
SSJV (TULARE)

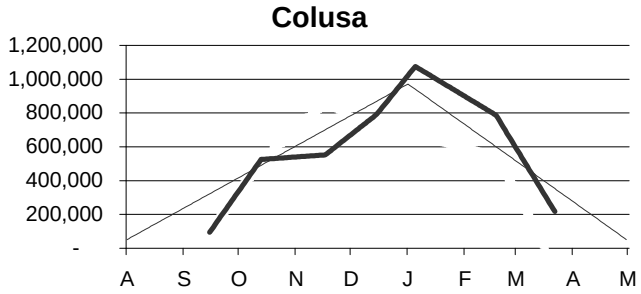


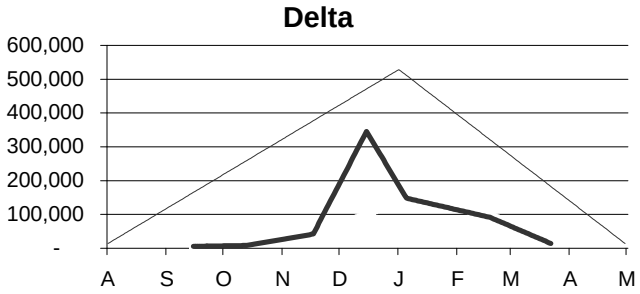
Duck, Geese, and Swan abundance during Sep - Jan

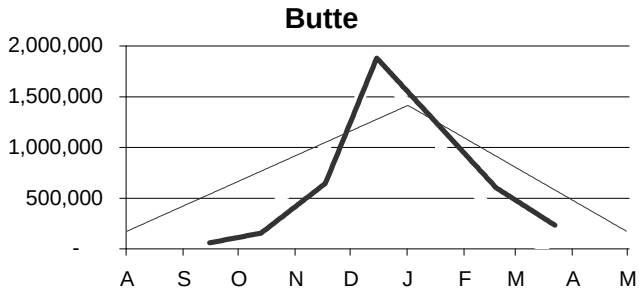
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

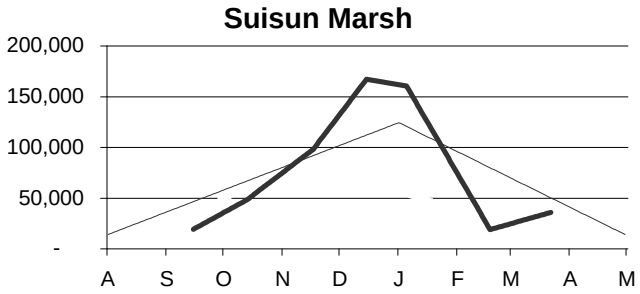


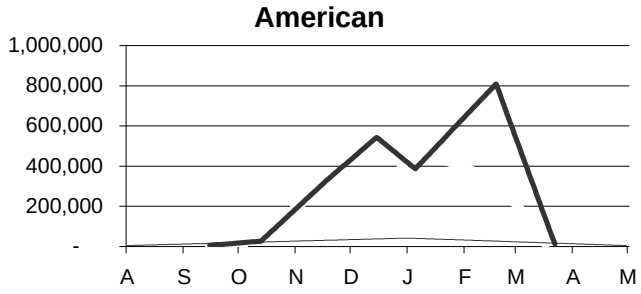


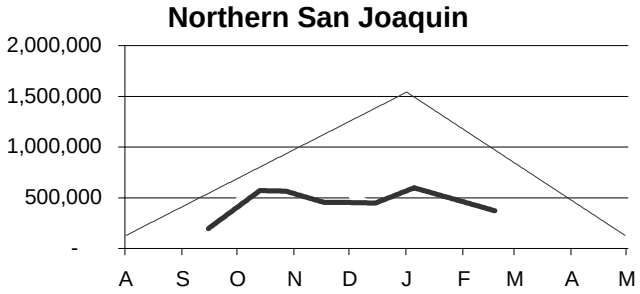


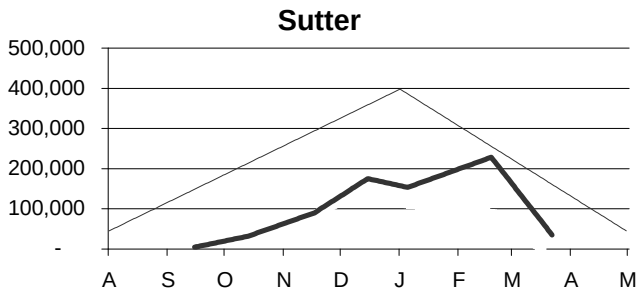


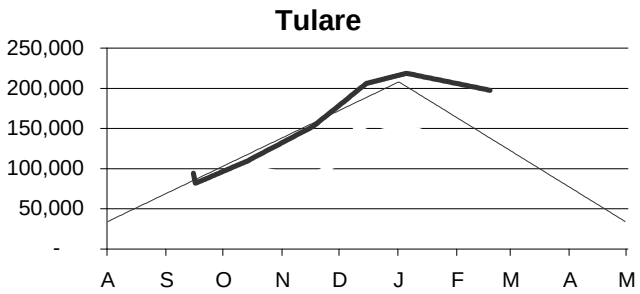






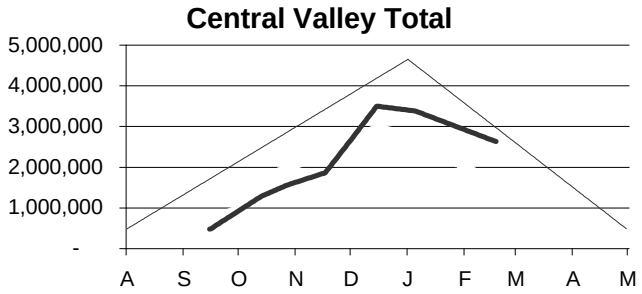


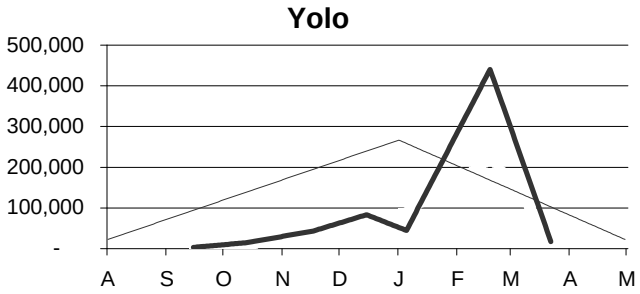


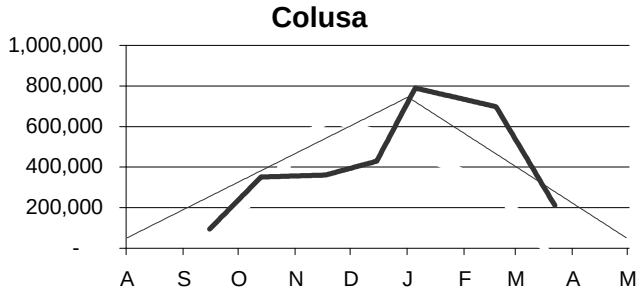


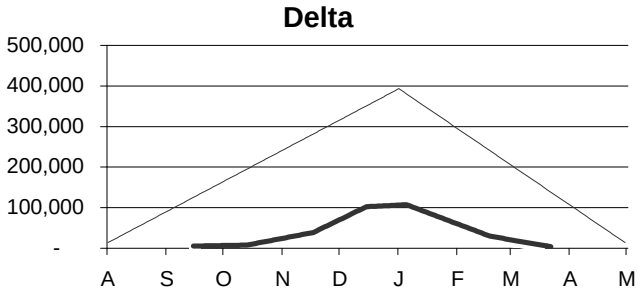
Duck abundance during September - January

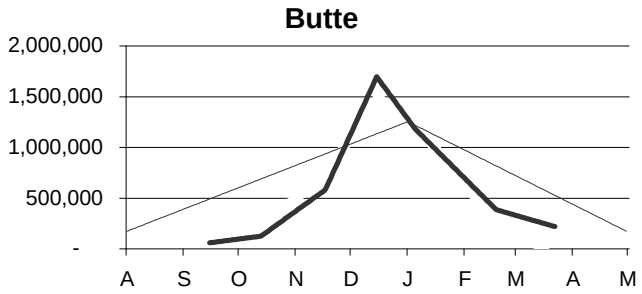
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

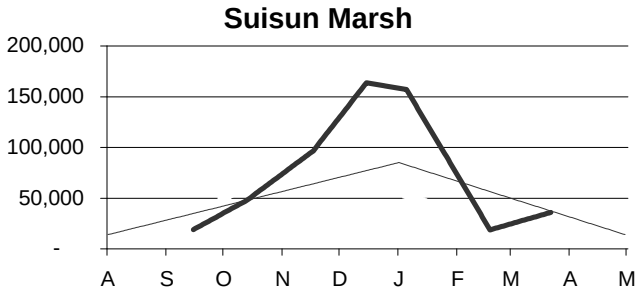


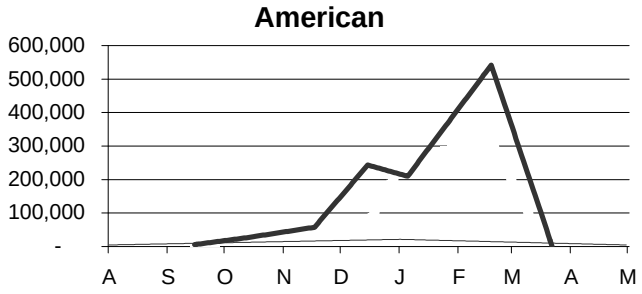


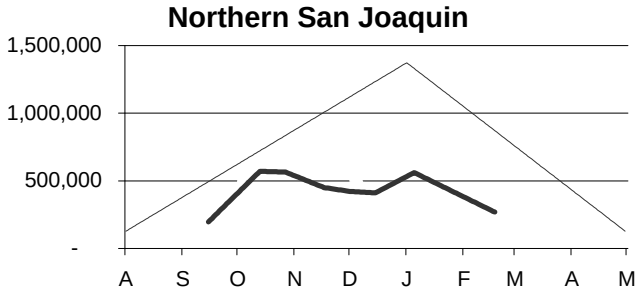


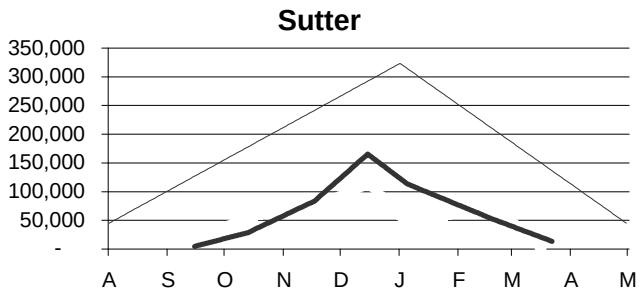


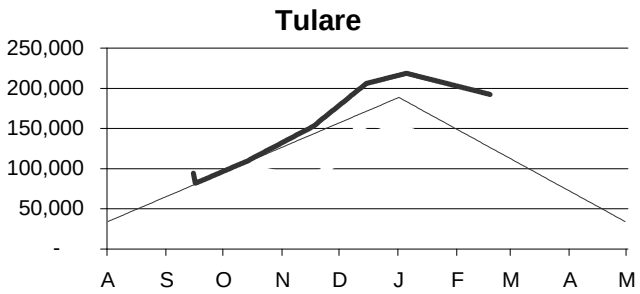








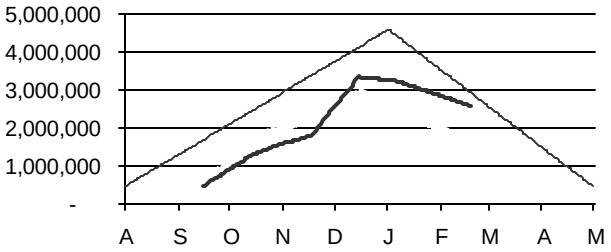




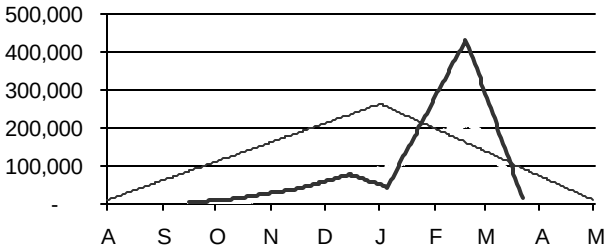
Dabbling duck abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

