Draft
Environmental Document
Migratory Game Bird Hunting
(Waterfowl, Coots, Moorhens)

Section 502, Title 14, California Code of Regulations
2025-26 Hunting Season

California Fish and Game Commission
Lead Agency under the
California Environmental Quality Act

Prepared by
State of California
The Natural Resources Agency
Department of Fish and Wildlife

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CONTENTS

TABLES

FIGURES

APPENDICES

CHAPTER 1 - SUMMARY

The California Department of Fish and Wildlife (Department) has prepared this environmental document (ED) for consideration by the California Fish and Game Commission (Commission), pursuant to the California Environmental Quality Act (CEQA; Public Resources Code Section 21000 et seq.) in compliance with the Commission's certified regulatory program as approved by the Secretary for the California Natural Resources Agency (Public Resources Code, Section 21080.5; CEQA Guidelines, Title 14, Section 15251, subsection (b); California Code of Regulations, Title 14, Section 781.5). This summary provides a brief description of the proposed project, project alternatives, and a summary of environmental impacts.

PROPOSED PROJECT

The project discussed in this document (the proposed project) involves modifications to the current waterfowl hunting regulations for the 2025-26 waterfowl hunting seasons. Specifically, the Department proposes that the California Fish and Game Commission (Commission):

- Provide a range of duck season lengths between 99 and 103 days in the Southern San Joaquin Valley, the Southern California, and the Balance of State zones. This proposal provides for a range of season lengths for consideration based on public input and discussion. The current duck season length is 98 days in the referenced zones. The total number of all hunting days used remain unchanged and will not exceed 107 days.
- Provide a range of regular goose season lengths between 99 and 103 days in the Southern San Joaquin Valley, and Southern California zones, and between 99 and 100 days in the Balance of State Zone. This proposal provides for a range of season lengths for consideration based on public input and discussion. The current regular goose season length is 98 days in the referenced zones. The total number of all hunting days used remain unchanged and will not exceed 107 days.
- Increase the pintail daily bag limit in all zones. This proposal recommends increasing the daily bag limit from 1 to 3.
- Allow up to 4 days of falconry-only season in the Southern San Joaquin Valley, Southern California and Balance of State zones. Duck and goose seasons length selection determines the available days for falconry-only seasons.

State and Federal Roles in Establishing Waterfowl Hunting Regulations

Migratory birds are managed under the provisions of the Migratory Bird Treaty Act of July 3, 1918 (Volume 40 Statutes at Large page 755: Title 16 United States Code section 703 et seq.), Federal regulations [50 CFR 20(K)(L)], as well as California statutes (California Fish and Game Code, sections 355 and 356) and regulations adopted by the Commission.

The regulations governing the take of migratory game birds in California are selected by the Commission and forwarded to the U.S. Fish and Wildlife Service (Service) each year. States (California) must set waterfowl hunting regulations within the federal frameworks established by the Service through a generalized four-step process:

1. The Service, with assistance from the states via the flyway system, assesses the status of migratory game bird populations and establishes a set of regulatory frameworks;

2. The Department recommends season dates and proposed changes to the Commission;
3. The Commission makes and forwards season selections to the Service regarding regulations for California; and
4. The Service and the State publish the final regulations.

The federal frameworks specify the outside dates, total number of hunting days, bag limits, shooting hours, and methods of take authorized for migratory game birds. The Department will recommend specific season dates and bag limits to the Commission that are within the federal frameworks. The Commission may not select more liberal season dates or bag limits than those set by the federal frameworks.

The Department has provided the Commission with a range of alternatives to the proposed project. Table 1 summarizes the Commission findings that there are no significant, long-term, adverse impacts associated with the proposed project or any of the project alternatives considered for the 2025-26 waterfowl hunting regulations.

In selecting hunting regulations, the Commission is governed by the State's Conservation of Wildlife Resources Policy (California Fish and Game Code, Section 1801). This policy contains, among other things, objectives to maintain sufficient populations of wildlife resources in the State and to provide public hunting opportunities through regulated harvest where such harvest is consistent with maintaining healthy wildlife populations (California Fish and Game Code, Section 1801).

The Service provided notice in February 2025 to establish hunting regulations for the 2025-26 hunting season (Federal Register (FR) 90 FR 7056-7066). The notice also solicits public comments and establishes the annual schedule for meetings of the four flyway councils and technical committees.

The Department recommends four changes to existing hunting regulations (Appendix A). The frameworks for the 2025-26 season have been approved by the flyway councils and adopted by the Service Regulations Committee meeting in October 2024. The frameworks allow for a liberal duck season that includes a 107-day season, 7 daily duck limit (including 7 mallards but only 2 hen mallards), 3 pintail, 2 canvasback, 2 redheads, and 2 scaup (during an 86-day season); the Department’s proposals for the 2025-26 hunting season for waterfowl, coots, and moorhens are based on these federal frameworks.

A range of season length and bag limit (zero bag limit represents a closed season) is also provided for black brant. The range is necessary, as the black brant framework cannot be determined until the Pacific Flyway Fall Brant Survey is analyzed by February 2025. The regulatory package is to be determined by the most current Fall Brant Survey, rather than the prior year survey. The regulatory package will be prescribed per the Black Brant Harvest Strategy (Pacific Flyway Council 2018) pending results of the survey.

The 2025-26 Preliminary Federal Frameworks Pertaining to California

Ducks, Mergansers, Coots, Moorhens and Gallinules

Hunting Seasons and Duck Limits: Concurrent 107 days. The daily bag limit is 7 ducks and mergansers, including no more than 2 female mallards, 3 pintail, 2 scaup (86-day season), 2 canvasback, and 2 redheads. The season on coots and common moorhens may be between the outside dates for the season on ducks, but not to exceed 107 days. Coot, Common Moorhen, and Purple Gallinule Limits: The daily bag limits of coots, common moorhens, and purple gallinules are 25, singly or in the aggregate. Possession limits for all species are triple the daily bag limit.

Outside Dates: Between the Saturday nearest September 23 and January 31.

Zoning and Split Seasons: Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and Wyoming may select hunting seasons by zones. Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and Wyoming may split their seasons into two segments. Colorado, Montana, and New Mexico may split their seasons into two segments.

Colorado River Zone, California: Seasons and limits shall be the same as seasons and limits selected in the adjacent portion of Arizona (South Zone).

Geese

Season Lengths, Outside Dates, and Limits

Canada geese and brant: Except as subsequently noted, 107-day seasons may be selected with outside dates between the Saturday nearest September 23 and January 31. In California, Oregon, and Washington, the daily bag limit is 4 Canada geese. For brant, the season framework will be determined by the harvest strategy in the management plan for the Pacific Population of Brant, pending results of the 2024 Fall Izembek Survey (FIS). If the results of the 2024 FIS are not available, results of the most recent FIS will be used. Days must be consecutive. Washington and California may select hunting seasons for up to two zones. The daily bag limit is in addition to other goose limits. In Oregon and California, the brant season must end no later than December 15.

White-fronted geese: Except as subsequently noted, 107-day seasons may be selected with outside dates between the Saturday nearest September 23 and March 10. The daily bag limit is 10.

Light geese: Except as subsequently noted, 107-day seasons may be selected with outside dates between the Saturday nearest September 23 and March 10. The daily bag limit is 20.

Split Seasons: Unless otherwise specified, seasons for geese may be split into up to 3 segments. Three-way split seasons for Canada geese and white-fronted geese require Pacific Flyway Council and Service approval and a 3-year evaluation by each participating State.

California: The daily bag limit for Canada and cackling geese is 10 in the aggregate.

Balance of State Zone (includes Southern San Joaquin Valley Zone): A Canada goose season may be selected with outside dates between the Saturday nearest September 23 and March 10. Canada and cackling goose seasons may be split into 3 segments. In the Sacramento Valley Special Management Area, the season on white-fronted geese must end on or before December 28, and the daily bag limit is 3 white-fronted geese. In the North Coast Special Management Area, hunting days that occur after the last Sunday in January should be concurrent with Oregon's South Coast Zone.

Northeast Zone: White-fronted goose seasons may be split into 3 segments.

Shooting Hours – From One-half hour before sunrise to sunset.

SUMMARY OF IMPACTS AND MITIGATION

Table 1. Summary of Alternatives and Their Impacts

Alternative	Description	Significant Impact	Mitigation
Proposed Project	Provide a range of duck season lengths between 99 and 103 days in the Southern San Joaquin Valley, the Southern California, and the Balance of State zones. The current duck season length is 98 days. The total number of all hunting days used remain unchanged and will not exceed 107 days. Provide a range of regular goose season lengths between 99 and 103 days in the Southern San Joaquin Valley and Southern California zones, and between 99 and 100 days in the Balance of State Zone. The current goose season length is 98 days in the referenced zones. The total number of all hunting days used remain unchanged and will not exceed 107 days. Increase the pintail daily bag limit in all zones from 1 to 3 per day. Allow up to 4 days of falconry-only season in the Balance of State, Southern San Joaquin Valley and Southern California zones. Goose and duck season lengths determines the available days for falconry-only seasons.	No	N/A
Alt 1. No Project	No change from the 2024-25 hunting regulations.	No	N/A
Alt 2. Reduced Season Lengths, Timing and Bag Limits	Reduce season lengths, timing, and/or bag limits by up to 50 %.	No	N/A

Alternative	Description	Significant Impact	Mitigation
Alt 3. Eliminate All Mechanical Decoys	Eliminate mechanical decoys as a method of take.	No	N/A

The Department concludes that the regulated harvest of migratory game birds within the federal frameworks does not result in a significant adverse impact to their populations as analyzed in the 2006 Final Environmental Document for Migratory Game Bird Hunting of Waterfowl, Coots, and Moorhens (incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605). This is because the size of a wildlife population at any point in time is the result of the interaction between population (reproductive success and mortality rates) and its environment (habitat). Declines in habitat quality and quantity result in reduced carrying capacity, which results in corresponding declines in populations.

AREAS OF CONTROVERSY

A public scoping session regarding preparation of environmental documents for hunting waterfowl was held on January 16, 2025, via teleconference. No areas of controversy regarding migratory bird hunting were identified at the meeting. However, members of the public have expressed concern regarding: (1) mechanical spinning wing decoys in the use of taking waterfowl during past hunting seasons (since 2002 about 100 letters and/or public testimony has been received by the Commission requesting to ban mechanically spinning wing decoys, while only about 12 letters of support or public testimony in favor of mechanically spinning wing decoys during the same time period - Department files); (2) supporting or opposing continued hunting in Morro and Tomales bays; and (3) opposition to continued restrictions on bag limit and season length for white-fronted geese in the Sacramento Valley Special Management Area.

ISSUES TO BE RESOLVED

The Commission is the lead agency considering the proposed project, while the Department has responsibility for conducting management activities such as conducting resource assessments, preparing management plans, operating public hunting opportunities, and enforcing laws and regulations. The primary issue for the Commission to resolve is whether to change waterfowl hunting regulations, within the federal framework, as an element of waterfowl management. If such changes are authorized, the Commission will specify the areas, season lengths, and bag and possession limits and other appropriate conditions.

FUNCTIONAL EQUIVALANCY

The California Environmental Quality Act (CEQA) requires all public agencies in the State to evaluate the environmental impacts of projects they approve, including regulations, which may have potential to significantly affect the environment. CEQA review of the proposed project will be conducted in accordance with the certified regulatory program approved by the Secretary for the California Resources Agency pursuant to Public Resources Code section 21080.5 (see generally California Code of Regulations, Title 14, Section 781.5 and subdivision (b) of Section 15251). In compliance with the requirements, the Department has prepared this environmental document which is the functional equivalent of an environmental impact report, for Commission consideration. The environmental document provides the Commission, other agencies, and the general public with an assessment of the potential environmental effects.

SUBMITTING COMMENTS ON THE ENVIRONMENTAL DOCUMENT

Pursuant to Section 15087 of the CEQA Guidelines, this environmental document is available for public review for 45 days. During the review period, the public is encouraged to provide written comments to:

California Department of Fish and Wildlife
Attention: Wildlife Branch, Waterfowl Program
P.O. Box 944209
Sacramento, CA 94244-2090

Or submit by email to Waterfowlmgmt@wildlife.ca.gov

Comments must be received by the Department no later than 5:00 p.m. on April 10, 2025.

CHAPTER 2 - THE PROPOSED ACTION

The proposed project being considered consists of four modifications to existing migratory game bird hunting regulations:

1. Provide a range of duck season lengths between 99 and 103 days in the Southern San Joaquin Valley, the Southern California, and the Balance of State zones. The current duck season length is 98 days in the referenced zones. The total number of all hunting days used remain unchanged and will not exceed 107 days.
2. Provide a range of regular goose season lengths between 99 and 103 days in the Southern San Joaquin Valley and Southern California zones, and between 99 and 100 days in the Balance of State Zone. The current goose season length is 98 days in the referenced zones. The total number of all hunting days used remain unchanged and will not exceed 107 days.
3. Increase the pintail daily bag limit in all zones from 1 to 3 per day.
4. Allow up to 4 days of falconry-only season in the Balance of State, Southern San Joaquin Valley and Southern California zones. The current falconry-only season is closed in the referenced zones. Goose and duck season lengths determine the available days for falconry-only seasons.

Table 2. Proposed Changes to Season Dates and Bag Limits for 2025-2026.

Species by Zone	Daily Bag Limit	Possession Limit	Season Length
COOTS AND MOORHENS			
Northeastern CA	no change	no change	no change
So. San Joaquin Valley	no change	no change	no change
So. California	no change	no change	no change
Colorado River	no change	no change	no change
Balance of State	no change	no change	no change
DUCKS			
Statewide	no change	no change	
EXCEPTIONS			
Mallard (max.)	no change	no change	no change
Mallard Hen (max.)	no change	no change	no change
Pintail (max.)	3	no change	no change
Redhead (max.)	no change	no change	no change
Scaup (max.)	no change	no change	no change
Canvasbacks (max.)	no change	no change	no change
Northeastern Calif.	no change	no change	no change
So. San Joaquin Valley	no change	no change	99-103
Southern California	no change	no change	99-103
Colorado River	no change	no change	no change
Balance of State	no change	no change	99-103
GEESE			
Northeastern Calif.		no change	no change
EXCEPTIONS			
Large Canada Geese (max.)	no change	no change	
White-Front (max.)	no change	no change	no change
Small Canada Geese (max.)	no change	no change	
White Geese (max.)	no change	no change	no change
So. San Joaquin Valley	no change	no change	99-103
EXCEPTIONS			
Large Canada Geese (max.)	no change	no change	
White-Front (max.)	no change	no change	
Small Canada Geese (max)	no change	no change	
White Geese (max.)	no change	no change	
Southern Calif.	no change	no change	99-103
EXCEPTIONS			
Large Canada Goose (max.)	no change	no change	
White-Front Geese (max.)	no change	no change	
Small Canada Geese (max)	no change	no change	
White Geese (max.)	no change	no change	
Colorado River	no change	no change	no change
EXCEPTIONS			
White Geese (max.)	no change	no change	
Dark Geese (max.)	no change	no change	
Balance of State	no change	no change	99-103
EXCEPTIONS			
Large Canada Geese (max.)	no change	no change	
White-Front (max.)	no change	no change	
Small Canada Geese (max)	no change	no change	
White Geese (max.)	no change	no change	
Special Management Areas	**Species**		**Season**
North Coast	no change		no change
Humboldt Bay South Spit	no change		no change
Klamath Basin	no change		no change
Sacramento Valley (West)	no change		no change
Morro Bay	no change		no change
Martis Lake	no change		no change
Northern Brant	no change		0-37 days
Balance of State Brant	no change		0-37 days
Imperial County	no change		no change

Figure 1. Waterfowl Zones in California

BACKGROUND AND EXISTING CONDITIONS

Waterfowl, coots and moorhens are migratory game birds that use varied habitat types in different geographical areas of North America. Many individuals of these species reproduce in other states and countries and migrate in the fall and winter to California, although there are substantial resident populations of some species.

There are 36 species of migratory game birds from two of the taxonomic families that occur in California, listed below. Migratory game birds are defined by convention and law as belonging to six taxonomic families (USDI 1988a:1):

1. *Anatidae* (ducks, geese, brant, and swans)
2. *Columbidae* (doves and pigeons)
3. *Gruidae* (cranes)
4. *Rallidae* (rails, coots, and gallinules)
5. *Scolopacidae* (woodcock and snipe)
6. *Corvidae* (crows).

The two families discussed in this ED are *Anatidae* and *Rallidae*. These families are combined herein due to similarities in basic life-history characteristics. These characteristics include: (1) the use of California as a migration and wintering area (Palmer 1976, Bellrose 1980, Zeiner et al. 1990); (2) the use of seasonal wetlands as roosting and foraging habitats (Bellrose 1980, Heitmeyer and Raveling 1988, USDI 1988a:31-56); and (3) for most duck species, similarities in nesting areas, habitat types, age at reproduction, and clutch sizes (Palmer 1976, Bellrose 1980, USDI 1988). Some differences among the species in these families exist. Geese and some duck species breed at an older age than most ducks (Palmer 1976, Bellrose 1980). Deepwater and estuarine habitats are more important to some species (Palmer 1976, Bellrose 1980), and the use of dry and wet agricultural fields are more important to other species (Bellrose 1980, Zeiner et al. 1990).

Individuals and populations of migratory birds spend parts of the year in different geographical areas. Due to this geographic distribution and migratory nature, management for these species is based on geographic units, or flyways, (USDI 1975, USDI 1988a:63) comprised of several states (Figure 2).

These units, or flyways, incorporate populations that are generally discrete from populations in other units. Therefore, an analysis of the environmental effects of the proposed project in California must consider the status of the affected species at a flyway level.

Figure 2. Administrative Waterfowl Flyways

Adaptive Harvest Management

In March 1995 (60 FR 15642–15648), the Service implemented a general harvest strategy for setting duck framework regulations and the process will be used again in 2025 (see 90 FR 7056-7066). The regulatory process for migratory birds has evolved since the early 1900s from one that included little, or no monitoring of populations and the establishment of regulations based on traditions, to today's more data-driven process (Johnson et al. 1993). The current process, known as Adaptive Harvest Management (AHM)(USFWS 2024a) establishes explicit harvest objectives and a single regulatory package is selected from a limited array of options. This single package is evaluated based on mathematical models, with the goal of ensuring that duck populations are healthy over the long-term while providing hunting opportunity consistent with the long-term health while learning more about the effect of hunting mortality on population parameters (see Final Environmental Document for Migratory Game Bird Hunting

90August 2006, incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605)

AHM balances hunting opportunities with the desire to achieve the duck population goals identified in the North American Waterfowl Management Plan (NAWMP). Currently, a set of four regulatory options, each containing flyway-specific season lengths, bag limits, and dates are being used. The selection of a specific option is recommended each year from a decision matrix based on mid-continent mallard breeding populations and habitat conditions in the current year, although the State continues to have the option to establish more restrictive regulations.

For the Pacific Flyway, the proposed regulatory packages vary primarily in season length (closed, 60, 86, or 107 days) and total duck bag limit (either four or seven ducks per day). Species- (e.g. mallard) and sex- (e.g. hen mallard) specific limits are contained within the AHM packages. Additionally, prescriptive regulation processes for pintail, canvasback and scaup have been adopted by the Service that determine daily bag limits depending on breeding population size, habitat conditions, and the season length established through the AHM process (see below).

In March 2008, the Pacific Flyway Council recommended that the Service set duck season frameworks in the Pacific Flyway based on a separate modeling approach that uses data from western mallards rather than mallards from the mid-continent region. This is because most of the mallards harvested in the Pacific Flyway originate from within the Flyway. The Service adopted the separate mallard model in August 2008 and plans to continue the use of that approach in 2025 (90 FR 7056-7066).

The western mallard approach uses the same regulatory packages as currently in use under continental AHM. Instead of a harvest objective constrained by the population goal in the NAWMP plan, the harvest objective for western mallards is based on a “shoulder approach”, or a proportion of maximum sustained yield. Current modeling suggests that western mallards have been harvested at about 80% of their maximum potential, compared to about 90% for mid-continent mallards under the continental AHM approach.

As in mid-continent AHM, daily bag limits and season length will be set based on the status of the Western Mallard breeding population (Appendix C). Bag limits for other species, including those for which individual harvest strategies have been adopted (pintail, canvasbacks, scaup) are based on mid-continent AHM and will be used in the Pacific Flyway. The State continues to have the option to establish more restrictive regulations.

Western mallards consist of 2 sub stocks and are defined as those birds breeding in Alaska and those birds breeding in the Southern Pacific Flyway (California, Oregon, Washington, and British Columbia). Breeding population surveys are conducted annually by both the Service and the states (Appendix C, CDFW 2024, USFWS 2024b).

Pintail Harvest Strategy

In 1997 a prescribed harvest strategy was developed (62 FR 39721 and 50662) with several modifications since inception. The harvest strategy was revised in 2002 when Flyway-specific harvest models were updated (67 FR 40131). In 2002 and 2003, the Service set pintail regulations that deviated from the strict prescriptions of the harvest strategy (i.e., partial season), but remained true to the intent of the strategy (67 FR 53694 and 59111; 68 FR 50019 and 55786). In 2004, the harvest strategy was modified to include a partial season option (69 FR 43696 and 52971). In adopting those changes, the USFWS and others called for review of the pintail strategy (69 FR 57142) and consideration of technical modifications that could be made to improve it. As a result of this review, the strategy was revised in 2006 to include updated flyway-specific harvest models, an updated recruitment model, and the addition of a procedure for removing bias in the breeding population size estimate based on its mean latitude (71 FR 50227 and 55656). Pursuant to requests from the flyways and other stakeholders, a compensatory model was added to the strategy in 2007 (72 FR 18334, 31791, and 40198) as an alternative to the existing additive harvest model, and this update made the harvest strategy adaptive on an annual basis. In 2010, a new strategy was developed (75 FR 32873).

In 2018, collaboration between the Service, the U.S. Geological Survey and the flyways resulted in the development of a new interim strategy (Boomer et. al 2024) in January 2024 (approved by the Service in May 2024) for implementation for the 2025-26 season (90 FR 7056-7066). The impetus behind developing the new strategy was concern using outdated modeling techniques and data, artificially constraining daily bag limit options and poor performance statistics in the 2010 strategy. The 2024 strategy uses a new, advanced model that links hunting regulations to how harvest may impact the pintail population, based on actual harvest data and expected fall flight.

An Integrated Population Model (IPM) was developed that uses multiple data sources (breeding population estimates, band recovery data and harvest data) to estimate fall flight, using a Bayesian estimation framework. If population size declines, so does the fall flight and harvest under the specific regulatory package. This feedback effect allows sustainable harvest under conditions that were not previously thought to be sustainable. The harvest strategy relies on models for two state variables: the size and mean latitude of the breeding population. Pintail breeding population size and mean latitude are used to predict pintail recruitment. The subsequent year's pintail breeding population size is predicted using a full balance-equation model, which accounts for summer survival, predicted recruitment, predicted harvest and winter survival. The parameters for the population model are estimated from the IPM. Stochastic dynamic programming is used to find the state-dependent solution that best achieves the objectives for pintail harvest management. The optimization process is based on 1) regulatory alternatives (closed, 1-, 2- or 3-bird daily bag); 2) current population, latitude, and harvest models; and 3) objective of maximizing long-term cumulative harvest. The derived harvest strategy is state-dependent in that it specifies pintail harvest regulations as a function of breeding population size and latitude. Use of the harvest strategy has been simulated to determine expected performance characteristics. The breeding population size is expected to average 2.01 million birds with a mean annual harvest of 467,000 birds. The expected frequency of closed seasons is 12.6%, the frequency of liberal seasons with a 1-bird bag is 31.4%, and the frequency of liberal seasons with 2- and 3-bird bag limits is 0.8% and 55.2%, respectively. The regulatory alternative is expected to change in 20.9% of years. An optimal pintail regulation is calculated under the assumption of a liberal mallard season length in all flyways. See Appendix D for pintail status (USFWS 2024b).

The 2024 strategy will be considered interim until three seasons of experiencing a daily bag of 3 birds has been achieved. The evaluation of the interim phase will include three analyses:

(1) evaluation of the integrated population model, (2) evaluation of the harvest models (whether the effect of the 3-bird bag limit is greater than estimated in the current models) and (3) evaluation of updated performance metrics for the strategy. Results of the evaluations will be considered by all flyways and an operational strategy will be implemented based on the results from the interim phase.

Canvasback Harvest Strategy

Since 1994 the Service has followed a harvest strategy that canvasback population status and production are sufficient to permit a harvest of 1-bird daily bag limit nationwide for the entire length of the regular duck season, while still attaining a projected spring population objective of 500,000 birds. In 2008 (73 FR 43290), the strategy was modified to incorporate the option for a 2-bird daily bag limit for canvasbacks when the predicted breeding population the subsequent year exceeds 725,000 birds. A partial season would be permitted if the estimated allowable harvest was within the projected harvest for a shortened season. If neither of these conditions can be met, the harvest strategy calls for a closed season. See Appendix D for canvasback status (USFWS 2024b).

Scaup Harvest Strategy

The scaup population has experienced a significant long-term decline. The 2007 population estimate was the third lowest on record. Recent population estimates have been more than 30 % below the 55-year average with the biggest decline occurring over the last 25 years. There is evidence that the long-term scaup decline may be related to changes in scaup habitat. Several different ideas have been proposed to explain the decline, including a change in migration habitat conditions and food availability, effects of contaminants on scaup survival and reproduction and changing conditions on the breeding grounds possibly related to warming trends in portions of northern North America. Hunting has not been implicated as a cause of the past scaup decline, but the Service is committed to ensuring that harvest levels remain commensurate with the ability of the declining population to sustain harvest. In 2008 the Service implemented a new scaup harvest strategy (73 FR 43290) that used restrictive, moderate, and liberal regulatory alternatives. The scaup harvest strategy prescribes optimal harvest levels given an observed breeding population size and an explicit harvest management objective; maximize 95% of long-term cumulative harvest. See Appendix D for scaup status (USFWS 2024b).

Service Changes in the Timing of Annual Migratory Bird Hunting Adoption

Historically, the Service published preliminary federal frameworks in mid-August and states adopted hunting regulations in early August based on the decisions of the Service Regulation Committee in late July. The Service then published final frameworks, which contained the state-selected seasons in September. Beginning with the 2016 hunting seasons (79 FR 56864) a new schedule is now used for setting annual migratory bird hunting regulations. The new schedule will establish migratory bird hunting seasons much earlier than the historic system. Under the new process, proposed hunting season frameworks for a given year will be developed in early fall of the prior year. Those frameworks will be finalized in October, thereby enabling the state agencies to select their seasons by late April and the Service will publish final frameworks in early summer.

Biological data (spring and summer surveys) for the following year will not be available in the fall, when the Flyway Councils and the Service will be developing hunting regulations for the next year. Thus, regulation development will be based on predictions derived from long-term biological information and established harvest strategies (as described above). This process will continue to use the best science available and will balance hunting opportunities with long-term migratory game bird conservation, while fulfilling all administrative requirements. Existing individual harvest strategies have been modified using either data from the previous year(s) or model predictions to fit this new schedule. Many existing regulatory prescriptions used for Canada goose, sandhill cranes, mourning doves, and American woodcock currently work on this basis. Uncertainty associated with these population status predictions has been accounted for and incorporated into the decision-making process. The Service concluded (Boomer, et al. 2015) that this uncertainty should not result in a disproportionately higher harvest rate for any stock, nor substantially diminish harvest opportunities, either annually or on a cumulative basis.

Service Changes to Season Ending Date (Season Extensions)

At the Service's Regulation Committee meeting in October 2018, the ending date for the duck season framework was changed to January 31, replacing the last Sunday in January. The framework ending date of the last Sunday in January has been in place since 2002, as previously analyzed in the 2006 Final Environmental Document for Migratory Game Bird Hunting of Waterfowl, Coots, and Moorhens (incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605). The maximum season length remains 107 days.

The change to January 31 results in up to a 6-day later ending date, depending on the year. For example, the new closing date for the 2023-24 season was Wednesday, January 31, 2023, rather than Sunday, January 28, 2023: resulting in 103-day seasons. For the 2024-25 season, January 31 occurred on a Friday, resulting in 98-day seasons. All closing dates are based on the traditional opening Saturday in late October.

COVID-19 Pandemic

The COVID-19 pandemic prevented the Service and its partners (Department) from performing the 2020 and 2021 Breeding Population and related surveys. As a result, the Service and flyway councils agreed to use predictions of breeding population sizes and habitat conditions to determine regulatory decisions for the 2022-23 hunting season. Current system models for which there is an AHM decision framework (western mallard, pintail, canvasback, scaup) were used to predict 2021 population sizes as a function of 2020 predictions of breeding populations and habitat conditions, along with harvest and harvest rate estimates observed during the 2020–21 hunting seasons. These policies represent optimal decisions based on the most recent observations and understanding of system dynamics (USFWS 2021). The 2024 Breeding Population and related surveys were conducted by the Service and state partners, resulting in the use of current population models (USFWS 2024a) to determine optimal regulatory strategies for the 2025-26 season.

Existing Conditions

Northeastern Zone

In that portion of California lying east and north of a line beginning at the intersection of Interstate 5 with the California-Oregon state line; south along Interstate 5 to its junction with Walters Lane south of the town of Yreka; west along Walters Lane to its junction with Easy Street; south along Easy Street to the junction with Old Highway 99; south along Old Highway 99 to the point of intersection with Interstate 5 north of the town of Weed; south along Interstate 5 to its junction with Highway 89; east and south along Highway 89 to Main Street in Greenville; north and east to its junction with North Valley Road; south to its junction of Diamond Mountain Road; north and east to its junction with North Arm Road; south and west to the junction of North Valley Road; south to the junction with Arlington Road (A22); west to the junction of Highway 89; south and west to the junction of Highway 70; east on Highway 70 to Highway 395; south and east on Highway 395 to the point of intersection with the California-Nevada state line; north along the California-Nevada state line to the junction of the California-Nevada-Oregon state lines west along the California-Oregon state line to the point of origin.

Ducks: From the first Saturday in October extending for 103 days, 7/day which may include 7 mallards, 2 hen mallard, 1 pintail, 2 canvasback, 2 redheads, 2 scaup during the 86-day season. Possession limit triple the daily bag.

Small and Large Canada Geese: from the first Saturday in October extending for 100 days, white-fronted geese and white geese from the first Saturday in October extending for a period of 58 days and from January 3 extending for a period of 13 days. Late Season: White-fronted and white geese from February 5 extending for 34 days. 30/day, up to 20 white geese and up to 10 dark geese, but not more than 2 Large Canada geese Possession limit triple the daily bag.

Coots and Moorhens: Concurrent with Duck Season. 25/day. Possession limit triple the daily bag.

Youth Hunting Days: The Saturday fourteen days before the opening of waterfowl season extending for 2 days. To participate in these Youth Waterfowl Hunts, youth must be accompanied by a non-hunting adult 18 years of age or older. Federal regulations require that hunters must be 17 years of age or younger.

Veterans and Active Military Personnel Waterfowl Hunting Days Regulations
The Saturday following the closing of the regular duck season extending for 2 days. Goose hunting in this zone is not permitted during these days.

NOTE: Veterans (as defined in Section 101 of Title 38, United States Code) and members of the Armed Forces on active duty, including members of the National Guard and Reserves on active duty (other than training), may participate. Persons participating in this special hunt must possess and present upon demand verification of eligibility to participate in this hunt. Verification includes: Veteran’s ID Card and/or Military ID Card for active duty, or a State issued driver’s license or Identification Card with Veteran Designation.