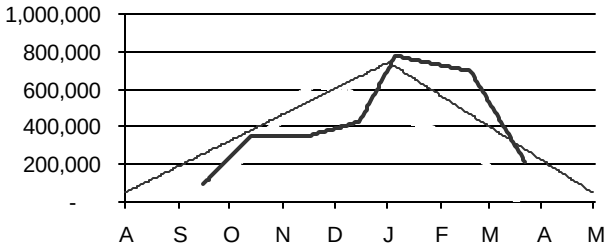
Central Valley Total



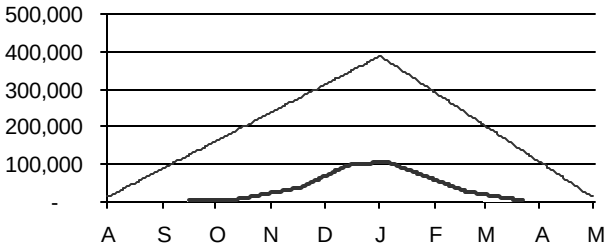
Yolo



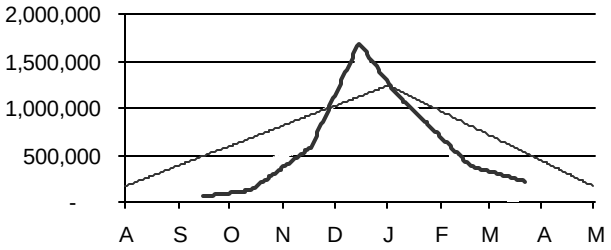
Colusa



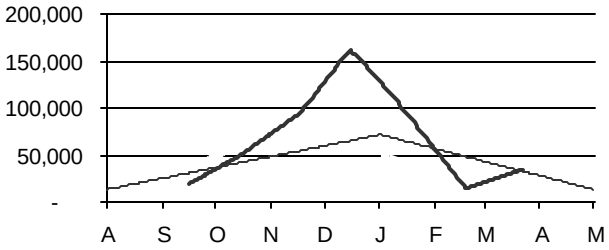
Delta



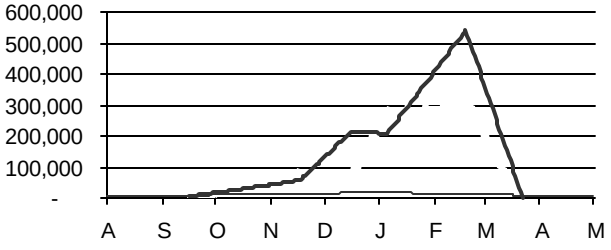
Butte



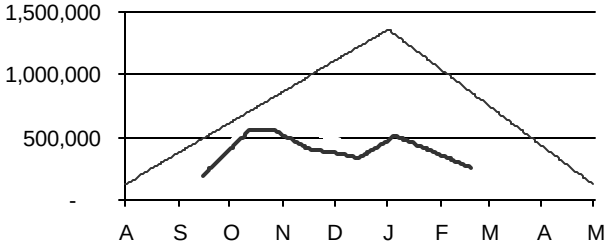
Suisun Marsh



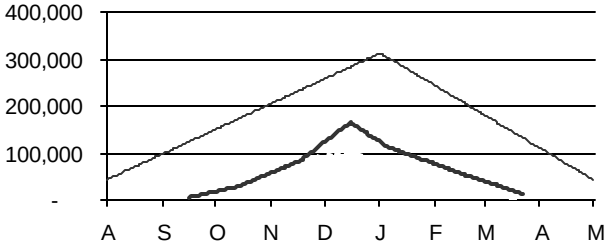
American



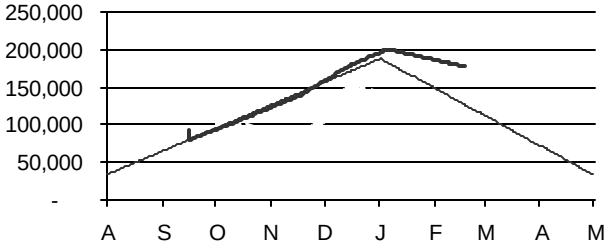
Northern San Joaquin



Sutter



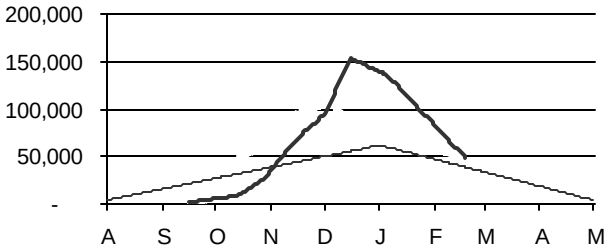
Tulare



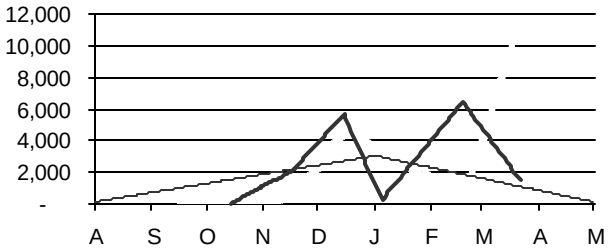
Diving duck abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

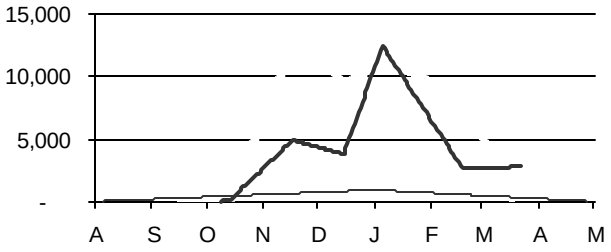
Central Valley Total



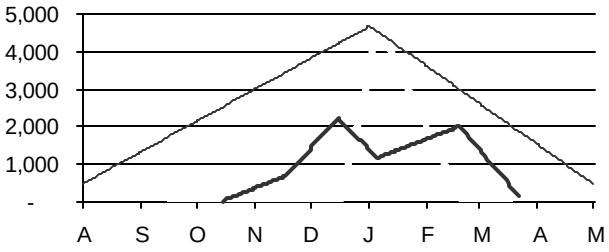
Yolo



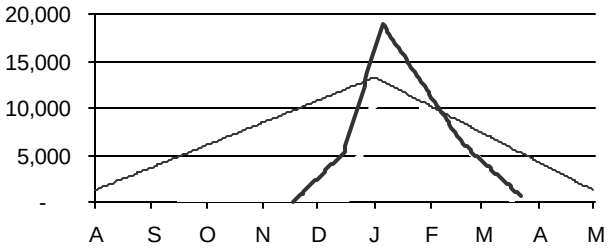
Colusa



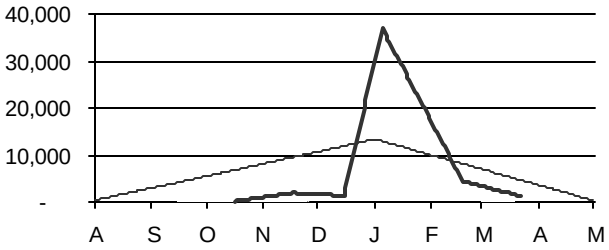
Delta



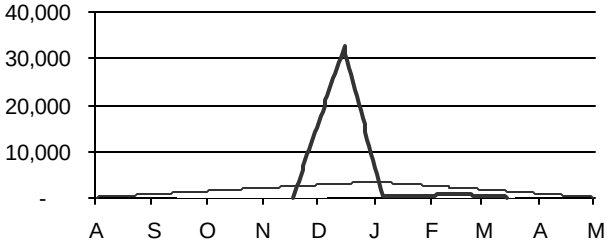
Butte



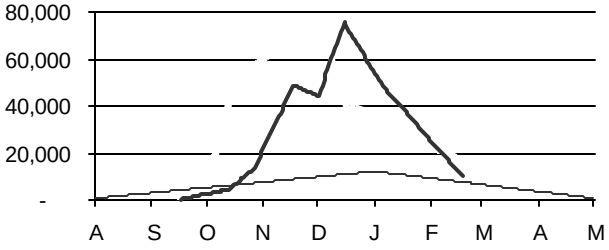
Suisun Marsh



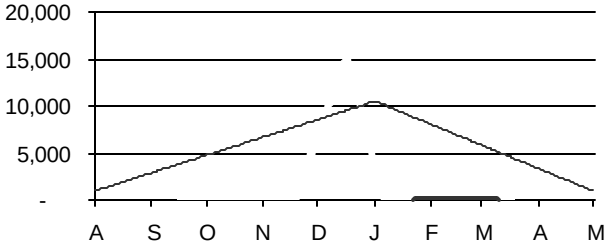
American



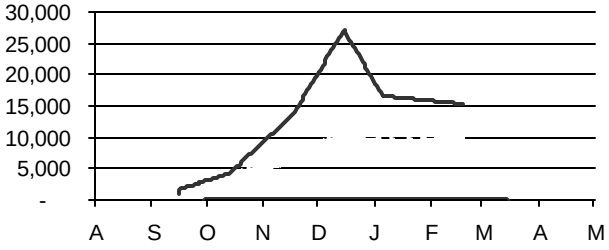
Northern San Joaquin



Sutter



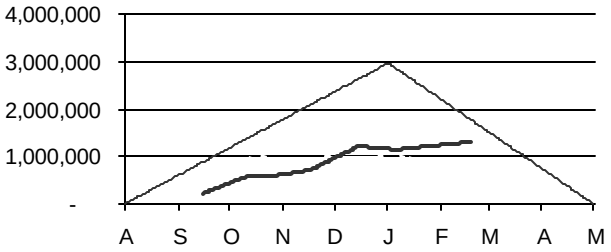
Tulare



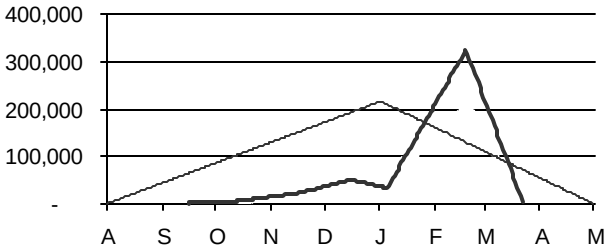
Northern Pintail abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