Falconry Take of Ducks (including Mergansers) Geese, American Coot and Common Moorhen: Open concurrently with duck season extending for 103 days. 3/day. Possession limit triple the daily bag.

Southern San Joaquin Valley Zone

All of Kings and Tulare counties and that portion of Kern County north of the Southern California Zone.

Ducks: From the fourth Saturday in October extending for 98 days, 7/day which may include, 7 mallards, 2 hen mallards, 1 pintail, 2 canvasback, 2 redheads, 2 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From the fourth Saturday in October extending for 98 days, 30/day, up to 20 white geese and up to 10 dark geese. Possession limit triple the daily bag.

Coots and Moorhens: Concurrent with Duck Season, 25/day. Possession limit triple the daily bag.

Youth Hunting Days: The first Saturday in February extending for 2 days. The Saturday following the closing of the regular duck season extending for 2 days.

Veterans and Active Military Personnel Waterfowl Hunting Days Regulations
The second Saturday in February extending for 2 days. Veterans (as defined in Section 101 of Title 38, United States Code) and members of the Armed Forces on active duty, including members of the National Guard and Reserves on active duty (other than training), may participate. Persons participating in this special hunt must possess and present upon demand verification of eligibility to participate in this hunt. Verification includes: Veteran's ID Card and/or Military ID Card for active duty, or a State issued driver's license or Identification Card with Veteran Designation.

Falconry Take of Ducks (including Mergansers) Geese, American Coot and Common Moorhen: Ducks only, concurrent with duck season and February 1-2, 2025, and February 15-19, 2025. 3/day. Possession limit triple the daily bag.

Southern California Zone

In that portion of southern California (but excluding the Colorado River zone) lying south and east of a line beginning at the mouth of the Santa Maria River at the Pacific Ocean; east along the Santa Maria River to where it crosses Highway 101-166 near the City of Santa Maria; continue north on 101-166; east on Highway 166 to the junction with Highway 99; south on Highway 99 to the junction of Interstate 5; south on Interstate 5 to the crest of the Tehachapi Mountains at Tejon Pass; east and north along the crest of the Tehachapi Mountains to where it intersects Highway 178 at Walker Pass; east on Highway 178 to the junction of Highway 395 at the town of Inyokern; south on Highway 395 to the junction of Highway 58; east on Highway 58 to the junction of Interstate 15; east on Interstate 15 to the junction with Highway 127; north on Highway 127 to the point of intersection with the California-Nevada state line.

Ducks: From the fourth Saturday in October extending for 98 days, 7/day which may include, 7 mallards, 2 hen mallards, 1 pintail, 2 canvasback, 2 redheads, 2 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From the fourth Saturday in October extending for 98 days, 23/day, up to 20 white geese, up to 3 dark geese. Possession limit triple the daily bag.

Coots and Moorhens: Concurrent with duck season, 25/day. Possession limit triple the daily bag.

Youth Hunting Days: The first Saturday in February extending for 2 days. To participate in these Youth Waterfowl Hunts, youth must be accompanied by a non-hunting adult 18 years of age or older. Federal regulations require that hunters must be 17 years of age or younger.

Veterans and Active Military Personnel Waterfowl Hunting Days Regulations: The second Saturday in February extending for 2 days. Veterans (as defined in Section 101 of Title 38, United States Code) and members of the Armed Forces on active duty, including members of the National Guard and Reserves on active duty (other than training), may participate. Persons participating in this special hunt must possess and present upon demand verification of eligibility to participate in this hunt. Verification include: Veteran's ID Card and/or Military ID Card for active duty, or a State issued driver's license or Identification Card with Veteran Designation.

Falconry Take of Ducks (including Mergansers) Geese, American Coot and Common Moorhen: Concurrent with duck season and February 1–2, 2025 and February 15–19, 2025 EXCEPT in the Imperial County Special Management Area where the falconry season for geese runs concurrently with the season for white geese. 3/day. Possession limit triple the daily bag.

Colorado River Zone

In those portions of San Bernardino, Riverside, and Imperial counties lying east of the following lines: Beginning at the intersection of Nevada State Highway 95 with the California-Nevada state line; south along Highway 95 through the junction with Highway 40; continue south on Highway 95 to Vidal Junction; south through the town of Rice to the San Bernardino-Riverside county line on a road known as "Aqueduct Road" also known as Highway 62 in San Bernardino County; southwest on Highway 62 to Desert Center Rice Road; south on Desert Center Rice Road/Highway 177 to the town of Desert Center; continue east 31 miles on Interstate 10 to its intersection with the Wiley Well Road; south on this road to Wiley Well; southeast along the Milpitas Wash Road to the Blythe, Brawley, Davis Lake intersections; south on the Blythe Ogilby Road also known as County Highway 34 to its intersection with Ogilby Road; south on this road to Highway 8; east seven miles on Highway 8 to its intersection with the Andrade-Algodones Road/Highway 186; south on this paved road to the intersection of the Mexican boundary line at Los Algodones, Mexico.

Ducks: From October 23 extending for 101 days, 7/day which may include 7 mallards, 2 hen mallards or Mexican-like ducks, 1 pintail, 2 canvasback, 2 redheads, 2 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From October 23 extending for 101 days, 25/day, up to 20 white geese, up to 5 dark geese. Possession limit triple the daily bag.

Coots and Moorhens: Concurrent with Duck Season, 25/day, 25 in possession.

Youth Hunting Days: The first Saturday in February extending for 2 days. To participate in these youth hunts hunters must be 17 years of age or younger and must be accompanied by a non-hunting adult 18 years of age or older.

Falconry Take of Ducks (including Mergansers) Geese, American Coot and Common Moorhen: Ducks only. Concurrent with duck season and from February 1-4, 2025. 3/day. Possession limit triple the daily bag.

Balance of State Zone

That portion of the state not included in Northeastern California, Southern California, Colorado River or the Southern San Joaquin Valley zones.

Ducks: From the fourth Saturday in October extending for 98 days, 7/day which may include 7 mallards, 2 hen mallards, 1 pintail, 2 canvasback, 2 redheads, 2 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: Early Season: Large Canada only from the Saturday closest to October 1 for a period of 3 days EXCEPT in the North Coast Special Management Area where Large Canada geese are closed during the early season. Regular Season: Dark and white geese from the fourth Saturday in October extending for 98 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season will close after December 21. Late Season: Canada geese from the second Saturday in February extending for 2 days. White-fronted geese and white geese from the second Saturday in February extending for a period of 5 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted geese is closed. During the Late Season, hunting is not permitted on wildlife areas listed in Sections 550–552 EXCEPT on Type C wildlife areas in the North Central and Central regions. 30/day, up to 20 white geese and up to 10 dark geese, but not more than 3 white-fronted geese in the Sacramento Valley Special Management Area. Possession limit triple the daily bag.

Coots and Moorhens: Concurrent with Duck Season, 25/day. Possession limit triple the daily bag.

Youth Hunting Days: The first Saturday in February extending for 2 days. To participate in these Youth Waterfowl Hunts, youth must be accompanied by a non-hunting adult 18 years of age or older. Federal regulations require that hunters must be 17 years of age or younger.

Veterans and Active Military Personnel Waterfowl Hunting Days Regulations The second Saturday in February extending for 2 days. Veterans (as defined in Section 101 of Title 38, United States Code) and members of the Armed Forces on active duty, including members of the National Guard and Reserves on active duty (other than training), may participate. Persons participating in this special hunt must possess and present upon demand verification of eligibility to participate in this hunt. Verification includes a veteran’s identification card and/or military identification card for active duty, or a State-issued driver’s license or identification card with veteran designation.

Falconry Take of Ducks (including Mergansers) Geese, American Coot and Common Moorhen: Open concurrently with duck season and February 1–2, 2025 and February 15-19, 2025, 3/day. Possession limit triple the daily bag.

North Coast Special Management Area

All of Del Norte and Humboldt counties.

All Canada Geese: From October 5 extending for a period of 78 days (Regular Season) and from February 12 extending for a period of 27 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the landowner under provisions of Section 2016. Up to 10/day Canada geese of which only 1 may be a Large Canada goose, EXCEPT during the Late Season the bag limit on Large Canada geese is 0/day. Possession limit triple the daily bag.

Falconry Take of Ducks: Concurrent with Canada goose season. 3/day. Possession limit triple the daily bag.

Humboldt Bay South Spit (West Side) Special Management Area

Beginning at the intersection of the north boundary of Table Bluff County Park and the South Jetty Road; north along the South Jetty Road to the South Jetty; west along the South Jetty to the mean low water line of the Pacific Ocean; south along the mean low water line to its intersection with the north boundary of the Table Bluff County Park; east along the north boundary of the Table Bluff County Park to the point of origin.

All species: Closed during brant season

Klamath Basin Special Management Area

Beginning at the intersection of Highway 161 and Highway 97; east on Highway 161 to Hill Road; south on Hill Road to N Dike Road West Side; east on N Dike Road West Side until the junction of the Lost River; north on N Dike Road West Side until the Volcanic Legacy Scenic Byway; east on Volcanic Legacy Scenic Byway until N Dike Road East Side; south on the N Dike Road East Side; continue east on N Dike Road East Side to Highway 111; south on Highway 111/Great Northern Road to Highway 120/Highway 124; west on Highway 120/Highway 124 to Hill Road; south on Hill Road until Lairds Camp Road; west on Lairds Camp Road until Willow Creek; west and south on Willow Creek to Red Rock Road; west on Red Rock Road until Meiss Lake Road/Old State Highway; north on Meiss Lake Road/Old State Highway to Highway 97; north on Highway 97 to the point of origin.

Canada Geese from the first Saturday in October extending for 100 days, White-fronted and white geese from the first Saturday in October extending for 105 days. 30/day, up to 20 white geese and up to 10 dark geese, but not more than 2 Large Canada geese Possession limit triple the daily bag.

Sacramento Valley Special Management Area

Beginning at the town of Willows; south on Interstate 5 to the junction with Hahn Road; east on Hahn Road and the Grimes-Arbuckle Road to the town of Grimes; north on Highway 45 to its junction with Highway 162; north on Highway 45-162 to the town of Glenn; west on Highway 162 to the point of beginning.

White-fronted geese: Open concurrently with the goose season through December 21, and during Youth Waterfowl Hunting Days. 3/day. Possession limit triple the daily bag.

Morro Bay Special Management Area

Beginning at a point where the high tide line intersects the State Park boundary west of Cuesta by the Sea; northeasterly to a point 200 yards offshore of the high tide line at the end of Mitchell Drive in Baywood Park; northeasterly to a point 200 yards offshore of the high tide line west of the Morro Bay State Park Boundary, adjacent to Baywood Park; north to a point 300 yards south of the high tide line at the end of White Point; north along a line 400 yards offshore of the south boundary of the Morro Bay City limit to a point adjacent to Fairbanks Point; northwesterly to the high tide line on the sand spit; southerly along the high tide line of the sand spit to the south end of Morro Bay; easterly along the Park boundary at the high tide line to the beginning point.

All species: Open in designated areas only from the opening day of brant season through the remainder of waterfowl season.

Martis Creek Lake Special Management Area

The waters and shoreline of Martis Creek Lake, Placer and Nevada counties.

All species: Closed until Nov 16

Northern Brant Special Management Area

Del Norte, Humboldt and Mendocino counties.

Black Brant: From November 18 extending for 27 days. 2/day. Possession limit triple the daily bag.

Balance of State Brant Special Management Area

That portion of the state not included in the Northern Brant Special Management Area.

Black Brant: From November 19 extending for 27 days. 2/day. Possession limit triple the daily bag.

Imperial County Special Management Area

Beginning at Highway 86 and the Navy Text Base Road; south on Highway 86 to the town of Westmoreland; continue through the town of Westmoreland to Route S26; east on Route S26 to Highway 115; north on Highway 115 to Weist Rd.; north on Weist Rd. to Flowing Wells Rd.; northeast on Flowing Wells Rd. to the Coachella Canal; northwest on the Coachella Canal to Drop 18; a straight line from Drop 18 to Frink Rd.; south on Frink Rd. to Highway 111; north on Highway 111 to Niland Marina Rd.; southwest on Niland Marina Rd. to the old Imperial County boat ramp and the water line of the Salton Sea; from the water line of the Salton Sea, a straight line across the Salton Sea to the Salinity Control Research Facility and the Navy Test Base Road; southwest on the Navy Test Base Road to the point of beginning.

White geese: From November 4 extending for a period of 89 days (Regular Season) and February 3-9, 2025 and February 12-20, 2025 (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the landowner under provisions of Section 2016. Up to 20 geese. Possession limit is triple the daily bag.

Proposed Changes and Analysis

The Commission is considering four changes to waterfowl hunting regulations: (1) Duck seasons, (2) goose seasons, (3) pintail daily bag limit, and (4) falconry-only season.

1. *Duck Seasons*

   Provide a range of duck season lengths between 99 and 103 days in the Southern San Joaquin Valley, the Southern California, and the Balance of State zones. This recommendation offers a range of season lengths for consideration based on public input and discussion.

   The existing duck season length for the referenced zones is 98 days. In prior rulemakings, the Commission adopted the latest possible closing date of January 31 rather than the historical last Sunday in January, based on public input. Closing on January 31 and maintaining a traditional opening day of Saturday in late October results in an annual adjustment to the general season length because of calendar progression. However, some members of the public prefer an earlier opening date. As a result, a range of season lengths are provided to the Commission for consideration. The total days for all hunting methods combined remain unchanged at 107 days.

2. *Goose Seasons*

   Provide a range of regular goose season lengths between 99 and 103 days in the Southern San Joaquin Valley and Southern California zones, and between 99 and 100 days in the Balance of State Zone.

   The existing regular goose season length for the for the referenced zones is 98 days. In prior rulemakings, the Commission adopted the latest possible closing date of January 31 rather than the historical last Sunday in January, based on public input. Closing on January 31 and maintaining a traditional opening day of Saturday in late October results in an annual adjustment to the general season length because of calendar progression. However, some members of the public prefer an earlier opening date. As a result, a range of general season lengths are provided to the Commission for consideration. The total number of days for all hunting methods combined remains unchanged at 107 days.

3. *Pintail Daily Bag Limit*

   Increase the pintail daily bag limit in all zones from 1 to 3 per day.

   The existing regulation allows a daily bag limit of 1 pintail based on the 2010 harvest strategy. The optimal regulatory package for the 2025/26 season is 3/day based on the new pintail harvest strategy adopted in October 2024. The new strategy uses an integrated population model that considers breeding population size, banding data, and harvest estimates to calculate a fall flight. The harvest strategy seeks a balance of objectives by conserving pintail in perpetuity, providing hunting when the observed breeding population is above 1.2 million birds; and allowing a liberal season length with a 3-bird bag limit when the population size and expected fall flight are large enough to support the estimated harvest (the prior strategy did not allow a 3-bird bag limit). Allowing a 3-bird daily bag limit as a regulatory option has been a long-standing goal of both the Department and the Pacific Flyway Council.

The strategy is on an interim basis until three 3-bird seasons have been experienced, which could take five to six years. The review of the interim phase by all flyways and the Service will include evaluation of the integrated population model (ensuring parameters remained stable), harvest models, and regulatory package performance metrics.

4. *Falconry-Only Season*

   Allow up to four days of falconry-only season in the Southern San Joaquin Valley, Southern California and Balance of State zones.

   The existing regulation allows a five-day falconry-only season. The length of the falconry-only season is contingent upon the number of days used for the general duck and goose seasons, in addition to the Youth and Veteran Hunt Days. The total number of days for all hunting methods combined remains unchanged at 107 days.

POLICY CONSIDERATIONS

The legislature formulates laws and policies regulating the management of fish and wildlife in California. The general wildlife conservation policy of the State is to encourage the conservation and maintenance of wildlife resources under the jurisdiction and influence of the State (California Fish and Game Code, Section 1801). The policy includes several objectives:

1. To provide for the beneficial use and enjoyment of wildlife by all citizens of the State;
2. To perpetuate all species of wildlife for their intrinsic and ecological values, as well as for their direct benefits to man;
3. To provide for aesthetic, educational, and non-appropriative uses of the various wildlife species;
4. To maintain diversified recreational uses of wildlife, including hunting, as proper uses of certain designated species of wildlife, subject to regulations consistent with public safety, and a quality outdoor experience;
5. To provide for economic contributions to the citizens of the State through the recognition that wildlife is a renewable resource of the land by which economic return can accrue to the citizens of the State, individually and collectively, through regulated management. Such management shall be consistent with the maintenance of healthy and thriving wildlife resources and the public ownership status of the wildlife resource;
6. To alleviate economic losses or public health and safety problems caused by wildlife; and

7. To maintain sufficient populations of all species of wildlife and the habitat necessary to achieve the above-state objectives.

With respect to migratory game birds, sections 355 and 356 of the California Fish and Game Code provide that the Commission may adopt migratory game bird hunting regulations to conform with or further restrict rules and regulations prescribed at the federal level pursuant to the Migratory Bird Treaty Act (stated within the federal frameworks).

The Department has concluded that the proposed project will not have a significant adverse effect on the environment; no mitigation measures or alternatives to the proposed project are recommended. Commission staff reviewed this draft document and the proposed project, and determined that the document reflects the independent judgment of the Commission; the Commission will consider certifying a final environmental document at the end of the public review period.

POTENTIAL FOR SIGNIFICANT EFFECTS

Previous reviews of other potential environmental effects were analyzed extensively in previous environmental documents. The analysis of fifteen factors regarding migratory game bird hunting were examined in “2006 Final Environmental Document for Migratory Game Bird Hunting of Waterfowl, Coots, and Moorhens” (2006 Final Environmental Document; incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605) and certified by the Commission. The modifications proposed are to increase hunter opportunity and reduce depredation caused by some goose populations that winter in California. The Department concludes that the proposed project and existing hunting regulations will not cause significant adverse effects on the factors analyzed in the 2006 Final Environmental Document, as summarized herein. Commission staff reviewed this draft document and the potential for significant effects, and determined that the document reflects the independent judgment of the Commission;

Effects of Habitat Degradation

Breeding Areas

The 2006 analysis of breeding areas was presented on page 100 of the 2006 Final Environmental Document. The primary impacts on breeding waterfowl from agriculture are the cultivation or tillage of nesting cover (Higgins 1977, Kirsch 1969, Milonski 1958). A secondary effect of the agricultural process is the tillage of lands right up to the edges of ponds or other water sources, which effectively eliminates brood rearing habitat. These activities in the prairies are especially prevalent in years of drought where farmers can intensively farm all of a wetland basin.

In the primary duck production areas of Canada, there is greater opportunity during drought periods for intensive farming and greater demand for available forage for cattle. Unfortunately, waterfowl must compete for the same resources. Agriculture does not generally impact breeding habitats for most goose populations, because most goose nesting occurs in undeveloped areas of the arctic.

Wintering Areas

The 2006 analysis of wintering areas was presented on page 101 of the 2006 Final Environmental Document. Wetland habitats in California have been reduced from an estimated five million acres to less than 450,000 acres at present. Most of these wetlands have been converted to agricultural uses, but urban developments have also reduced the wetland acreage in California. In the critically important Central Valley, about 70% of the remaining acreage is in private ownership and managed primarily as duck hunting clubs.

Some of the agricultural areas continue to provide habitat of value to waterfowl through the availability of waste grains and the provision of nesting cover. However, certain agricultural activities, such as fall plowing, can reduce food availability for waterfowl.

Habitat conversions by humans have reduced the habitat available for waterfowl. These conversions take place over a period of time, such that substantial habitat losses during the period of the proposed project are not likely to occur and act in a cumulative manner with the hunting of waterfowl, coots and moorhens in California that would result in significant adverse effects to the environment.

Effects of Diseases, Pesticides, and Other Contaminants

The 2006 analysis was presented on page 101 of the 2006 Final Environmental Document. Diseases, pesticides and other contaminants will likely cause the death of waterfowl, coots, and moorhens in California. Even though some losses to disease can be in the tens of thousands of individual birds, these losses are small relative to the populations present in the State. Accordingly, the Department concludes that the combination of the proposed project and existing regulations and potential losses to diseases and other contaminants will not result in a significant adverse impact to waterfowl, coot and moorhen populations in California in 2025-2026.

Effects of Illegal Harvest

The 2006 analysis for effects of illegal harvest was presented on pages 110 of the 2006 Final Environmental Document. The Department currently has a staff of about 430 game wardens stationed throughout the State. The Department analyzed waterfowl-related citations to estimate the extent of waterfowl mortality occurring as a result of illegal take of waterfowl in California. The level of illegal harvest is difficult to determine (USDI 1988a:29–30). To model the possible extent of illegal harvest, the Service compared known survival rates of mallards against known hunting mortality (USDI 1988a). Estimated average annual survival rates are 66% and estimated hunting mortality is 18% (based on recoveries of banded birds), all other forms of mortality would thus equal 16% of the population. Since other mortality factors are known to exist (disease, predation, starvation, weather), illegal harvest is considerably less than 16% and is probably not a significant portion of the annual mortality of mallards (USDI 1988a).

Effects of Subsistence Harvest

The 2006 analysis was presented on page 112 of the 2006 Final Environmental Document. Native and nonnative peoples living in remote areas of Alaska and Canada are dependent on migratory birds and other wildlife for subsistence; they take birds and eggs during spring and summer for food (USDI 1988a:26). These levels of harvest do not appear to be acting as a cumulative effect in conjunction with current hunting, because in general, the populations of migratory birds that are being monitored continue to increase. In particular, goose populations affected by this project are growing and some are at or near record levels (Appendix F).

Effects of Harvest Outside the United States

The 2006 analysis was presented on page 113 of the 2006 Final Environmental Document. The harvest of waterfowl in areas outside of California is easier to quantify than to determine what specific effects it has on California's migratory and resident populations because of mixing of different populations on the winter grounds. Harvest in two areas, Canada, where most of California's waterfowl originate, and Mexico, where segments of some populations winter, could act in addition to the harvest in California.

This information identifies the need for migratory game bird management to be conducted on a flyway, multi-flyway, or population basis. The total harvest of waterfowl throughout North America results in a decrease in the number of waterfowl in that year. Issues, such as subsistence harvest in Alaska and Canada and the harvest of birds outside the United States, clearly identify the need for a comprehensive perspective. The establishment of hunting frameworks by the Service addresses this issue by modifying hunting regulations in response to long-term population fluctuations. The Department concludes that the combination of California harvest from this proposed project and harvest outside the State will not result in significant adverse impacts to migratory bird populations.

Effects of Major Development Projects

The 2006 analysis of the effects of major development projects was presented on page 115 of the 2006 Final Environmental Document. Migratory game bird habitat will continue to be altered in California as the human population increases. However, strong enforcement of State and Federal laws, such as the Clean Water Act, as well as Commission policy of no net loss of wetlands, will help to minimize any adverse effect. Changes in agricultural policies at the national level may also affect the quantities of waste grain available to some species of migratory game birds. Competitive urban needs for water, especially as it relates to rice production, may affect waterfowl food supplies in the future; this will be especially prevalent when drought conditions return.

Effects on Listed Species

The 2006 analysis of the effects on listed species was presented on page 91 of the 2006 Final Environmental Document. The Department is charged with the responsibility to determine if any hunting regulations will impact threatened and endangered species. It complies with this mandate by consulting internally and with the Commission when establishing migratory game bird regulations to ensure that the implementation of the proposed project and existing hunting regulations do not affect listed species. The Department has concluded that, based on conditions of the proposed project and existing hunting regulations, differences in size, coloration, distribution, and habitat use between the listed species and legally harvested migratory game birds, the proposed project will not jeopardize these species.

Effects on Migratory Bird Habitats

Habitat Protection Effects

The 2006 analysis of habitat protection effects was presented on page 93 of the 2006 Final Environmental Document. Waterfowl, coot and moorhen hunting in California provide a positive incentive for private individuals to acquire, develop, and maintain habitat that might otherwise be converted to other uses. Habitat provided by hunters is entirely available at night as a roosting site and is partially available during the day during hunting season (during days when private wetlands are not hunted or on portions of private wetlands that are not hunted). Long-term vegetative changes may occur in areas that are managed specifically for wintering waterfowl foods. This may affect species more dependent upon climax vegetation than waterfowl, coots and moorhens, which favor early successional stages of vegetation.

Short-Term Effects on Habitat

The 2006 analysis of short-term effects on habitat was presented on page 93 of the 2006 Final Environmental Document. Some short-term impacts of the proposed project, and existing hunting regulations such as vegetative trampling and litter in the form of spent shell casings, occur. These impacts are considered minor, and the effects on vegetation are generally reversed in the next growing season (USDI 1975:205).

Effects on Recreational Opportunities

The 2006 analysis of effects on recreational opportunities was presented on page 96 of the 2006 Final Environmental Document. The implementation of the proposed project and existing regulations will result in the presence of hunters, their vehicles, and their dogs in migratory bird habitats throughout the State. The enjoyment of observing waterfowl by those opposed to hunting may be reduced to some degree by the knowledge or observation of hunters in the field. Because the proposed project and existing regulations occur for no more than 107 days in largely unpopulated areas of the State, this will not result in significant adverse environmental impacts.

Effects on Methods of Take and Impacts on Individual Animals

The 2006 analysis was presented on page 88 of the 2006 Final Environmental Document. Section 20.21, subpart C, of Part 20, Title 50, CFR, and Section 507, Title 14, CCR, stipulate the methods of hunting that are allowed by the Service for migratory game birds. The Commission, in concert with Federal law, has authorized the use of shotguns 10-gauge or smaller, muzzle-loading shotguns, falconry, bow and arrow and crossbows, and dogs for retrieval or take. Historically, these methods of take have been used on a variety of migratory game birds throughout North America. In previous regulation-setting processes, both the Service and the Commission have stipulated restrictions on equipment and methods of take which attempt to provide for reasonably efficient and effective taking of waterfowl, coots and moorhens.

Effects from Drought

Drought cycles are part of the ecological system in California and waterfowl are well adapted to dealing with low water years e.g., delaying nest initiation, re-nesting capability, and reduced clutch size. Still, multi-year droughts can reduce waterfowl populations on a local scale and a much broader continental scale. Drought conditions impact waterfowl in a variety of ways including degraded habitat quality that creates poor breeding habitat conditions (McLandress et al. 1996), lowers food production (both natural and agricultural) which can limit the ability of birds to migrate and breed successfully (McWilliams et al. 2004), as well as exposes large portions of waterfowl populations to disease. This section summarizes potential impacts that drought may have on waterfowl throughout the annual cycle in California.

California is an area of continental importance for waterfowl during various annual life history events (CVJV 2009). Winter is more significant than breeding due to the abundance of waterfowl that migrate here from northern breeding areas (Bellrose 1980). Stresses encountered on wintering areas can have carry over effects during spring migration or the breeding season, which ultimately can limit populations (Klaassen 2002, Inger et al. 2008). It is critical that adequate habitat for waterfowl is provided during winter.

Breeding

Female ducks find a mate on wintering areas and breed where they were hatched because of high natal fidelity (Rowher and Anderson 1988). Critical components to when and where a hen will nest are available brood water and adjacent upland habitat. In dry years females may leave their natal area and migrate to areas with better quality habitat (Johnson and Grier 1988). Females need time in a location to build energy stores such as protein which is typically associated with aquatic invertebrates (Krapu 1974). Egg formation and laying will be delayed until conditions are adequate (Ankney and Alisauskas 1991). Early in the breeding season many species of ducks delay nest-initiation in response to drought. During periods of severe drought many species of waterfowl may not breed at all. If a rapid decline in water levels occurs midway into nesting or during incubation females may desert their nests (Smith 1971). By not breeding when conditions are poor, birds enhance their survival and their probability of reproducing later when habitat conditions improve (Krapu et al. 1983).

Reduced recruitment can occur when ducks travel great distances to find adequate habitat conditions for nesting or re-nesting because energy reserves have been depleted. Reduced recruitment can result from: choosing not to nest, smaller clutch sizes, a lower likelihood of laying a second clutch (Grand and Flint 1991) and later laying date which has been shown to reduce nest success and brood survival in some species (Dzus and Clark 1998). Further, females that migrate out of their natal area may also have a higher mortality rate due to increase susceptibility to predation in unfamiliar areas. Reduced recruitment and adult survival could decrease short-term population levels and if poor habitat conditions persist for subsequent years, reduce long term population levels. An adaptation to drought is in years of good habitat conditions, hens can raise numerous broods giving waterfowl populations the ability to recover quickly (McLandress et al. 1996).

Critical breeding areas for ducks in California as identified by the Department’s breeding population survey for waterfowl (Figure 3A) are the Sacramento Valley, San Joaquin Valley grasslands, Suisun Marsh and high desert region of northeastern California. Figures in this document are for mallards because they make up most of the breeding duck population in California (Figure I4). Breeding population numbers in the Central Valley (i.e. Sacramento and San Joaquin valleys) are correlated to precipitation as well as recruitment from previous years (figures 3B and 3C). Breeding mallard populations in northeastern California, however, do not follow precipitation trends (Figure 3D) indicating that other factors may be impacting duck production and breeding population trends in that region. The statewide breeding population of mallards has remained relatively stable except for northeastern California where the population trends are decreasing. The cause of this decline is unknown but speculated to be the lack of adequate brood water in early spring and the increase in invasive plant species (e.g. *Lepidium sp*.) throughout the area (Dave Mauser, Klamath Basin National Wildlife Refuge personal communication).

Another breeding population indicating a decline is Canada geese that nest in northeastern California. Historically, Canada geese nested in this region in larger numbers but have declined considerably (Figure 4). Climate change is speculated (i.e. dry conditions over the long term; NOAA unpublished data) to play a significant role in the decline but no analysis or studies have been conducted (Melanie Weaver, CDFW personal communication). The Department will include an analysis of possible climate change impacts as well as a survival analysis from Department leg banding data in an upcoming management plan for this population.

Molting

During late July, male ducks will typically migrate to a large permanent water marsh to molt while females follow soon after nesting in August. Like nest site fidelity, ducks will molt in the same location as previous years (Yarris et al. 1994). One study has indicated that 60% of mallards that breed in the Central Valley will migrate 280 miles to northeastern California to molt while 25% molt in marshes in the Central Valley (Yarris et al. 1994). Molt is an extremely vulnerable time for ducks because they become completely flightless for 30–40 days. Marsh water levels are critically important during the molting period and must be maintained or birds could be subject to depredation by mammalian and avian predators (Arnold et al. 1987).

Avian Botulism

Botulism outbreaks typically occur in marshes with warm water, little flow, high organic load (rotting vegetation) and high amounts of algae (Rocke and Samuel 1999). Botulism is a bacterium that naturally occurs in wetland environments and persists in marshes with histories of outbreaks due to the release of spores into the environment. Ducks are infected by ingesting the bacterium and become paralyzed, eventually dying. Duck carcasses attract flies which lay eggs that produce maggots that in-turn eat the flesh of the carcass and consume botulism spore. Maggots drop into the water and are eaten by ducks in the marsh thereby escalating mortality events (Rocke and Samuel 1999). Outbreaks of avian botulism (Fleskes et al. 2010) often coincide with the molt cycle of ducks and the brood rearing stages of late nesting duck species. Many studies have been conducted to better understand the cycle of botulism and inform managers of how to prevent or minimize outbreaks

In California, botulism outbreaks have been reported in every region of the state however, frequency is not well known due to reporting inconsistencies (Figure 5; USGS National Wildlife Health Center personal communication). A robust analysis on this disease data is not possible because of the reporting inconsistences and the numerous factors possible that may have caused the outbreaks. In some years die-offs can be quite severe (Figure 5). Botulism outbreaks can kill large numbers of hens, broods and molting ducks (Fleskes et al. 2010).