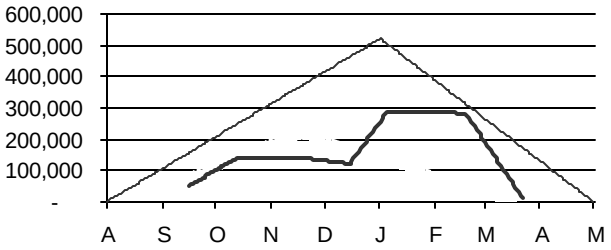
Central Valley Total



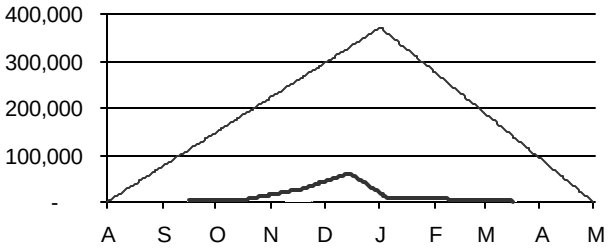
Yolo



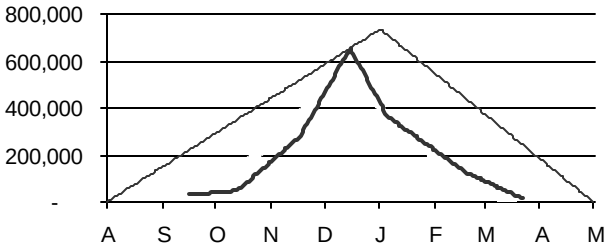
Colusa



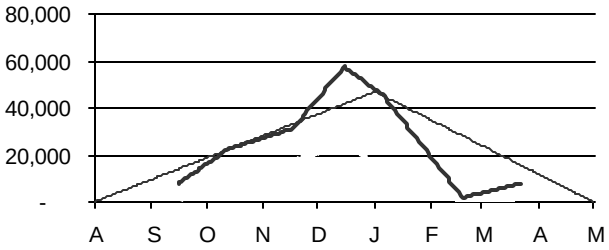
Delta



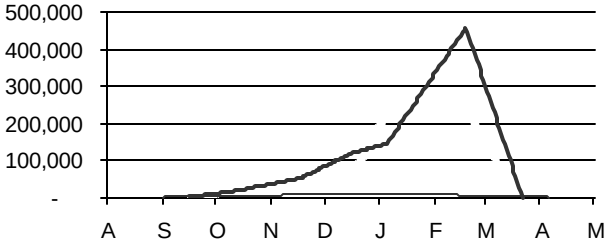
Butte



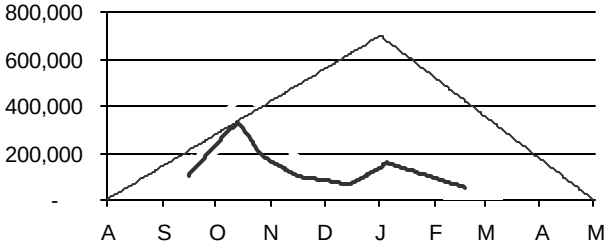
Suisun Marsh



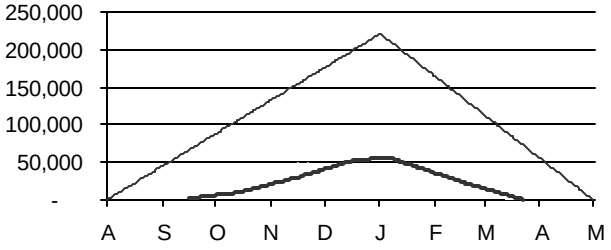
American



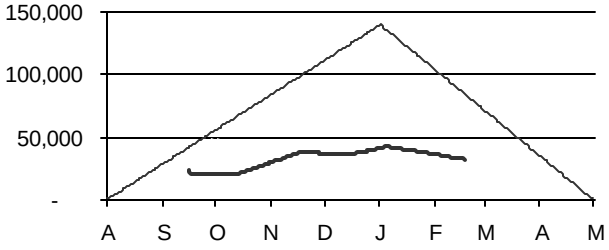
Northern San Joaquin



Sutter

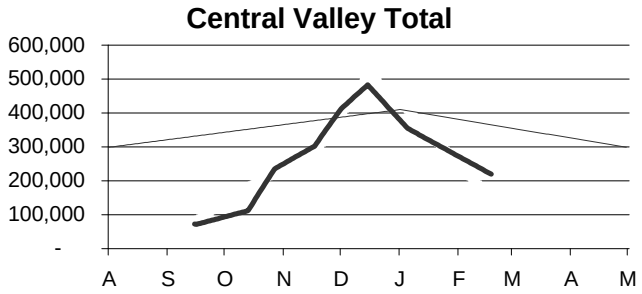


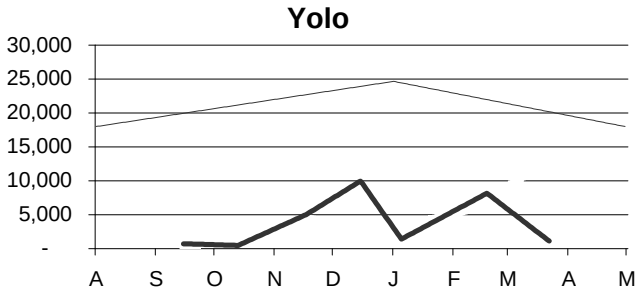
Tulare

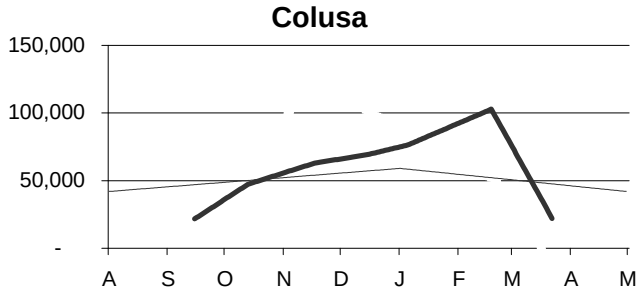


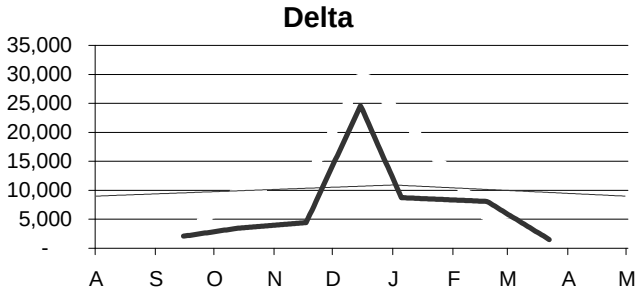
Mallard abundance during September - January

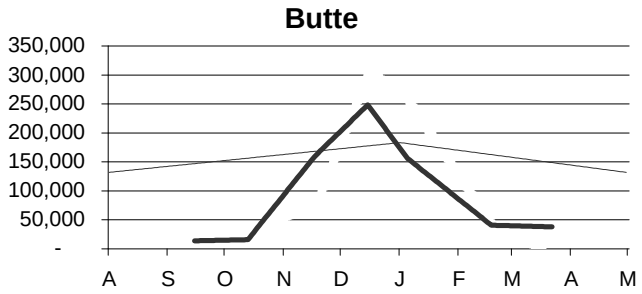
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

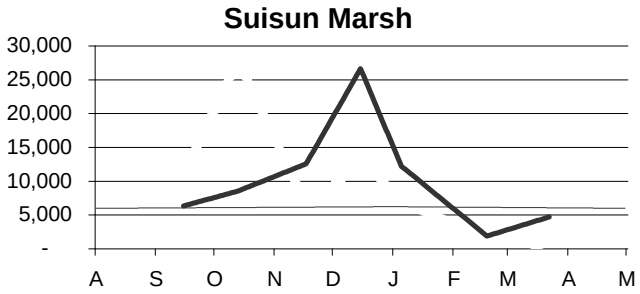


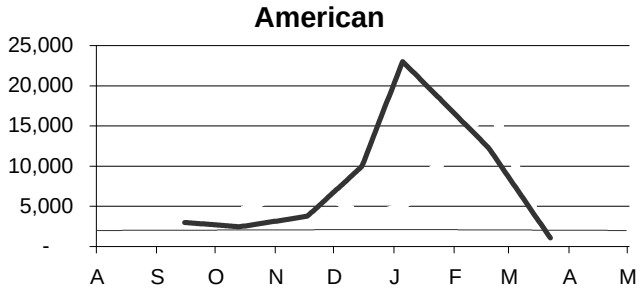


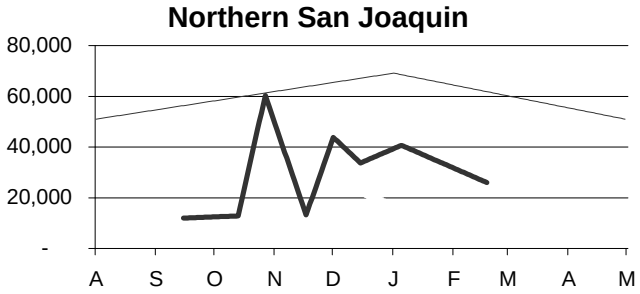


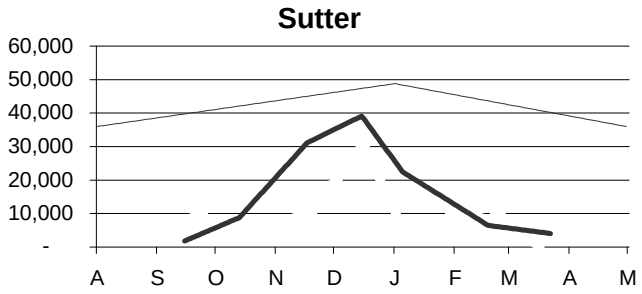


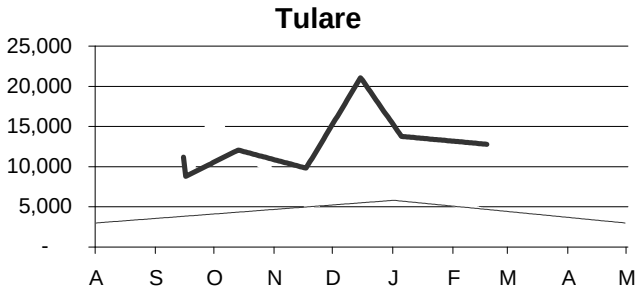








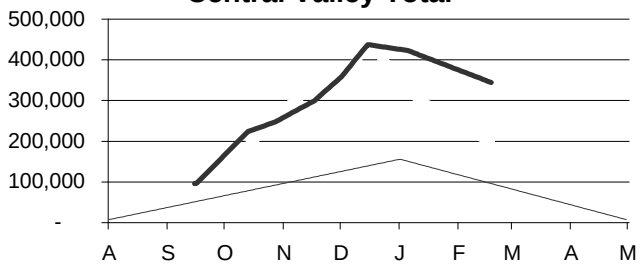




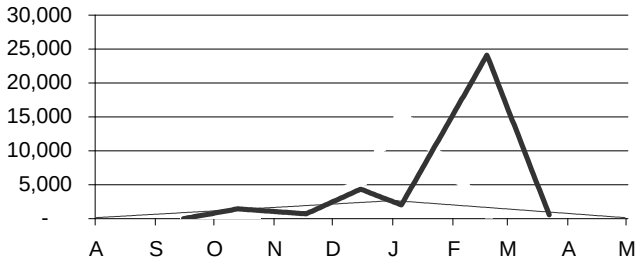
Green-winged Teal abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