During drought summer water allocation is reduced for managed wetlands in the Central Valley and the Klamath Basin in northeastern California. Decreasing the number of flooded wetlands increases concentrations of waterfowl, thus raising the chance of an outbreak and more birds being affected. Breeding mallards throughout California molt in the Klamath Basin. The Klamath Basin experiences botulism annually, even during normal water years (Figure 5C). During drought years the potential for a high mortality event is great.

Wintering Waterfowl

Waterfowl migrate from northern latitudes to California beginning in August. Multiple stopover sites are used during migration to rebuild energy reserves. The Klamath Basin in northeastern California is one of the most important waterfowl stopover sites during fall and spring for waterfowl in the Pacific Flyway (Bellrose 1980). Peak numbers of waterfowl are seen on major wintering areas south of the Klamath Basin by December.

During early January, the Department and the Service conduct the Midwinter Waterfowl Survey. This survey has been conducted since 1953 and has provided managers with midwinter indices of waterfowl species. During midwinter California supports 66% of all ducks (excluding mergansers; based on long term average 1955–2014) in the Pacific Flyway, 40% of which occur in the Sacramento Valley. Of total waterfowl in the Pacific Flyway (i.e. geese, ducks, swans, coots and cranes), California supports 73%, the Sacramento Valley alone supports 43% (Olson 2014, Department unpublished data). California waterfowl distribution based on this survey indicates the Sacramento Valley harbors 60% of total waterfowl, the San Joaquin has 20%, and the Delta, Suisun Marsh, northeastern California combined hold 10% of total waterfowl.

Sensitive Wintering Populations

Sensitive waterfowl subspecies also occur in California during winter. Tule greater white-fronted geese are one of the smallest populations of geese occurring in North America making them a species of conservation concern (Yparraguirre et al. 2020). Tule geese are monitored by the Department and Service through telemetry and population surveys throughout the winter in the Sacramento Valley, the Delta and northeastern California. This subspecies of white-fronted goose uses permanent marshes early in winter and begins to feed in rice fields during midwinter. The bulk of the Tule population overwinters (November to February) adjacent to and on the Sacramento National Wildlife Refuge Complex. To minimize hunting pressure on this population, a special management area in the Sacramento Valley is maintained that has restrictive hunting regulations (reduced season length and bag limit). Department staff monitor harvest by collecting tissue samples from all hunter-harvested greater white-fronted geese coming through check stations on the Sacramento National Wildlife Refuge Complex. DNA is extracted from the tissue samples and analyzed to determine if a Tule goose.

This population could be negatively impacted by poor body condition caused by limited habitat, particularly reduced rice decomposition flooding.

Wintering Waterfowl Habitat

Since the implementation of the NAWMP (USFWS 1986) and the subsequent initiation of the Central Valley Joint Venture (CVJV) (CVJV 1990), the wetlands of the Central Valley have fluctuated in size and quality (Fleskes et al. 2005, CVJV 2009). Wetland acres as of 2006 were estimated to be 205,900. Current wetland acres are being calculated as there have been several large easement properties acquired since 2006. The amount of wetland acres as well as the quality have increased since the last update (i.e. moist soil management and infrastructure).

Additionally, since 1996 changes in post-harvest rice straw decomposition have added an estimated 209,000 acres of flooded rice for wintering waterfowl in the Sacramento Valley (Garr 2014). Increased post-harvest flooded rice and increased wetland area is speculated to be the cause for the increasing densities of waterfowl seen in the Sacramento Valley relative to other areas on the midwinter survey (Fleskes and Yee 2005). Recent body condition studies of numerous wintering waterfowl species have improved significantly (Ely and Raveling 1989, Miller 1986, Thomas et al. 2008, Skalos et al. 2011) particularly within the Sacramento Valley. Numerous duck and goose species have changed their roosting and feeding habits considerably because of the increase in water on the landscape (Fleskes et al. 2005). For example, prior to post-harvest flooded rice Pacific greater white-fronted geese traveled an average of 17.5 miles from roost to forage areas. This distance has been reduced to 15 miles (14%) because of the proximity of undisturbed roost areas (Ackerman et al. 2006). Increased body condition (Skalos et al. 2011) combined with undisturbed roost areas (Ackerman et al. 2006) has probably been a major contributor to the recovery of Pacific greater white-fronted geese since the record low in the mid 1970’s (Appendix F); Pacific greater white-fronted goose population indices). Waterfowl and non-game waterbird species have been known to use flooded agriculture in the Sacramento/San Joaquin Delta region (Shuford 1998) as well as the Tulare Basin in the San Joaquin Valley (Fleskes et al. 2013). Reduction of post-harvest agricultural field flooding because of drought in these regions could have a large impact on wintering waterfowl populations because most of the natural marsh habitat has been eliminated (Gilmer et al. 1982).

The CVJV has modeled the food resource needs of wintering ducks in California. The CVJV estimated that California currently has an adequate supply of food resources for all waterfowl species during winter. The drought model scenario decreased the total winter flooded wetlands from an estimated 197,200 to 148,000 acres and flooded rice from 305,000 to 135,000 acres in the Central Valley. Flooding rice for decomposition was assumed to be limited and at least 136,000 acres of the dry acreage would be harvested and not deep tilled post-harvest (therefore accessible). In this scenario energy available to ducks would be reduced to below adequate levels by mid-January (CVJV 2014). However, the model did not consider precipitation that may occur in winter and aid in flooding rice and making available to waterfowl.

Waterfowl can make up energetic shortfalls from limited food resources (Skalos et al. 2011) on wintering areas during migration if the adequate food resources are provided on stopover sites (Bauer et al. 2008). If the Central Valley has limited food resources for waterfowl, the CVJV speculates that further stress would be applied to waterfowl populations migrating through the Klamath Basin during spring due to the ongoing water allocation issues in that region (CVJV 2014).

Avian Cholera

Avian cholera (*Pasturella multocida*) is a common winter bacterial infection in waterfowl. This disease agent occurs naturally in waterfowl populations and particular species (e.g. Lesser snow geese, Ross's geese, mute swans) tend to be reservoirs for cholera (Samuel et al. 2005, Pedersen et al. 2014). Environmental and physiological conditions that stress (e.g. prolonged cold temperatures, wind, precipitation, inadequate food resources and injury) birds tend to influence the expression of this disease. Blanchong et al. (2006) found that highly eutrophic water conditions are correlated to cholera abundance in wetlands. These conditions would be promoted in years of drought due to slow flow-through in wetlands. Eutrophic conditions would also be exacerbated by large concentrations of waterfowl defecating in wetlands, agricultural runoff (i.e. cattle and fertilizer) or other upstream sources of nutrients. This study also cited the increased abundance of cholera in wetlands with higher protein concentrations. Increased protein concentrations were correlated with the number of dead bird carcasses found emphasizing the need for monitoring and removal to stem outbreaks.

Figure 6 indicates the frequency and intensity of avian cholera mortality events in California as reported to the USGS Wildlife Health Center. Cholera outbreaks tend to be more common in the Sacramento Valley and northeastern California. This may be from colder temperatures experienced during winter but more likely from the high densities of waterfowl (particularly *Chen sp*.) at the time of the outbreak. Cholera outbreaks have the potential to be very severe; an outbreak in the Salton Sea during 1991 claimed an estimated 155,000 birds.

Concerning sensitive waterfowl populations Greater white-fronted geese (i.e.Tule geese) seem to be resistant to outbreaks of avian cholera (Blanchong 2006).

Hunter Harvest Impacts on Waterfowl Populations

Wintering numbers of mallards are relatively low compared to other wintering species and the population of mallards that breed in the state. The 2023 California midwinter survey (the 2021 and 2022 survey was not conducted due to the COVID-19 pandemic and the 2024 results were not available at the time of environmental document development) indicate 1,705,261 Northern pintail, 564,442 Northern shoveler, 342,545 American wigeon, 333,104 American green-winged teal, compared to 88,091 mallards counted on the survey. Nonetheless, mallards are the most sought-after species by hunters by proportion of population (Raftovich et al. 2019).

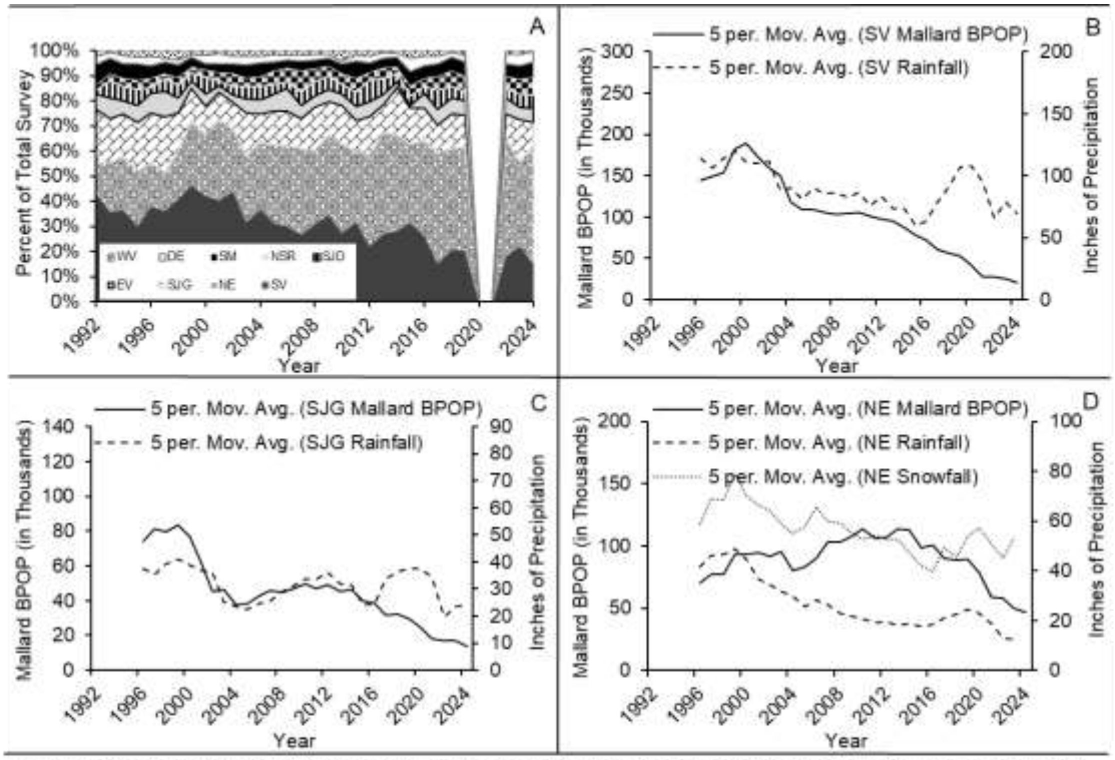
Currently, little evidence supports hunter harvest having an additive effect on duck population trends (Afton and Anderson 2001). Rather, available breeding habitat (i.e. nesting habitat and brood habitat) is the driving factor behind most duck population changes. Even in absence of hunter or other mortality factors, density dependent factors on breeding areas (available habitat, predator response etc.) drive duck populations (Newton 1994, Clark and Shulter 1999, Viljugrein et al. 2005). Figure 7 compares hunter harvest in relation to the breeding population of mallards in California. Harvest has very little correlation (Chart A; R^2=0.11, Chart B; R^2=0.42, respectively) with subsequent breeding population levels.

A number of goose populations have increased substantially in the Pacific Flyway in recent years, with continued hunting and more liberal season and bag limits (Appendix F). Examples are the Pacific greater white-fronted goose and the Ross's goose. Pacific greater white-fronted geese have increased from 75,000 in 1978 to 650,000 by 2010. Surveys conducted in the 1960's estimated Ross's geese at 10,000 while the current population estimate is 1,100,520. When goose populations are low, they are vulnerable to over exploitation by sport hunting. Ducks can breed successfully at age one while geese will breed at age two to three (refer to "K selection"). In the past, goose populations have been subject to overexploitation by predators (e.g. Aleutian Canada goose; PFC 2006[b]) or overharvest by subsidence or recreational hunting (Pacific greater white-fronted goose; Pamplin 1986). Recovery actions have successfully increased these populations.

The Service implemented a general harvest strategy for setting duck framework regulations that regularly occur in California and are sought after by hunters (as explained in the Adaptive Harvest Management Section under Background and Existing Conditions). These harvest management strategies ensure duck populations are healthy over the long-term while providing hunting opportunity consistent with the long-term health. As a participant of the Pacific Flyway Council, the Department reviewed and voted to adopt these management strategies for establishing seasons and bag limits. In addition, the Department participates in the monitoring of various populations, both wintering and breeding. If defined populations goals are not met, then bag or season limit reductions are triggered. For example, the California Breeding Population Survey is used in the Adaptive Harvest Management strategy that establishes regulatory packages for most duck species for all 11 states in the Pacific Flyway.

The Pacific Flyway Study Committee is currently working on revising the management plan for Tule white-fronted geese. The plan will incorporate population estimates derived from Department ground surveys (Yparraguirre et al. 2020), telemetry data and public hunt area harvest from check station measurements. Data based management actions will ensure the conservation of waterfowl species in California over the long term

Figure 3. Proportion of California breeding mallard population[5] by stratum 1992-2024 (Chart A), Sacramento Valley (SV) mallard breeding population estimates and total rainfall[1] 1992-2024 (Chart B), San Joaquin Grasslands (SJG) mallard breeding population estimates and total rainfall[2] 1992-2024 (Chart C), Northeastern California (NE) mallard breeding population estimate, total rainfall[3] and average seasonal snow water content[4] 1992-2024 (Chart D).



[1]Total precipitation values derived January to April prior to breeding season using Lincoln, Nicolaus, Stonyford, Bangor, Paradise, Thomas Creek weather stations. [2]Total precipitation values derived January to April prior to breeding season using Green Springs and Stockton weather stations.
[3]Total precipitation values derived January to April prior to breeding season using Surprise Valley, Cedarville, Doyle, Juniper Creek and Tulelake weather stations. [4]Total precipitation values derived November to April prior to breeding season using Adin Mountain, Cedar Pass, Dismal Swamp and Independence SNOTEL stations.

Figure 4. California Department of Fish and Wildlife, Northeastern California Canada Goose Survey 1950–2013.