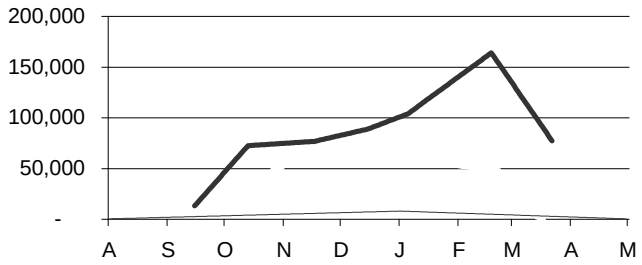
Central Valley Total



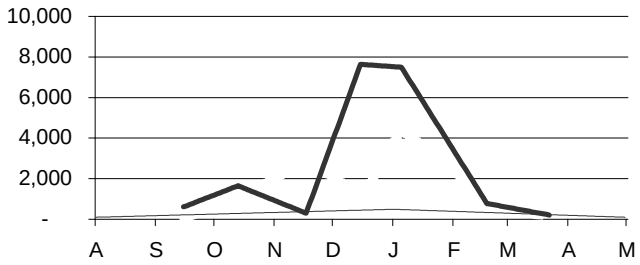
Yolo



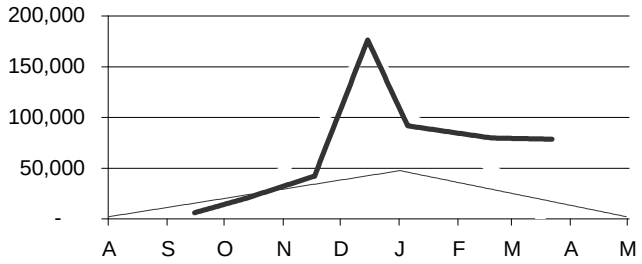
Colusa



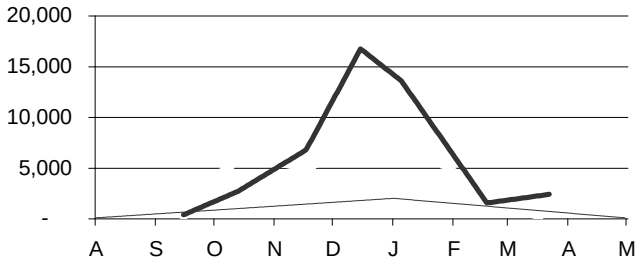
Delta



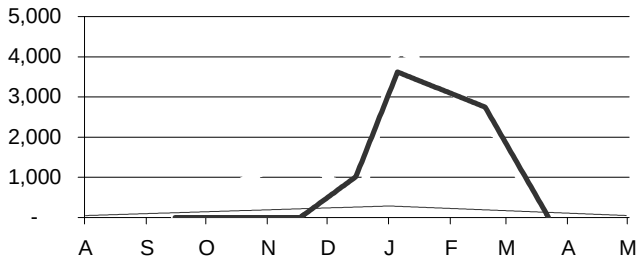
Butte



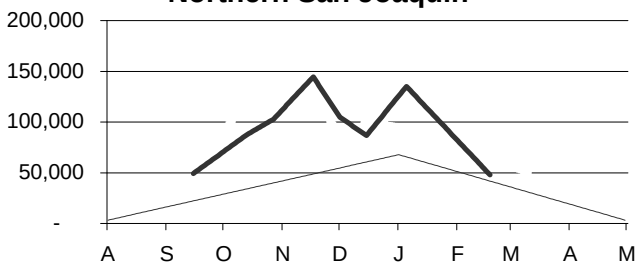
Suisun Marsh



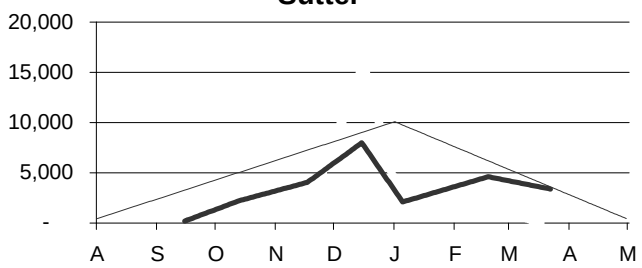
American



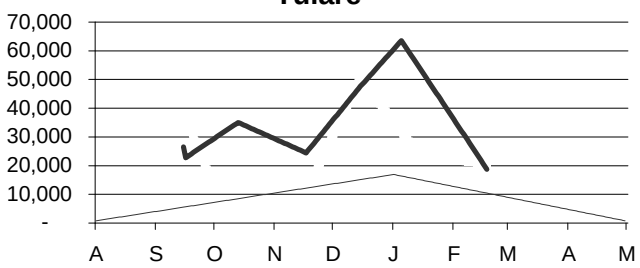
Northern San Joaquin



Sutter

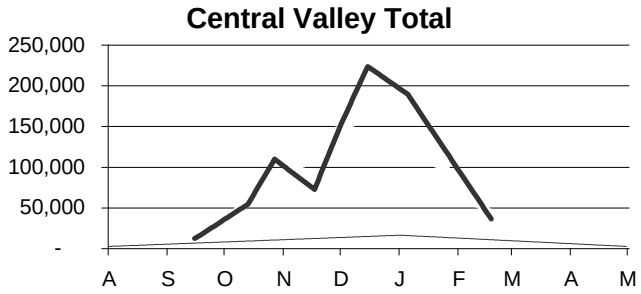


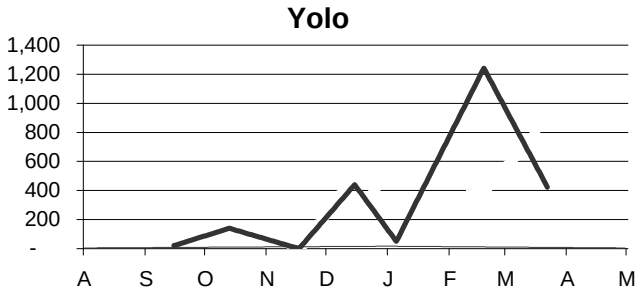
Tulare

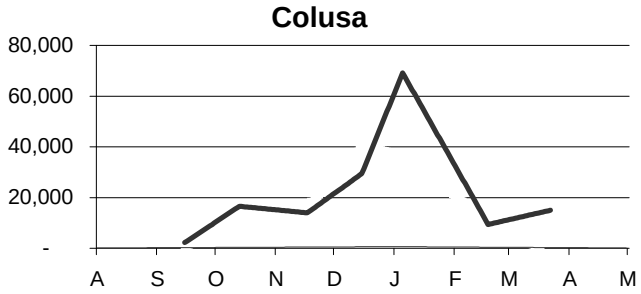


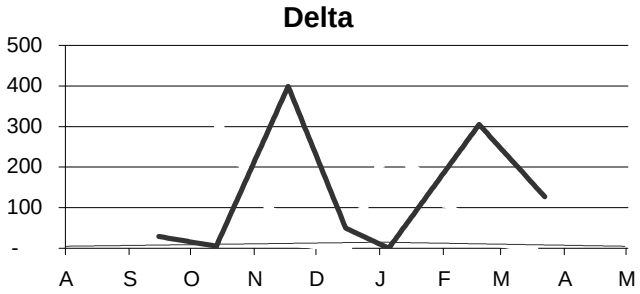
Gadwall abundance during September - January

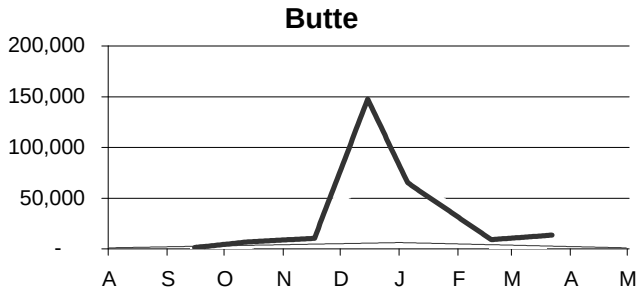
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