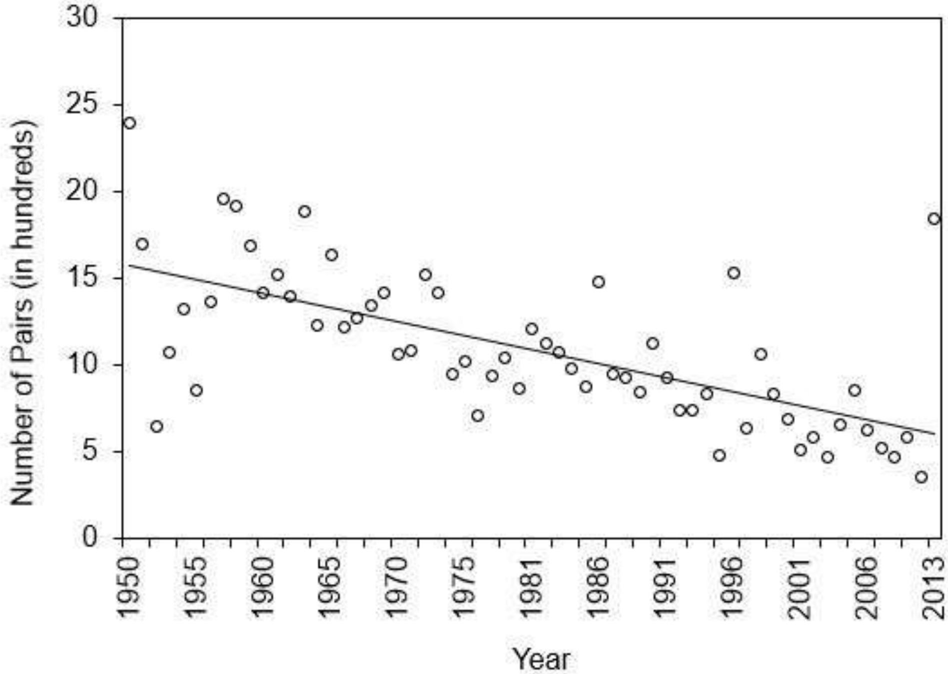
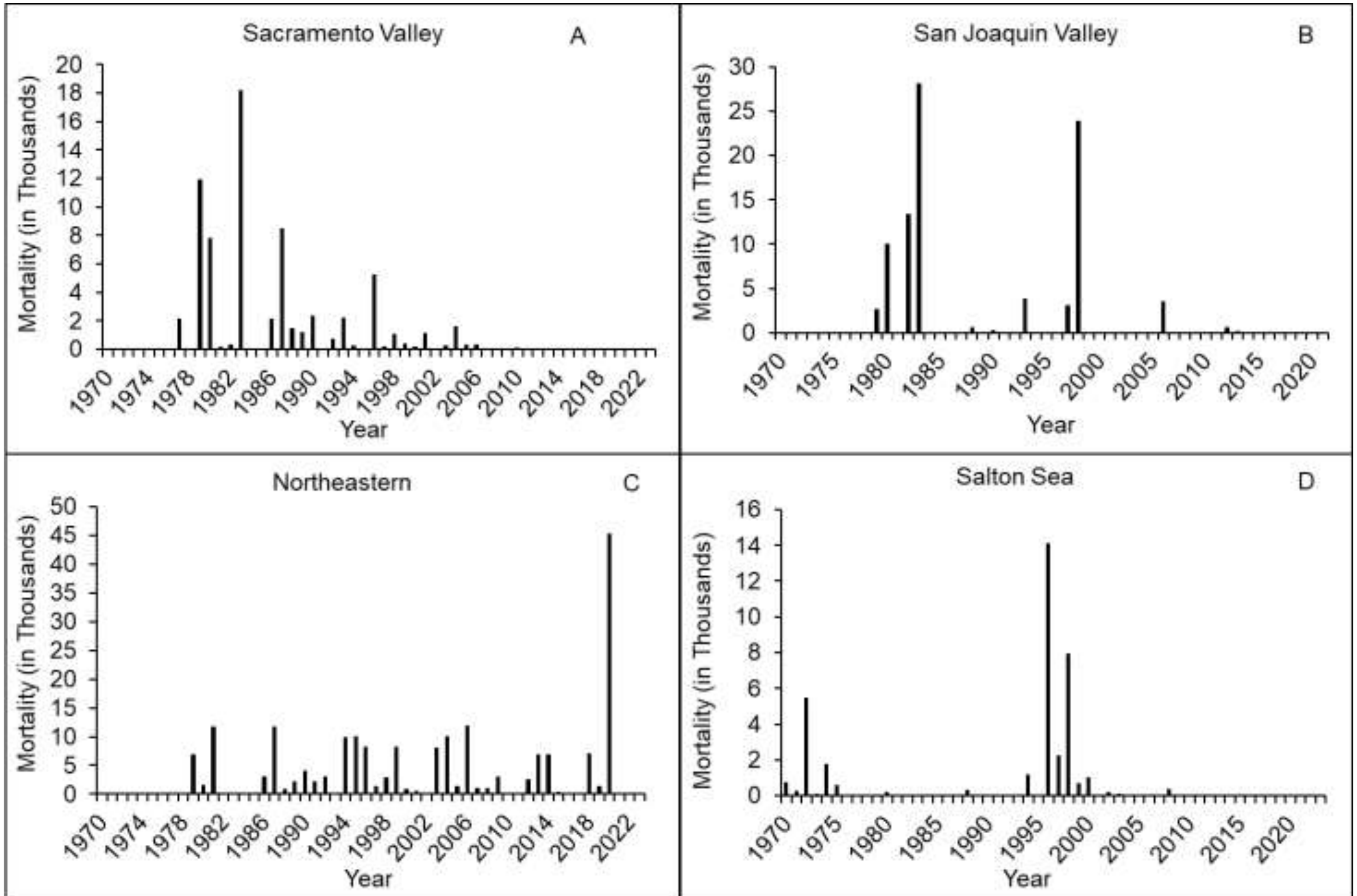


Figure 5. Regional waterfowl mortality from botulism, 1970–2024. U.S. Geological Survey WHISPers database.



[1]All waterfowl species combined.[2]Mortality represents total number reported to the USGS Wildlife Health Center. [3]No data collected in 1985 due to federal government shutdown.

Figure 6. Regional waterfowl mortality from avian cholera, 1970–2024. U.S. Geological Survey WHISPers database.

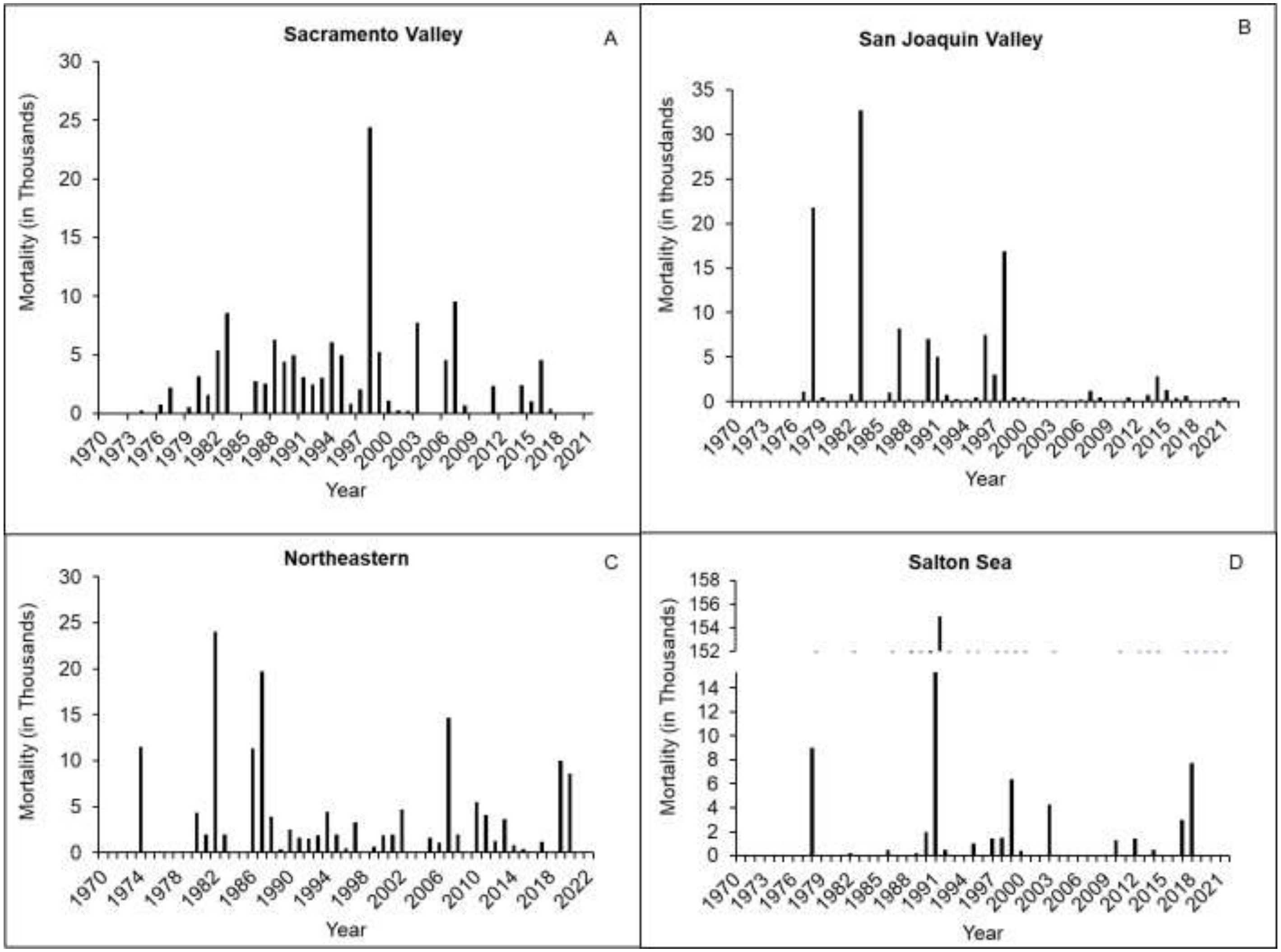
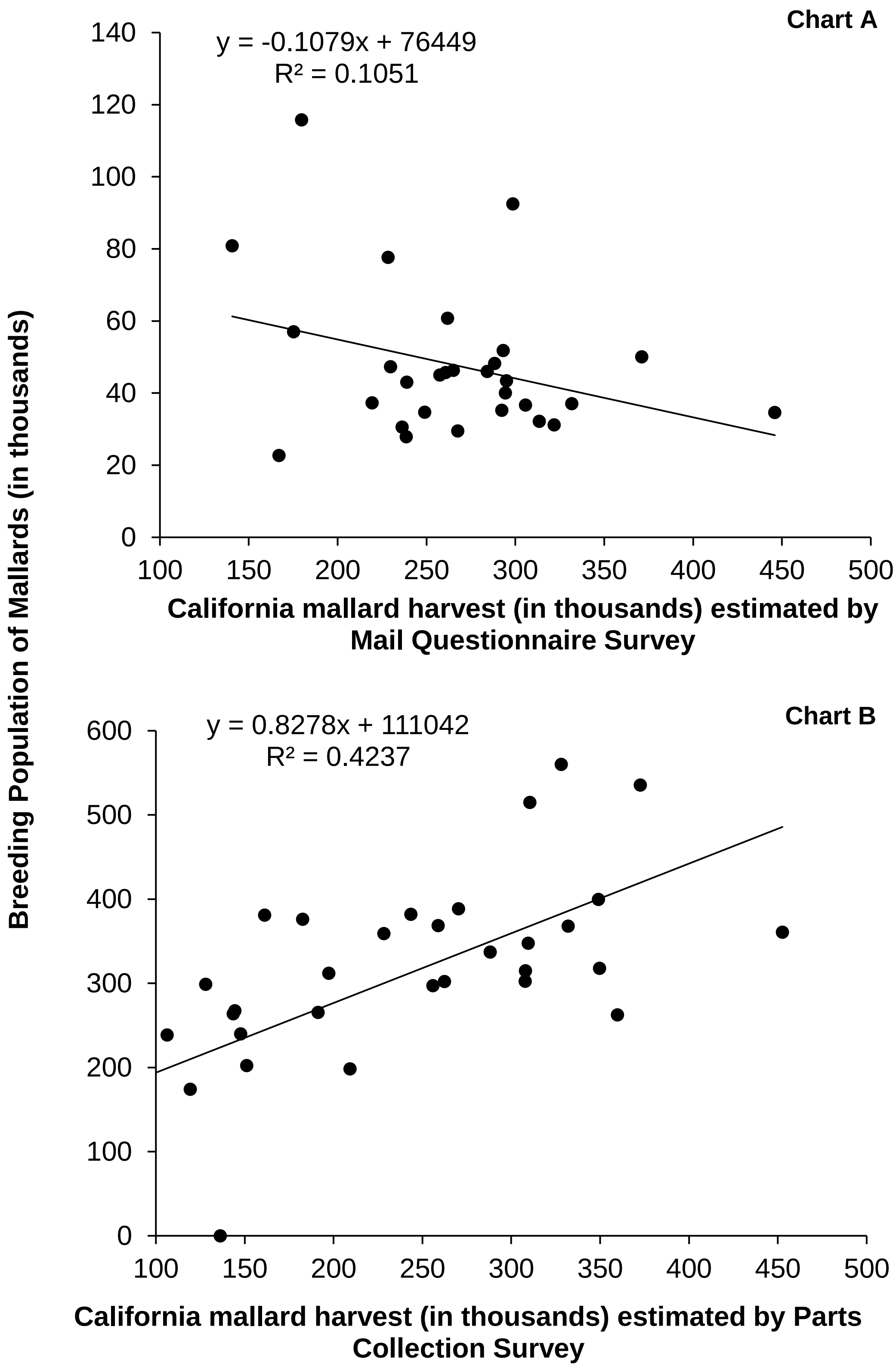


Figure 7. California breeding mallard populations estimates vs hunter harvest: 1960–1990 (Chart A), 1991–2023 (Chart B).



Effects of Habitat Change

Agriculture and urban development dominate the landscape in the Central Valley of California (Frayer et al. 1989). Over the past 30 years cropping patterns have changed considerably and urban development has increased by 25–35% in the Central Valley (U.S. Department of Agriculture National Agricultural Statistics Service [USDA NASS] 1992–2017, California Department of Conservation [CDOC]). Mallards use certain agricultural crops for breeding, however urban development does not provide useful habitat (Skone et al. 2016, McLandress et al. 1996, Kucera and Barrett 1995). Numerous studies indicate that population bottlenecks in waterfowl often occur when vital rates during the breeding season (e.g., nest success, duckling survival) are low (Koons et al. 2014). Low vital rates can be caused by several reasons but the removal or reduction in quality of habitat in areas with extensive human development is a common problem (Reynolds et al. 2001). Understanding how local mallard populations change in conjunction with land use would help managers strategize conservation planning to benefit breeding mallards in the Central Valley.

Breeding waterfowl surveys have been conducted by the Service in the midcontinent of North America since 1955 (USFWS 2024b). More recently, states began breeding waterfowl surveys as part of a joint effort to manage migrant and local populations. The Department has monitored breeding waterfowl populations since 1950, with a major revision to the survey design in 1992 (Appendix C, CDFW 2024). The Central Valley boasts some of the highest densities of breeding mallards in North America and is a major component of the Western Mallard population in the Pacific Flyway (USFWS 2024b), Sauer et al. 2017, McLandress et al. 1996). Over the past 30 years the Central Valley has seen a 60% decline in breeding mallards (CDFW 2024).

The CVJV was established in 1988 as part of the North American Waterfowl Management Plan (1986) due to its critical importance to wintering waterfowl. The CVJV is considered the major conservation planning entity for birds and their habitats in the Central Valley, as it incorporates elements of resource agencies as well as academic and private interests (CVJV 2006). The CVJV consists of five major planning regions which include: the Sacramento, Yolo–Delta, Suisun, San Joaquin and Tulare (CVJV 2016, see Figure 1). The priorities of the CVJV have evolved to incorporate a wider reach of species and protect and restore habitat for both non-breeding and breeding birds (CVJV 2006). An evaluation of mallard populations in conjunction with land use changes within planning regions of the CVJV is necessary for the Department and its partners to improve mallard habitat and their breeding populations in the state.

Analysis

Waterfowl breeding population surveys (hereafter BPOP) conducted by the Department were used to assess mallard population trends in conjunction with agricultural and urban landscape changes. Department survey estimates for the Central Valley were recalculated to fit CVJV regional strata (Appendix G). These adjustments were possible because the Department survey uses georeferenced transects which allow assigning of new strata using GIS (ESRI 2013). The CVJV boundary for the Tulare region was not included as it encompasses a significant amount of dry foothill and desert areas that have little waterfowl value. Instead, the San Joaquin Desert survey strata was used, and the north boundary was adjusted to fit the CVJV boundary. The Suisun region was not included in this assessment as it has very little agriculture or urban land use types. Other methods (e.g., Normalized Difference Vegetation

Index, also known as NDVI) may be used to assess breeding waterfowl trends in this region in the future along with other Department survey strata like Napa and Santa Rosa valleys and northeastern California.

Agricultural data was obtained from California county agricultural commissioners' reports spanning 1980–2017 (USDA NASS 2019). Urban development data were obtained from California Department of Conservation (CDOC) bi-annual reports (CDOC 2019). To assess various aspects of habitat conservation, the cumulative total acres of areas purchased by the Department and the Service; or private lands enrolled into the Conservation Reserve Program (hereafter CRP) were used (CDFW unpublished data, USFWS unpublished data, USDA Farm Services Agency 2019). Lastly, rainfall and temperature data were gathered from weather stations via the National Oceanic and Atmospheric Administration National Centers for Environmental Information, to assess breeding population changes in relation to climate (NOAA NCEI 2019).

Survey strata boundaries overlap numerous counties, therefore aggregation of agriculture or urban area from the county level to the survey strata level was necessary (Appendix G, Chart 17). CVJV regional boundaries extend to the edge of the Central Valley, but county boundaries often extend well beyond into the coastal or Sierra foothills. The vast majority of each counties' agricultural footprint lies within the Central Valley; therefore, the aggregation of total county data was not considered problematic for most crop types, except for rangeland. In some cases, adjustments needed to be made to distribute crops where counties overlapped basin boundaries (Appendix G, Chart 5).

Rangeland was difficult to assess within each survey stratum as it occurs on the fringes of the valley and most often extends beyond the boundaries of the CVJV. Thus, total rangeland based on county data was the only available option at this time. Even though an accurate amount of rangeland could not be calculated in the CVJV area, total rangeland is a useful index because conversion to other agriculture (e.g., almonds) or to urban area is more likely to occur on the edges of the Central Valley.

Urban area extent reported in CDOC biannual reports was converted into annual estimates using simple linear regression to fill in the gaps between years (CDOC 2015, Kutner et al. 2005). GIS was used to assess whether cities fell within CVJV boundaries to not inflate the amount of urban in each area. In some cases, a correction factor was created (ESRI 2013). For example, in Solano County, the cities of Benicia, Dixon, Fairfield (including Travis Air Force Base), Rio Vista, Suisun City, Vacaville and Vallejo are largely urban development. Some of these cites overlap both the Yolo–Delta region and Suisun regions or lie on the edge of planning regions where part of the urban footprint is outside of the scope of the survey strata. Data reported by Gazetteer in 1980, 2005 and 2016 was used to estimate annual urban growth of these areas from 1992–2017 using linear regression (U.S. Census Bureau 2016). Historic satellite imagery was used to assess the proportion of each city that occurred in each region to derive an accurate representation of urban growth over time within the Yolo–Delta and Suisun planning regions (Appendix G).

Three sets of covariates were modeled against mallard BPOP estimates from 1992–2017 to assess the effects of land use changes, conservation efforts and climate. The first set of models compares mallard BPOP estimates to changes in the agricultural landscape in each region. Crops were combined to include: tree crops, vine crops, row crops and field crops.

Rice, irrigated pasture and rangeland were considered different enough to have their own category. Crop specific relationships were not explored but may reviewed in the future. Mallard populations are expected to correlate positively with habitat types that ducks are known to use for nesting (e.g., row crops, field crops, pasture) and correlate negatively with habitat types that provide no nesting value (e.g., tree crops or urban). Over the past 30 years considerable effort has been placed on habitat protection and restoration via fee title acquisition or by easements. Thus, the second set of models compare combinations of managed (i.e., Type A wildlife areas) and unmanaged (i.e., Type C wildlife areas) governmental (i.e., Department and Service combined) habitat acquisitions, along with CRP acreages to mallard BPOP within each region by year. Fee title acquisitions were assumed to have little correlation with mallard BPOP as many of these properties do not provide significant amounts of summer wetlands. CRP properties are comprised of unirrigated farmland set aside, fallowed or planted with a cover crop but do not provide summer water. Mallard BPOPs are expected to have little correlation with CRP acreage as the total area is relatively small in most regions and only a portion of these acres would be suitable breeding habitat. Precipitation and temperature can affect the success of waterfowl nesting therefore the third set of models compared these variables to mallard BPOP by year. Specifically, the cumulative amount of precipitation and average temperature for January–April prior to the breeding season at one weather station per stratum was used. Previous assessment of precipitation by the Service indicated that California mallard BPOPs were not correlated with spring rainfall (i.e., more rain does not equal more ducks), so it is expected to remain true. Temperature, however, may have an impact as high temperatures can cause nest failure, therefore mallard BPOP is expected to be negatively correlated with higher temperatures.

Generalized linear models were used to model each covariate against mallard BPOP (Kutner et al. 2005). All analyses were conducted in R Studio (R Studio Team 2019) using packages *AIC_cmodelavg* (Mazerolle 2019) and *ggplot2* for graphics (Wickham 2016). AIC_c was used to rank each model and include adjusted R^2 as a measure of fit for each comparison (Burnham and Anderson 2002). As a conservative measure, all models ≤ 6 AIC_c from the top model are discussed (Arnold 2010). Models were not considered valid if ranked below the null (i.e., intercept-only) model.

Results

Sacramento Planning Region

The Sacramento region contributes an average of 41% of all mallards observed in the CVJV area, not including Suisun. This composition has ranged from 53% in the early 2000's to a low of 25% currently. Mallards have declined at a rate of 3,368 per year and 69% overall since 1992 (Appendix G, Chart 6A).

A total of nine models were to assess land use changes in relation to mallard BPOP in the Sacramento region (Appendix G, Chart G1). A total of five models fit within the ranking criteria (i.e., ≤ Δ 6 AIC_c from top model, ranked above the null model). This indicated most support for change in Rangeland, followed by Tree Crops ($\Delta AIC_c = 4.3$), Urban area ($\Delta AIC_c = 5.1$), Row Crops ($\Delta AIC_c = 5.7$) and Irrigated Pasture ($\Delta AIC_c = 6.1$). Fits (i.e., adjusted R^2) for each of these models were strong at 0.61, 0.54, 0.52, 0.51 and 0.50. Slopes for Rangeland, Row Crops and Irrigated Pasture were positive at 0.34 (95% CI = 0.24 – 0.45), 0.47 (CI = 0.29 – 0.64) and 1.69 (CI = 1.04 – 2.33), indicating mallard BPOPs were higher with these land use types (Appendix G, Chart G7). Mode slopes for Tree Crops and Urban were negative at -0.39 (CI = -0.52 – -0.25) and -1.62 (CI = -2.23 – -1.02), indicating mallard BPOPs are lower when these land use types are higher.

Four models were contrasted to assess habitat conservation efforts in the Sacramento region (Appendix G, Chart G1). Governmental Type A (i.e., actively managed) ranked highest, followed by Type C (i.e., unmanaged; Δ AIC_c = 0.1) and then CRP (i.e., private easement; Δ AIC_c = 5.9). Fits for each of these models were: 0.31, 0.31 and 0.14. Models slopes for Type A and Type C were negative at -40.17 (CI = -62.68 – -17.66) and -8.89 (CI = -13.89 – -3.88; Appendix G, Charts 8A and B) respectively, indicating BPOP has decreased as acres have been acquired. Slope of CRP acres was positive at 3.24 (80% CI = -1.36 – -5.11) indicating that mallard BPOP was higher when there was more set aside upland (Appendix G, Chart 8C).

Maximum temperature (i.e., TMAX) was the only climatic model with more support than the null (Appendix G, Chart 1). Model fit was poor at 0.15. The model slope was negative and predicts that for every 1-degree F increase in TMAX, the mallard BPOP decreases by 5,042 (80% CI = -9,827.2 – -257.7; Appendix G, Chart 1). No support was found for precipitation (Δ AIC_c = 4.0), which had uninformative parameter estimates (i.e., confidence intervals overlapped zero) indicating precipitation, at the level analyzed, has no influence on mallard BPOP in the Sacramento region.

Yolo–Delta Planning Region

The Yolo–Delta region contributes an average of 25% of the mallard BPOP surveyed in the CVJV. Since 1992 the range has been 13%–41%. Estimates of breeding mallards in Yolo–Delta have declined by 1,178 birds per year since 1992, a 49% decline over the 1992–2017 period (Appendix G, Chart 6B).

Of the nine models used to contrast mallard BPOP against gross land use, Urban was the highest ranked model, followed by Row Crops (Δ AIC_c = 2.3), Tree Crops (Δ AIC_c = 4.0) and Irrigated Pasture (Δ AIC_c = 5.4; Appendix G, Chart 2). Fits for each of these models were: 0.37, 0.31, 0.26 and 0.23. Slopes for Urban and Tree Crops were negative at 0.40 (CI = -0.59 – -0.20) and -0.22 (CI = -0.35 – -0.08; Appendix G, Charts 9A and C). Slopes for Row Crops and Irrigated Pasture were positive at 0.14 (CI = 0.06 – 0.22) and 1.07 (CI = 0.35 – 1.78; Figure 5A and C) mallards per acre, respectively.

Of the four models used to contrast Yolo–Delta mallard BPOP with conservation activities; Type A area had overwhelming support (i.e., other models were ≥ 6 Δ AIC_c; Appendix G, Chart 2). Model fit was moderate at 0.34. Model slope was negative indicating a decline of -0.99 (80% CI = -1.51 – -0.47) mallards per acre of Type A gained (Appendix G, Chart 9E).

Of the four models used to contrast Yolo–Delta mallard BPOP with climatic conditions; TMAX was the only model that performed better than the null model, however fit was poor (adj. R^2 = 0.14 and parameter estimates overlapped zero (Appendix G, Chart 2). The model slope was negative and indicates that for every 1-degree F increase in TMAX the mallard BPOP decreases by 2,121 (CI = -4,461.8 – 219.4, Appendix G, Chart 9F). No support was found for precipitation (Δ AIC_c = 3.1), which was ranked below the null model, had uninformative parameter estimates (i.e., confidence intervals overlapped zero) and essentially no fit (i.e., adj. R^2 = 0.00); meaning precipitation has no impact on mallard BPOP in the Yolo–Delta region.

San Joaquin Planning Region

The San Joaquin region contributes an average of 21% of the breeding mallard population annually, with a range of 11%–27%. This population has declined at a rate of 1,337 birds per year and has decreased by 57% since 1992 (Appendix G, Chart 6C).

Of the nine models used to contrast mallard BPOP with land uses in the San Joaquin; Urban area was the top model (Appendix G-3). This was followed by Field Crops (Δ AIC$_c$ = 0.3), Tree Crops (Δ AIC$_c$ = 0.9) and Irrigated Pasture (Δ AIC$_c$ = 2.6). Model fit was weak amongst all models at 0.22, 0.21, 0.20 and 0.14. Both Urban and Tree Crops had negative slopes indicating mallard BPOPs decreased by -0.79 (CI = -1.33 – -0.25) and 0.10 (CI = -17 – 0.03) with every acre increase of these land uses (Appendix G, Charts 10A and C). Field Crops and Irrigated Pasture were both positively correlated with mallard BPOP, increasing by 0.28 (CI = 0.08 – 0.48) and 0.19 (CI = 0.03 – 0.36) birds per acre increase of these land uses (Appendix G, Charts 10B and D). Initially Rice was the highest ranked model in this set, however model fit was relatively low with an adjusted of R^2 0.16, so it was separated. Also, rice decreased to zero acres by 2017 and accounted for less than 1% of land uses in the San Joaquin. As a result, it was included in the discussion but not included in competing models (Appendix G, Chart 10E). The San Joaquin region is wetland deficient compared to the Sacramento and the Yolo–Delta so it is possible that the decrease in rice here has negatively impacted local mallard BPOP. The annual estimates of Rangeland showed an irregular trend and is unclear as to why. Ignoring its presence in the San Joaquin model set is suggested until further assessment can be made.

Of the four models used to assess conservation activity in relation to mallard BPOP in the San Joaquin; Type C and Type A (Δ AIC$_c$ = 4.2) were the only two models ranked above the null model (Appendix G, Chart 3). Model fits were moderate at 0.40 and 0.30. Model slopes were both negative showing a decrease of -28.45 (CI = -41.7 – -15.2) and -2.08 (CI = -3.27 – -0.88) for every acre increase of these properties (Appendix G, Charts 11A and B).

Of the four models used to assess climate in relation to mallard BPOP in the San Joaquin, minimum temperature (MINT) was the only climatic model that ranked above the null model; however, model fit was poor (adj. R2 = 0.14; Appendix G-3). This model indicates that for every 1-degree F increase in MINT the mallard BPOP increases by 3,719 (CI = 490.0 – 6,947.3) in the region (Appendix G, Chart 11C). Like the Sacramento and Yolo–Delta regions, precipitation in the San Joaquin was not correlated to mallard BPOP and contained uninformative parameter estimates.

Tulare Planning Region

The Tulare region contributes an average of 13% to the mallard BPOP annually, with a range of 5%–21%. The population in this region is declining at a rate of 816 birds per year and has decreased by 57% since 1992 (Appendix G, Chart 6D).

Of the nine models used to assess gross land use changes in relation to the Tulare mallard BPOP; Row Crops, Urban (Δ AIC$_c$ = 0.8), Tree Crops (Δ AIC$_c$ = 1.3) and Rangeland (Δ AIC$_c$ = 2.3) were within the ranking criteria (Appendix G, Chart 4). Model fits were poor at 0.21, 0.19, 0.17 and 0.15. Slopes of Urban and Tree Crops models were negative, indicating that mallard BPOP decreased by -0.15 (CI = -0.27 – -0.04) and -0.03 (CI = -0.05 – -0.006) per acre increase of these land uses (Appendix G, Charts 12B and D). Row Crops and Rangeland had positive slopes, with mallard BPOP increasing by 0.02 (CI = 0.006 – 0.03) and 0.02 (CI = 0.004 – 0.05) birds per acre increase of these land uses (Appendix G, Charts 12A and C). Similar to the San Joaquin, Rice initially ranked the highest however it had very poor fit (adjusted R^2 = -0.04) and uninformative parameter estimates so was discarded. The lower AIC_c values for Rice was due to zero acres being planted over the past 5 years, skewing the model.

Of the four models used to assess habitat conservation activities in relation to mallard BPOP in Tulare; CRP ranked highest, followed by Type C (Δ AIC_c = 0.8), then Type A (Δ AIC_c = 1.4; Appendix G, Chart 4). Model fits were poor at 0.19, 0.16 and 0.14. CRP contained the only positive relationship, indicating that the mallard BPOP increased by 2.34 (CI = 0.58 – 4.10) for every acre increase of set aside upland (Appendix G, Chart 12E). Slopes of Type C and Type A properties were negative where mallard BPOP has decreased by -0.85 (CI = -1.55 – -0.16) and -1.10 (CI = -2.05 – -0.14) birds per acre for every acre increase in these acquisition types (Appendix G, Charts 12F and G).

None of the four models used to contrast climatic conditions against mallard BPOP in Tulare ranked above the null model indicating neither precipitation nor temperature correlates with mallard breeding population in this region.

Discussion

Mallards require both uplands for nesting and wetlands for brood rearing, thus if either of these habitats are limited – mallard reproduction will be limited (Drilling et al. 2018). Agriculture provides a significant amount of potential nesting habitat in some areas of the Central Valley, however; “reasonably adjacent” wetlands are few and far between, even in areas with rice. The phrase, “reasonably adjacent” is used because the relationship of distance between uplands and wetlands and brood loss has yet to be investigated in the Central Valley. This metric is particularly important in the Sacramento region and Yolo–Delta where rice can be used as surrogate wetland habitat. The amount of natural wetland habitat in summer is very small throughout the Central Valley and increasing wetlands is unlikely given water demand and habitat management strategies. Thus, using agricultural land as a surrogate may provide a reasonable alternative.