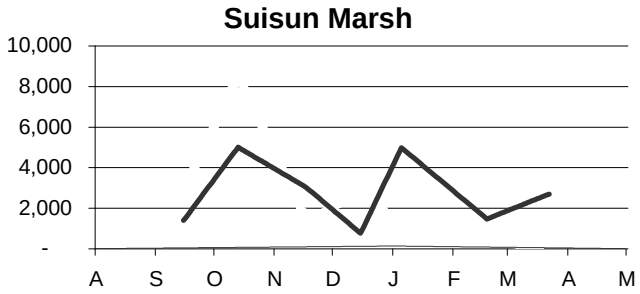


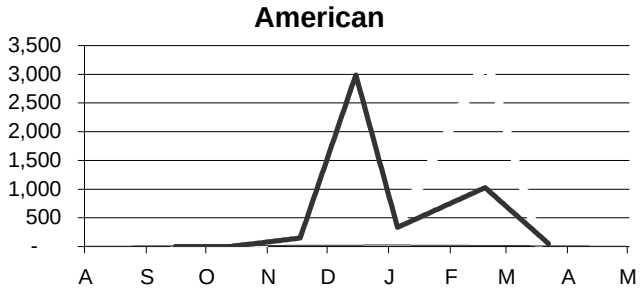


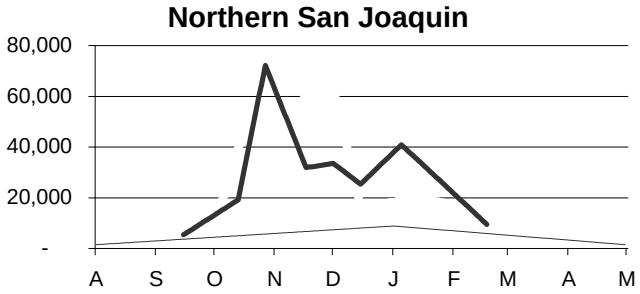


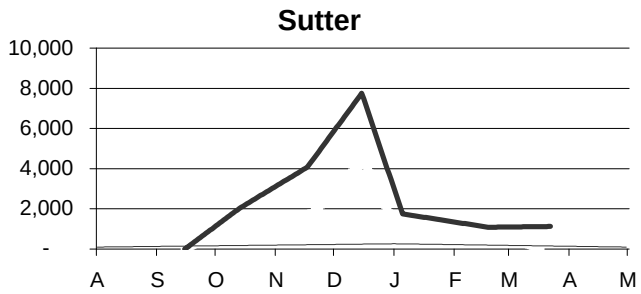


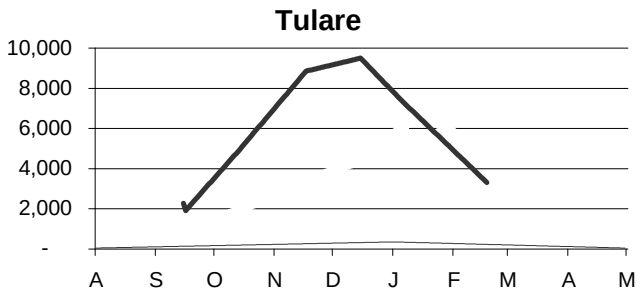








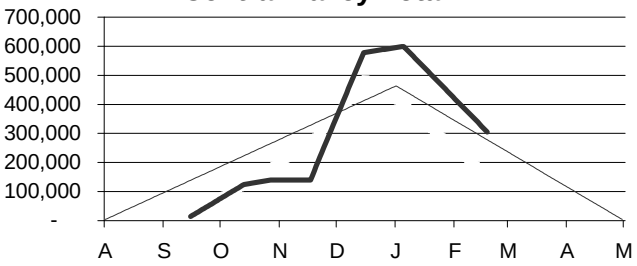




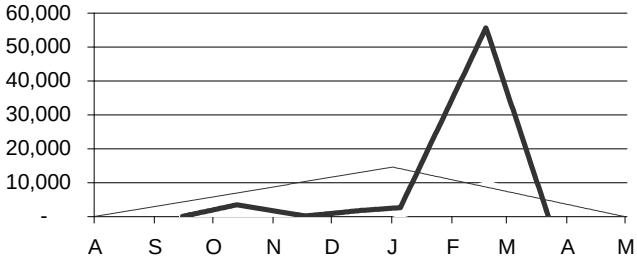
American Wigeon abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

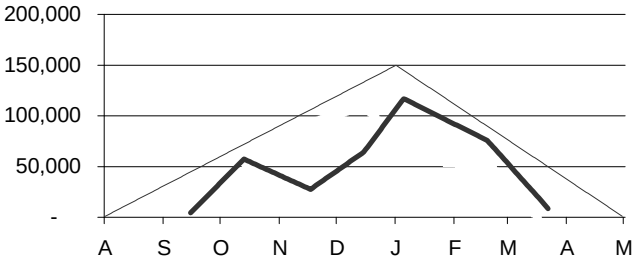
Central Valley Total



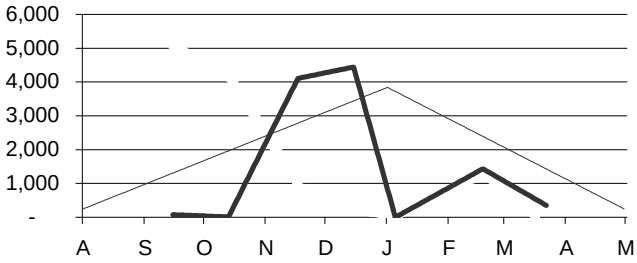
Yolo



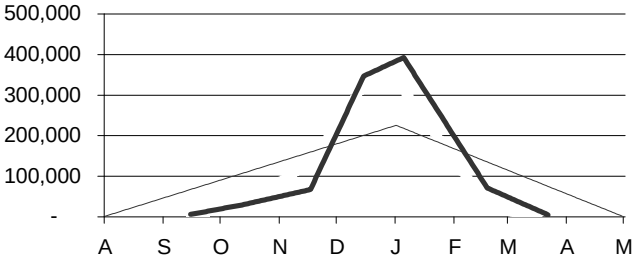
Colusa



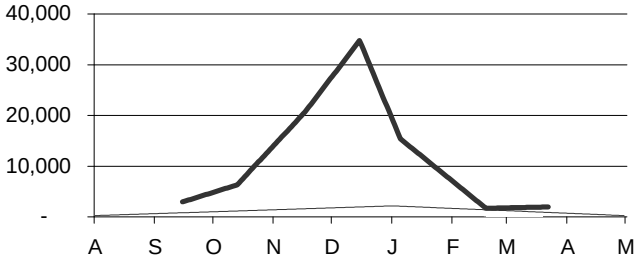
Delta



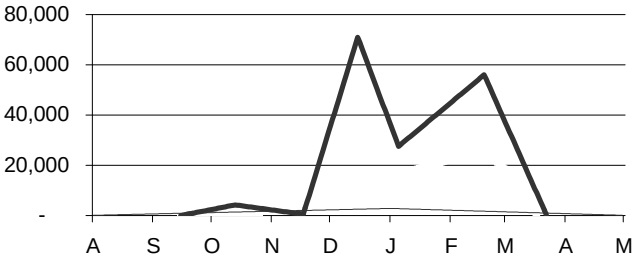
Butte



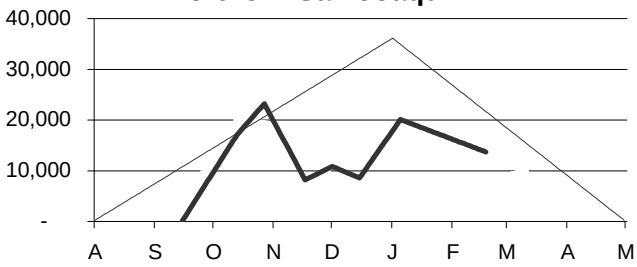
Suisun Marsh



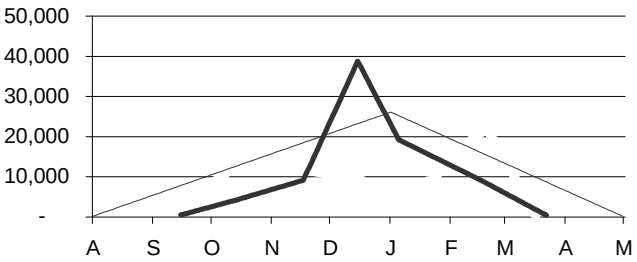
American



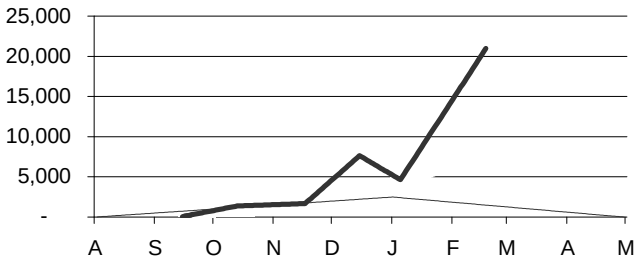
Northern San Joaquin



Sutter



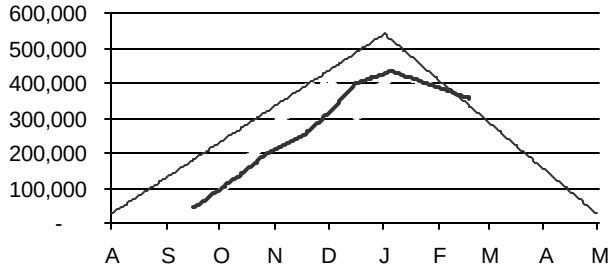
Tulare



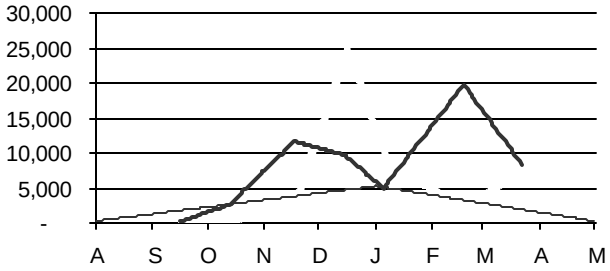
Northern Shoveler abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

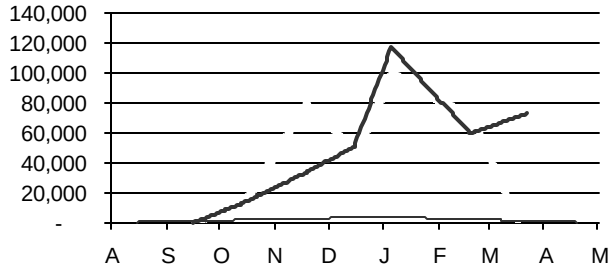
Central Valley Total



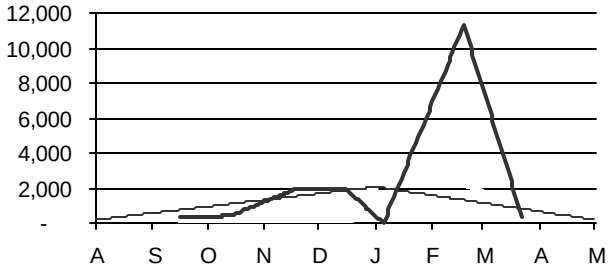
Yolo



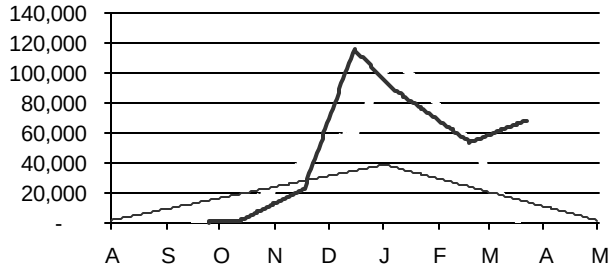
Colusa



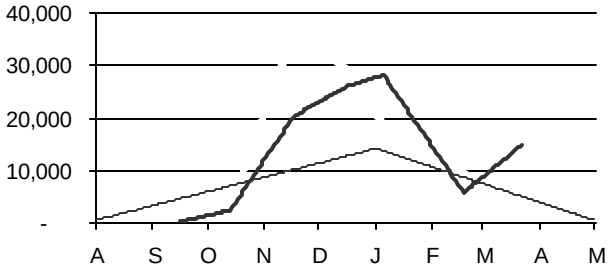
Delta



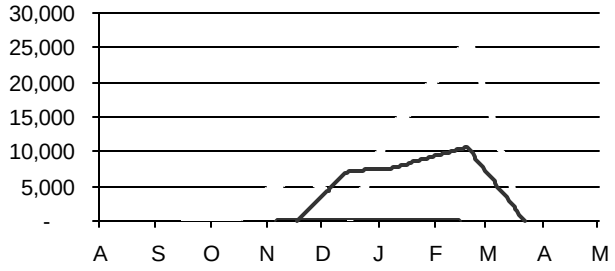
Butte



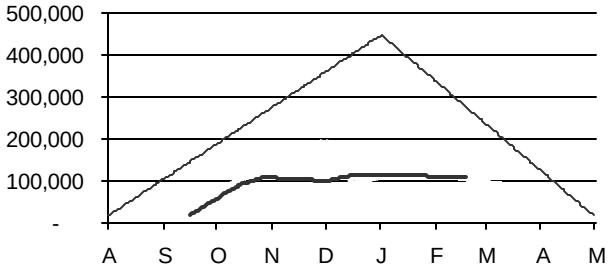
Suisun Marsh



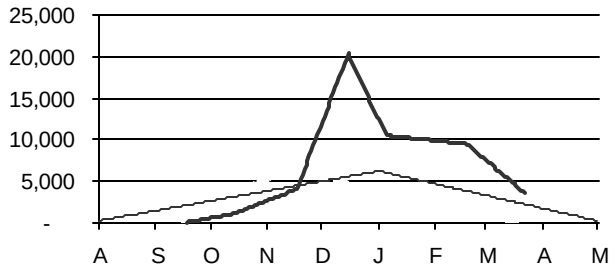
American



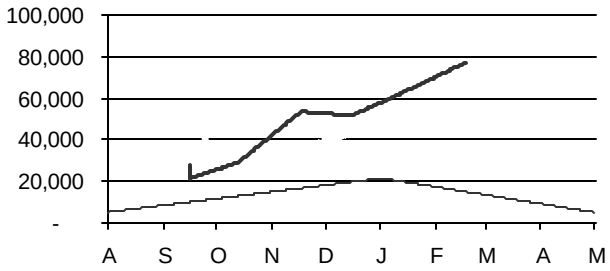
Northern San Joaquin



Sutter

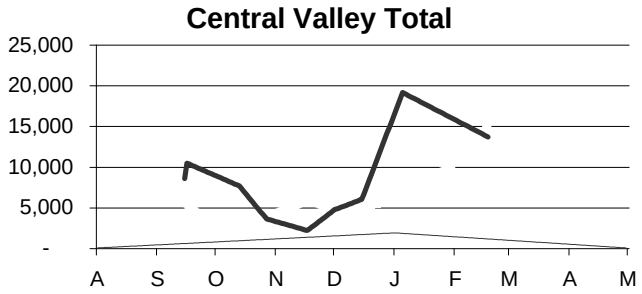


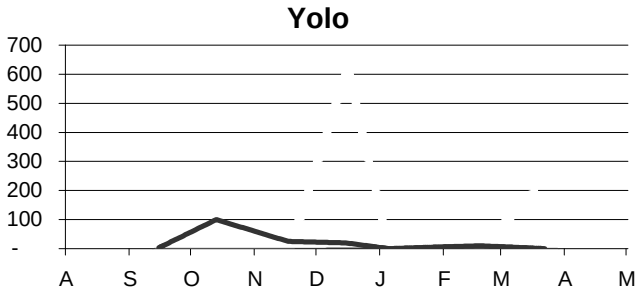
Tulare

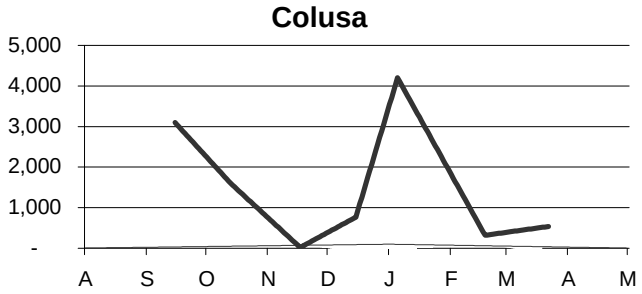


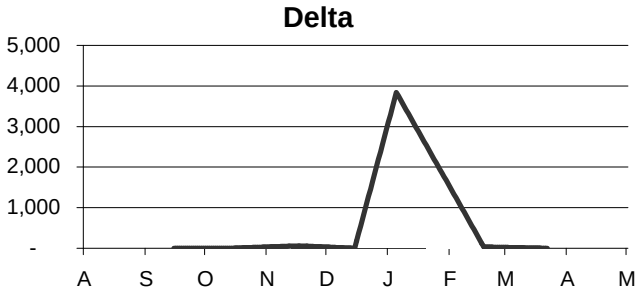
Cinnamon Teal abundance during September - January

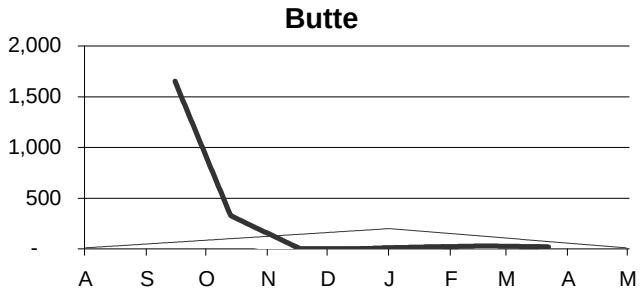
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

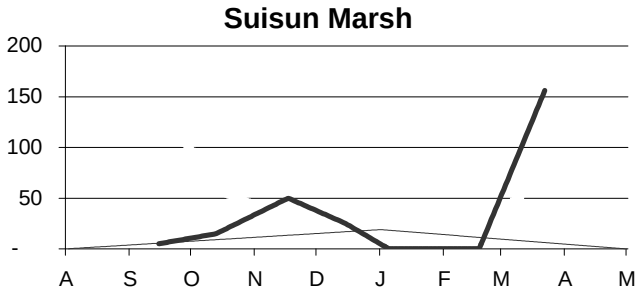


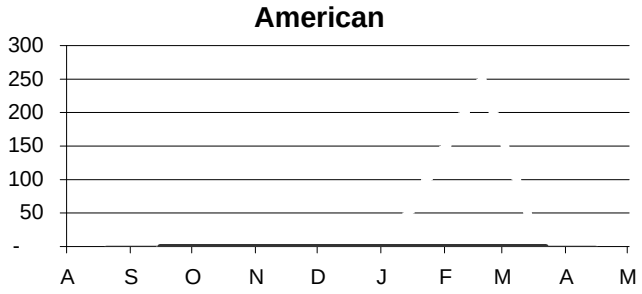


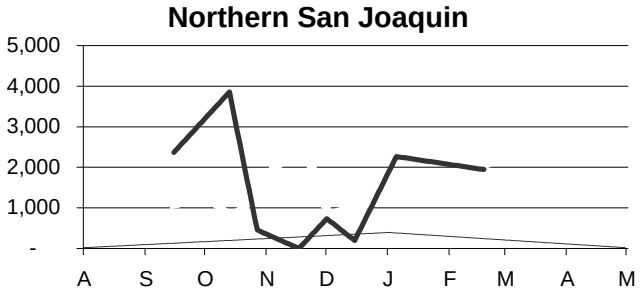


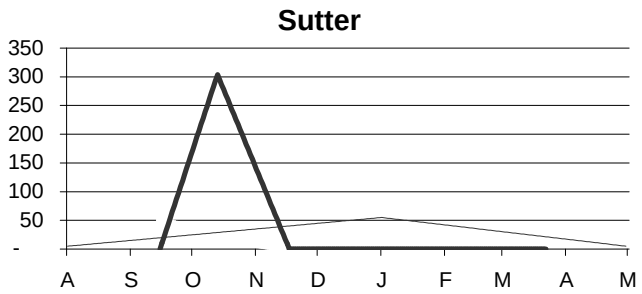


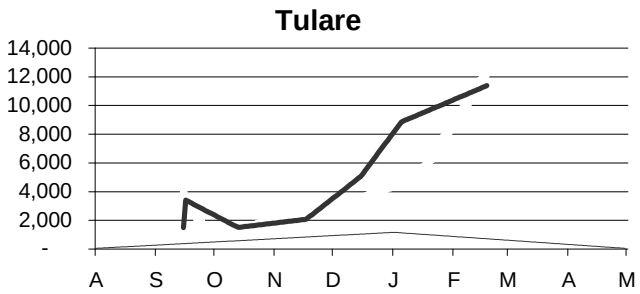






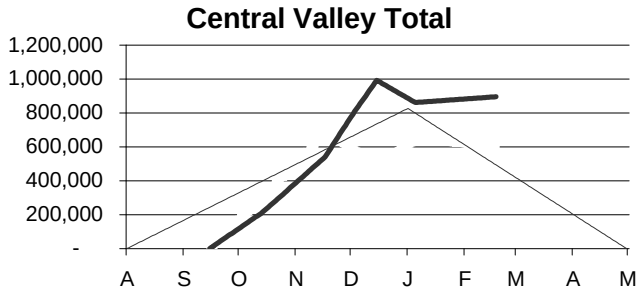


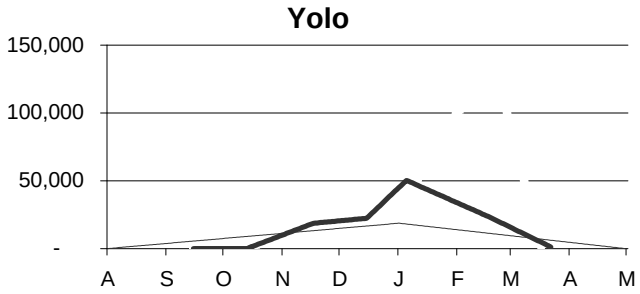


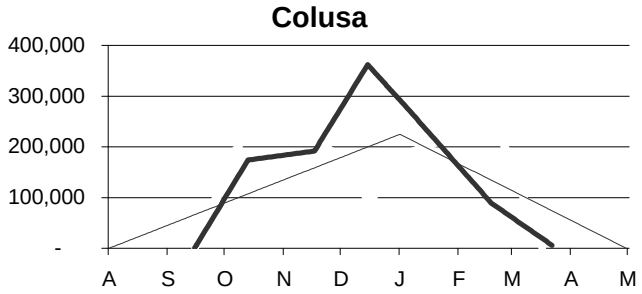


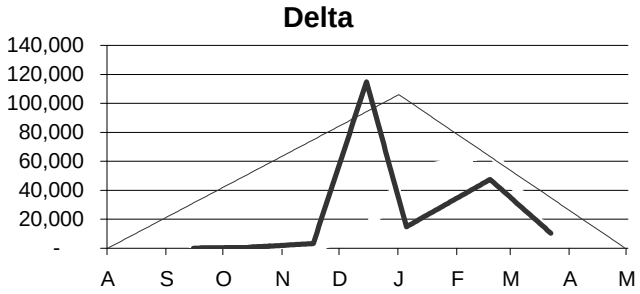
Geese abundance during September - January

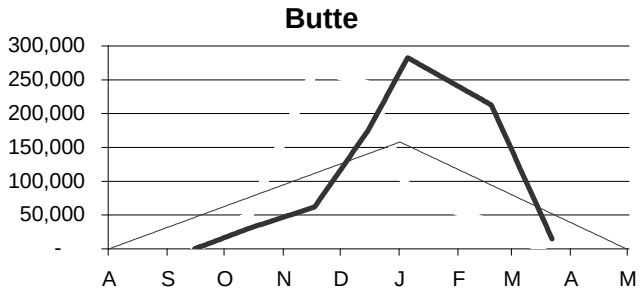
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

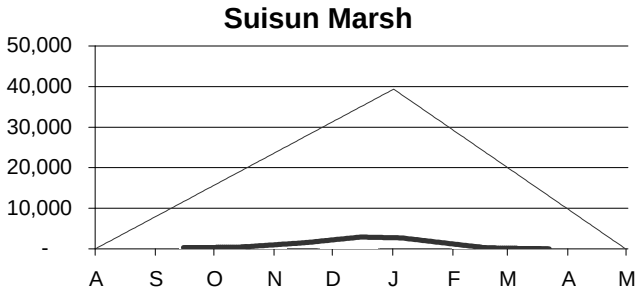


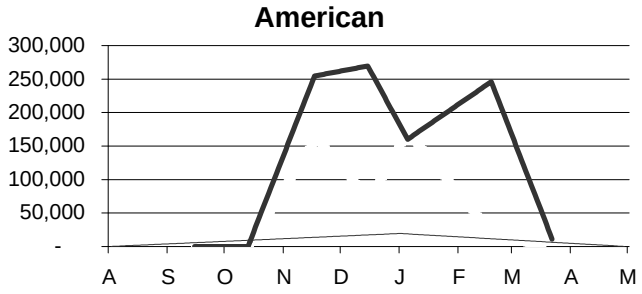


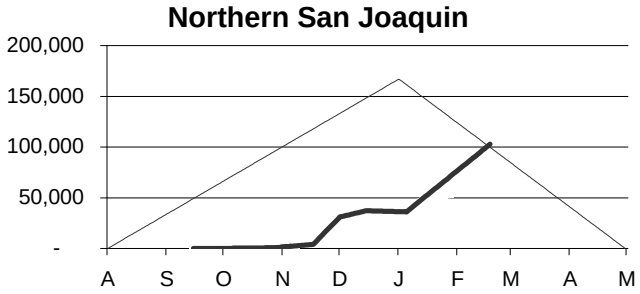


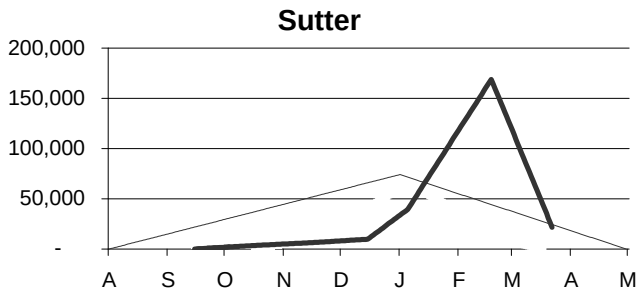


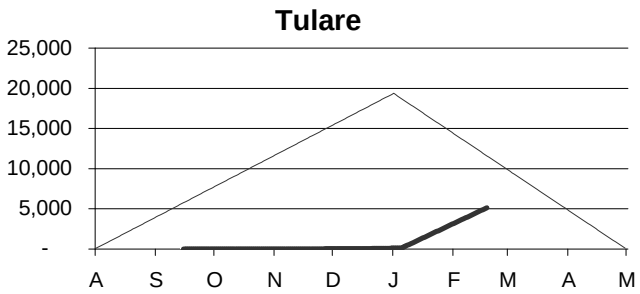






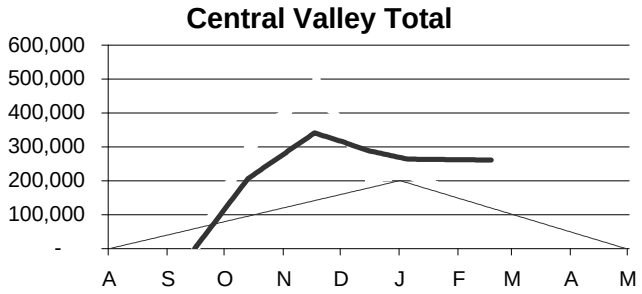


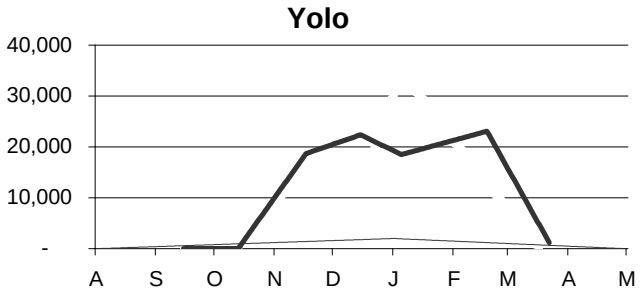


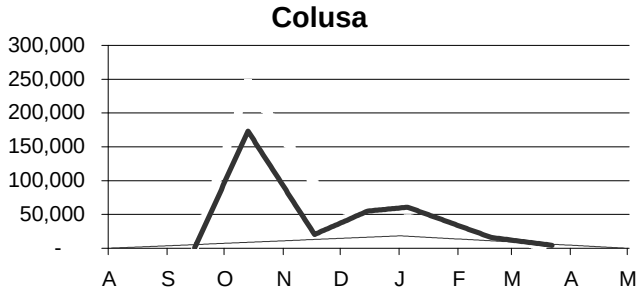


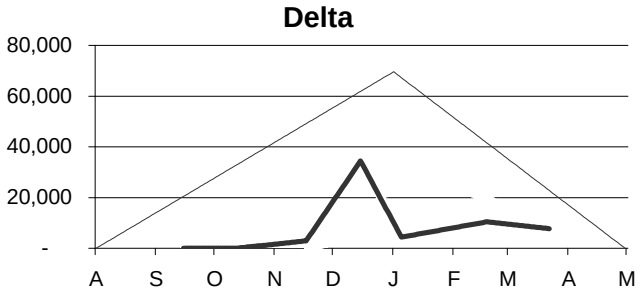
White-Front Geese abundance during September - January

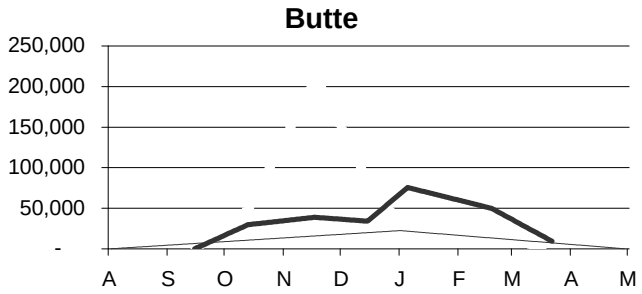
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

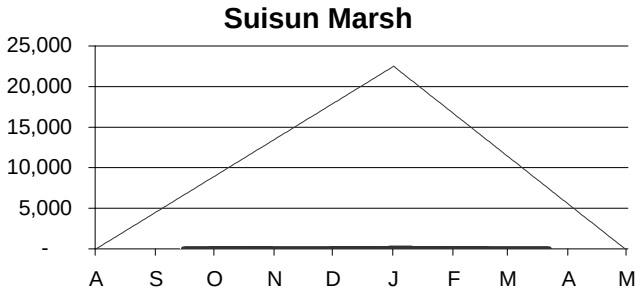


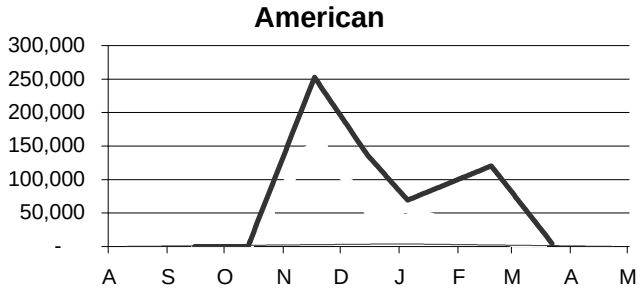


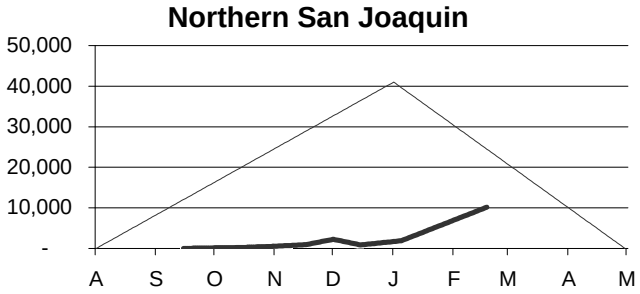


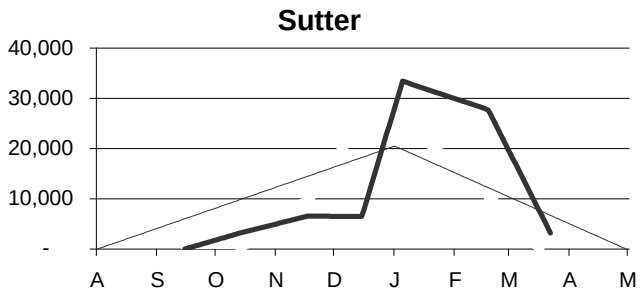


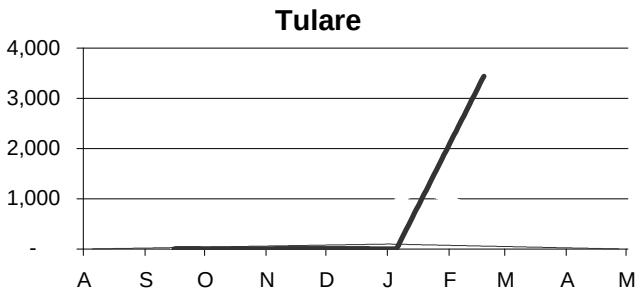








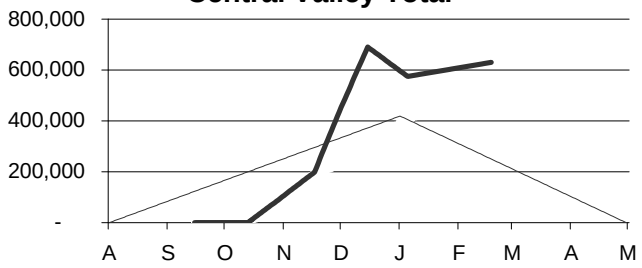




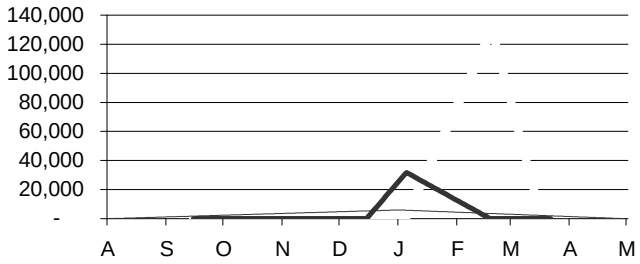
White Geese abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

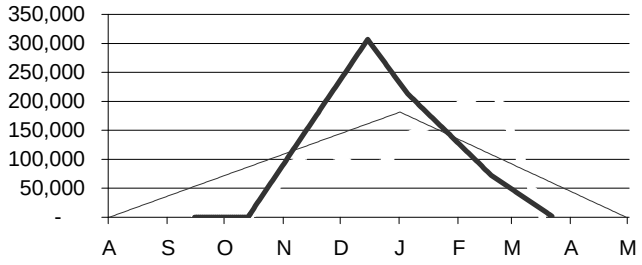
Central Valley Total



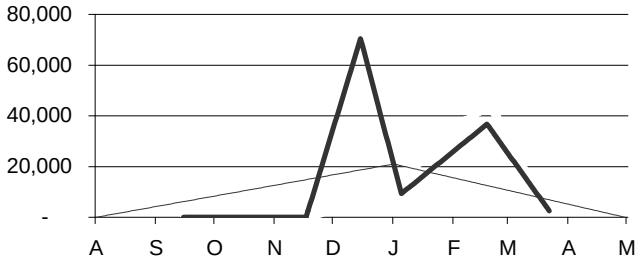
Yolo



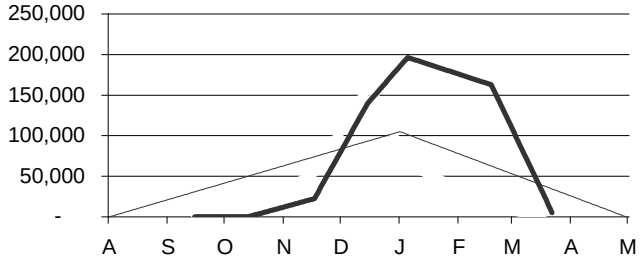
Colusa



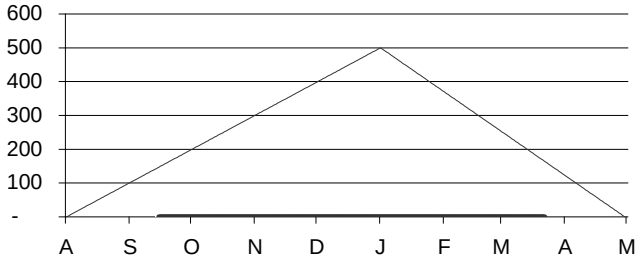
Delta



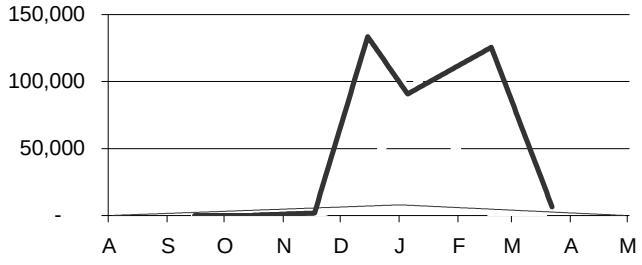
Butte



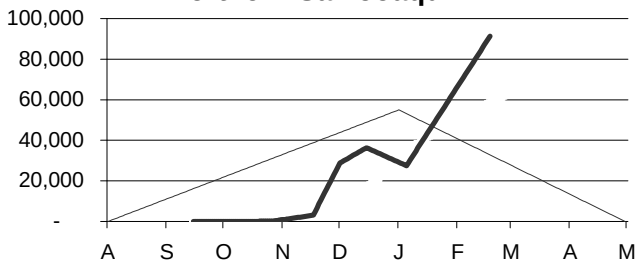
Suisun Marsh



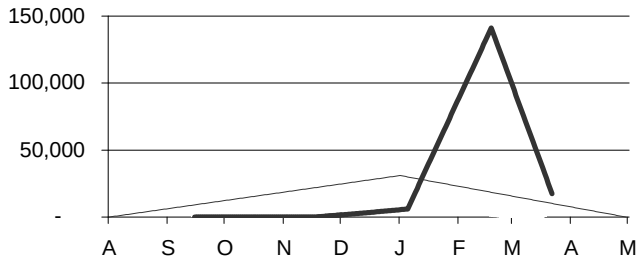
American



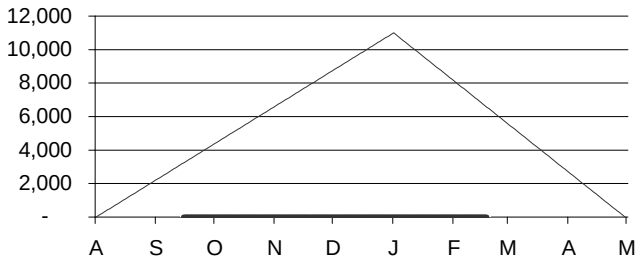
Northern San Joaquin



Sutter

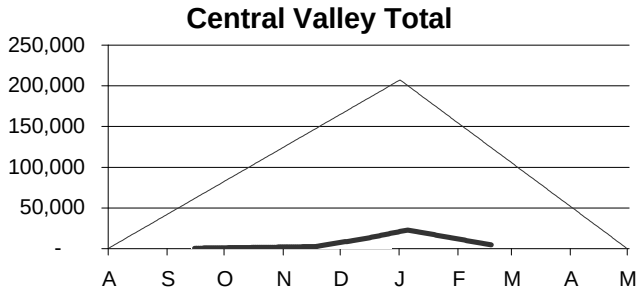


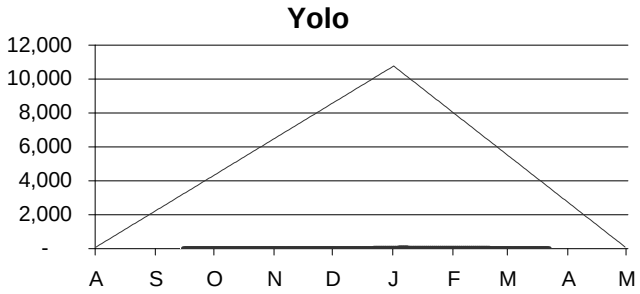
Tulare

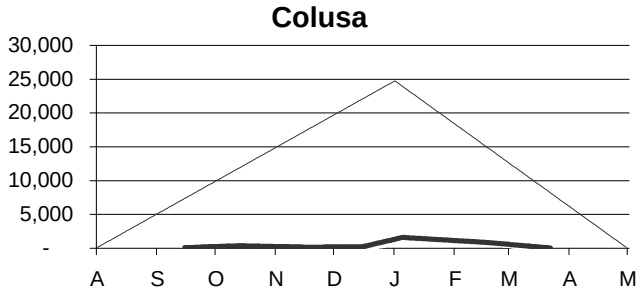


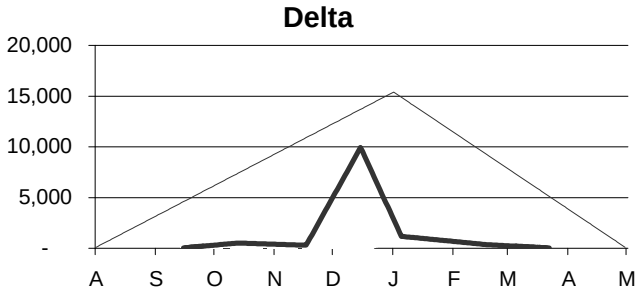
Canada geese abundance during September - January

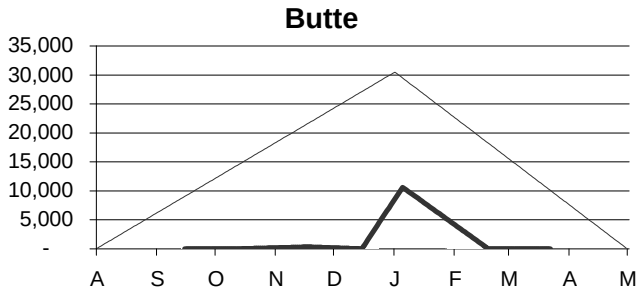
Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)

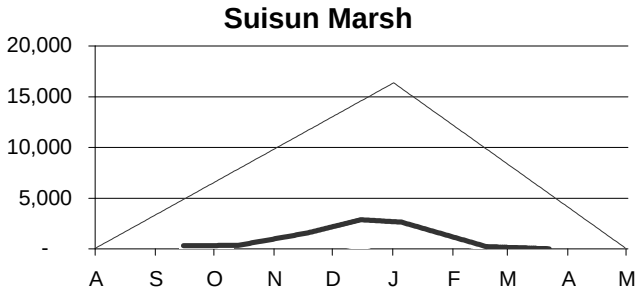


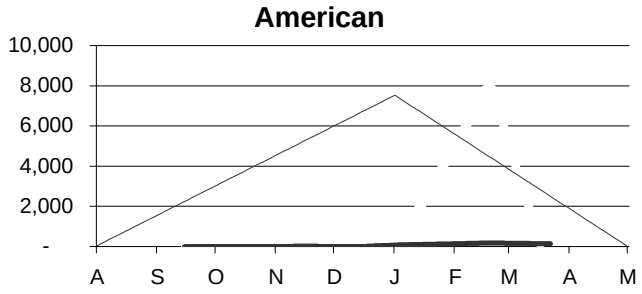


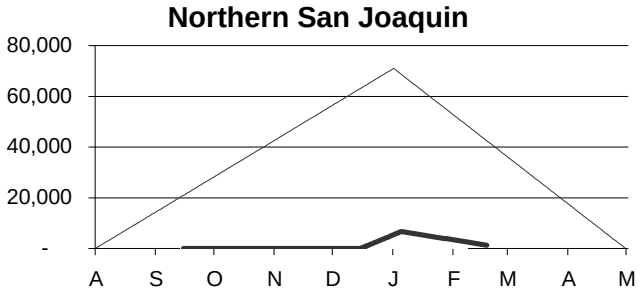


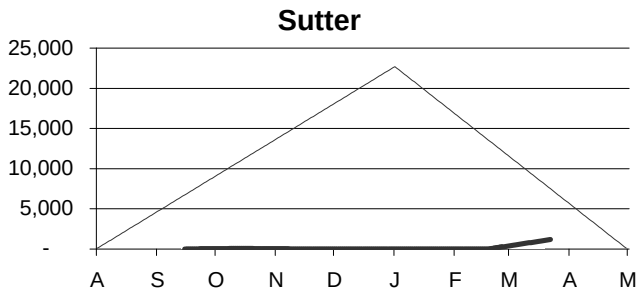


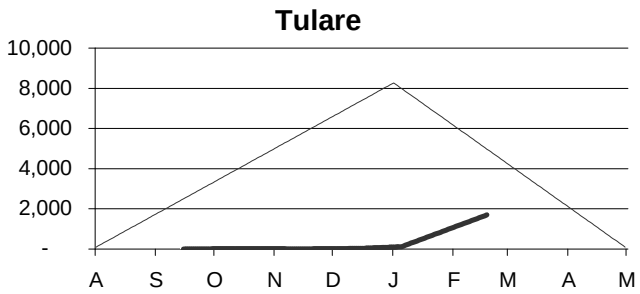












Swan abundance during September - January

Goals (thin line) vs 1998-99 (thick gray) and 1999-2000 (thick black)