Current estimates from the CVJV indicate the Sacramento region has the most summer wetland habitat with ~5,350 acres, followed by Tulare at ~5,034, Yolo–Delta at 4,010 acres and the San Joaquin at 2,872 acres (CVJV 2019 unpublished data). Management of summer water is problematic for both public and private property for a host of reasons including but not limited to; water supply, noxious weeds and mosquito abatement costs (Olson 2011). Even if wetland managers had unlimited summer water, the amount of flooding necessary to increase mallard populations would significantly reduce food resources for wintering waterfowl. The emphasis on winter management is based on the importance of the Central Valley to the millions of wintering waterfowl and the recreational opportunity they provide (i.e., hunting and viewing), which takes priority over supporting local breeding populations that are far fewer. Therefore, it is not surprising that the majority of public and private wetland habitat are managed for wintering waterfowl. Summer management on these same areas is focused on food production via irrigated moist soil or staged draw down to maximize plant species composition and seed yield. This does provide upland nesting habitat however the success of these uplands (i.e., seasonal or moist soil wetlands) to produce mallards may be dependent on the proximity of adjacent wetlands and the infrastructure (i.e., water delivery canals) to aid movements from uplands to brood rearing wetlands.

Similar to results reported by Coates et al. (2017) regarding pheasants (*Phasianus colchicus*), mallard populations have responded differently to land use changes amongst regions of the Central Valley. Generally, mallards BPOPs have decreased relative to increases in tree crops and urban area and were higher when crops that provide surrogate upland habitat were more abundant. Across all regions, urban development and tree crops were ranked within the top set of models and, as predicted, had negative correlation with mallard BPOPs. In the Sacramento region, tree crops increased by 77% ($\bar{x}$ =1992–1994 vs $\bar{x}$ = 2015–2017) while urban increased by 37% (Appendix G, Chart 13). Tree crops now account for 18% of total land area within the Sacramento region, while urban accounts for 6%. In Yolo–Delta, tree crops have increased by 82% while urban has increased by 32%, each accounting for 12% of total area (Appendix G, Chart 14). In the San Joaquin, tree crops have increased by 49%, while urban has increased by 25% (Appendix G, Chart 15). Both land types account for 21% and 5%, respectively. In Tulare, tree crops increased by 58% while urban area increased by 31% (Appendix G, Chart 16). Tree crops account for 45% of total area, while urban accounts for 15% within the Tulare region. Almonds and walnuts have increased the most within tree crops, with almonds increasing between 117% (Sacramento region) to 314% (Tulare) and walnuts increasing between 34% (San Joaquin) and 164% (Appendix G, Charts 18–21).

Whenever row crops, field crops, pasture or rangeland were in the top set of models, slopes indicated that these habitat types had a positive relationship with mallard BPOP. Data from past studies as well as egg salvage operations indicate certain row crops and field crops can produce significant number of nests in the Sacramento region and Yolo–Delta (California Waterfowl Association unpublished data). While the full effect of these crops as nesting habitat in the San Joaquin and Tulare is not well understood, they must provide some nesting habitat, albeit adjacent to poor quality brood rearing habitat in the form of barren canals. Cattle grazing has shown to have a mixed effect on waterfowl nesting (Carroll et al. 2007, Lapointe et al. 2000, Kirsch 1969). Past study in California has indicated that, while nest densities are low in pasture, they do produce mallards in conjunction with adjacent wetland habitat (Carroll et al. 2007). Rangeland above the Central Valley floor often consists of annual grasses and some oak woodland with artificial ponds to provide water for cattle. Waterfowl can and do reproduce in these areas but is assumed to be at low levels. Past studies have attempted to measure the production in these areas (California Waterfowl Association, unpublished data), however no long-terms datasets are available outside of Breeding Bird Survey data which has yet to be investigated (Sauer et al. 2017).

Row crops were found to be important in all but the San Joaquin region. Past research has shown that dry beans (e.g., garbanzo beans) and safflower can serve as high quality (i.e., high densities, high hatch success) nesting habitat (California Waterfowl Association unpublished data). These crops have declined by 74% in the Sacramento region, 68% in Yolo–Delta and 65% in Tulare (Appendix G, Charts 18–21). Other row crops such as silage, cotton, tomatoes, corn or vegetables are likely to have little to no value based on irrigation schedules, harvest chronology and or habitat structure. Row crops have decreased by 41% in the Sacramento region, 34% in Yolo–Delta and 58% in Tulare. Row crops currently comprise 16% of the Sacramento region, 13% of the Yolo–Delta, 21% of the San Joaquin and 26% of Tulare regions (Appendix G, Charts 18–21).

Models indicated that field crops were only important in the San Joaquin, however cereal grains (e.g., wheat, barley, oats) are known to provide high quality upland nesting habitat and have been studied in the Sacramento region and Yolo–Delta (Skone et al. 2016, California Waterfowl Association unpublished data). Field crops have decreased by 40% in the San Joaquin with the biggest loss occurring in grain at 62% (Appendix G, Charts 18–21). Unpublished data from California Waterfowl Association shows that average mallard nest densities in grain-fields in the Sacramento region is around 0.99 nests per acre (range 0.00–9.50), which is quite high relative to other more studied regions of North America. The agricultural use of grain in the Central Valley has changed over time from mostly seed-grain in the 1990's to a higher proportion of silage currently. The contrast of these uses is drastic in that seed harvest allows for some nests to hatch while the reduced plant to harvest chronology of silage allows very few, if any, to hatch. Currently there is no information to differentiate the amount of wheat grown for seed or silage uses to compare to changes in mallard BPOP. In total, field crops comprise 12% of the Sacramento region, 16% of the Yolo–Delta, 8% of the San Joaquin and 35% of Tulare (Appendix G, Charts 13–16).

Irrigated pasture ranked high within the Sacramento region, Yolo–Delta and San Joaquin model sets. It has decreased by 30%, 19% and 66% in each of these regions since 1992. In terms of total area, irrigated pasture comprises 4% in the Sacramento region, 3% in the Yolo–Delta, 2% in the San Joaquin and 4% in Tulare (Appendix G, Charts 13–16). Rangeland was in the top models in the Sacramento region and Tulare. Rangeland has decreased by 11% in the Sacramento region and by 19% in Tulare since 1992 (Appendix G, Charts 13–16).

Rice was in the top model set in only two areas, the San Joaquin and Tulare, which have the fewest wetland acres. This should be interpreted with caution as model assessment metrics were not good. Total acreage was likely great enough to have positive effects on mallard production during the 1990's when populations were greater. The amount of rice grown during the 1990's in the San Joaquin and Tulare (i.e., ~8000 acres in the San Joaquin, ~5,000 acres in Tulare) is more than the amount of summer wetland habitat currently provided on refuges in these areas (USDA NASS 2019). Rice is now nonexistent in both regions. Rice was not amongst the top models in the Sacramento region or Yolo–Delta regions however these two areas account for the largest portions of the overall mallard population in the Central Valley. This is likely due to rice agriculture as data indicates rice is an important brood rearing habitat (Yarris 2008, CDFW unpublished data). These two areas have a much larger and consistent rice footprint, suggesting that regional decreases in the mallard BPOPs are more likely related to the loss of upland habitat adjacent to rice. Based on visual assessment using the Cropscape data layer (USDA 2017), much of the rice currently grown in these regions occurs in large contiguous areas with little to no upland habitat intermixed (Appendix G-5). Previously (before 1996 Farm Bill), a portion of rice fields remained fallow each year and provided some undisturbed areas for nesting. Rice comprises 19% of the Sacramento region, 1% of the Yolo–Delta and <1% of the San Joaquin and Tulare regions. While rice has diminished completely from the latter two areas, planting remains steady with 500,000 acres in the Sacramento region and 15,000 acres in Yolo–Delta.

Vine Crops are not considered suitable nesting habitat for mallards and did not occur in the top model set for any region. Most regions have seen a decrease in vine crops, however the Yolo–Delta has had an increase of 136% since 1992. In total, vine crops comprise 1% of the Sacramento region, 7% of Yolo–Delta, 4% of San Joaquin and 13% of Tulare (Appendix G, Charts 13–16).

Our results indicated that habitat acquisition and easement acres did not correlate greatly with mallard BPOPs in most regions. These land use types comprised a very small amount of total area ranging between <1% and 2% of total area in regions of the Central Valley (Appendix G, Chart 22). In general, habitats acquired, whether managed or unmanaged, suggest a negative association with mallard BPOPs. Many of the actively managed areas do not provide habitat for breeding waterfowl as the tradeoff to provide summer habitat means less food availability for wintering waterfowl (Naylor 2002, CVJV unpublished data). Further, some are managed for other species (e.g., bluntnose leopard lizard (*Gambelia sila*)) and or contain mostly unsuitable habitat entirely (e.g., desert). CRP acres indicate positive relationship across all regions however model fits were somewhat poor, thus these relationships should be interpreted with caution. A short-term study conducted by the Department (unpublished data) suggested that the relationship between refuge areas and adjacent rice may be important to nesting mallards as females chose to nest on CRP, then moved their broods to adjacent rice where upland nesting habitat was nearly absent. Since brood water is likely the most limiting factor for mallard reproduction in the Central Valley, estimates of summer water on these properties as well as other conservation programs aimed at providing this resource (e.g., the California Waterfowl Habitat Program (also known as the Presley Program)) should be assessed in the future.

Local temperature and precipitation were modeled against regional mallard BPOP trends and indicated a very poor correlation in each case (Appendix G, Chart 23). Greater maximum temperature indicated a steeply negative relationship with mallard BPOP in the Sacramento and Yolo–Delta regions, while cooler minimum temperatures had a positive relationship with mallard BPOP in the San Joaquin. The former two relationships seem intuitive as high heat is not compatible with upland nesting birds (Carroll et al. 2018). The latter is strange as minimum temperatures in the San Joaquin are well above freezing. None of the variables used ranked above the intercept-only model in Tulare. As previous assessments indicated, precipitation did not correlate with mallard BPOP (G. Zimmerman, USFWS, personal comm.). This is not surprising as much of the Central Valley floor is covered in agriculture and includes a very effective water delivery and drainage network. This irrigation-drainage network channels water into canals and rivers to be carried away when flooding becomes a problem on ag-fields. Greater precipitation may positively impact microclimate variables associated with successful nesting (e.g. increased plant densities, increase humidity), but the drainage systems do not allow for water to pond in a way that provides additional brood rearing habitat. Further, our methods may be too coarse in this assessment as using a single weather station to determine climate across a relatively large spatial area is somewhat myopic. Other datasets may prove to be more useful in comparing climatic variables to BPOP over large areas (e.g., PRISM; Daley et al. 2008) and may provide a way of comparing observations on transects to investigate changes along a spatial gradient (Coates et al. 2017).

Management Implications from Effects of Habitat Change

Since each region has its own unique set of issues, solutions are best thought of on a region-by-region basis. One of the cheapest solutions in northern areas is to produce upland habitat adjacent to rice which would likely work immediately to increase local mallard numbers. Increasing summer wetlands in the Sacramento or Yolo–Delta regions are also alternatives and is encouraged; however, rice is an extensive crop and uplands are likely more limiting to mallard breeding and cheaper to produce in these areas.

In the San Joaquin and Tulare regions, wetlands are presumably the most limiting factor in mallard recruitment. Bringing back rice agriculture would be very difficult as the cost of water in these regions has likely reduced the capacity to profit. Regardless, incentive programs to increase rice should still be investigated as margins are affected by the dynamic nature of commodity prices and in some years may provide an opportunity. Rice is considered a good alternative to wetlands in these regions, mostly due to the potential to create a large footprint. State and or federal incentive programs (e.g., Presley Program and CRP) for private landowners to provide summer wetlands in the San Joaquin and Tulare have been a traditional approach to increasing mallard breeding with some success (California Waterfowl Association unpublished data). We would encourage to continue or expand these programs, however new water policies (e.g., the Sustainable Groundwater Management Act) may make this difficult in some planning regions over time. Cost-benefit evaluations should be considered periodically to better understand the amount of incentives necessary to offset costs in the San Joaquin and Tulare regions as well as whether a viable approach for conservation.

Opportunities exist in all regions of the Central Valley to improve waterfowl nesting and brood rearing conditions. On private lands, the Presley Program is a statewide program administered by the Department that incentivizes private landowners to manage their land in accordance with management plans cooperatively developed by the Department and the landowner. These plans are designed to implement goals as identified by CVJV’s most recent implementation plan and the Department’s State Wildlife Action Plan. The Presley Program has been in existence for close to 30 years and has remained extremely popular with private landowners. The Department received interest from approximately 200 properties encompassing 50,000 acres in the most recent solicitation (2019). At current funding levels, implementation of the program over the next 10 years will result in a net gain of approximately 3,000 acres of semi-permanent wetlands, and the annual enhancement of over 20,000 acres of seasonal wetlands within the Central Valley.

The Nesting Bird Habitat Incentive Program (NBHIP) was created in 2018 and funding recently acquired which allows the Department to provide payments or other incentives to landowners to cultivate or retain upland cover crops, cereal grains, grasses, forbs, pollinator plants or a combination thereof to provide waterfowl and other game bird nesting cover. The NBHIP is designed to increase the abundance and quality of upland nesting habitat in California. The Department estimates a long-term budget of just over $2 million annually and expects this will result in an additional 4,000 to 40,000 acres of nesting habitat each year (dependent upon water availability to growers).

Farm Bill funded programs such as the Regional Conservation Partnership Program administered by the Natural Resources Conservation Service, also offer significant potential for enhancing waterfowl nesting habitat in the Central Valley. This program offers incentives to growers to maintain cover crops through the nesting season, and not incorporate until mid-summer. Ensuring funding is available for programs such as these is critical to ensuring the resource needs of waterfowl breeding in the Central Valley are met on private lands. Secure, long-term funding has been the limiting factor to expanding the Presley Program in the Central Valley.

Adequate funding for wildlife areas and national wildlife areas is also critical to ensuring habitat is available for nesting hens and ducklings throughout the Central Valley. Annual management costs associated with semi-permanent wetlands are close to double that of seasonal wetlands.

If the goal is to improve conditions for waterfowl and other wetland-dependent species that utilize semi-permanent wetlands, operating budgets and staffing levels must be adjusted accordingly.

Other habitat enhancement opportunities may exist in the Central Valley as water infrastructure (i.e., canal systems) are extensive and may provide adequate wetland habitat if managed correctly. Research aimed at quantifying success of breeding waterfowl in these systems is necessary to inform policy, however some reasonable assumptions can be made. Vegetation along irrigation canals is most often eliminated using mechanical means, herbicide or burning. Recommendations to avoid vegetation removal from the outside of major levees before July 1st could be made to reduce impacts to nesting waterfowl. Providing vegetation along the inside of canals, particularly of species that do not greatly impede water systems (e.g., hardstem bulrush (*Schoenoplectus acutus*)) is a mitigation strategy that would improve habitat for brood rearing waterfowl. Management of water infrastructure owned by government agencies should be evaluated to ensure activities are not harming potential recruitment of waterfowl or other nesting bird species.

Filling information gaps may be necessary prior to modifying or proceeding with new programs. For instance, we do not fully understand which crops provide the most nesting value and having a diverse set of crop options would increase the success of nesting habitat incentive programs. The relationship between the distance of nesting uplands to brood rearing habitat and associated ducking survival after hatch is poorly understood. This relationship needs to be further investigated in order to better inform scoring criteria and evaluate the success of incentive programs. Additionally, research on waterfowl production in rangelands is required in order to better understand the contribution of these areas to waterfowl populations in the Central Valley.

Cumulative Impacts

Short-term Uses and Long-term Productivity

The 2006 analysis was presented on page 97 of the 2006 Final Environmental Document. The proposed project and existing hunting regulations will result in the temporary reduction of waterfowl, coot and moorhen populations and the use of nonrenewable fuels by hunters and the Department in the assessment of migratory game bird populations and the enforcement of the regulations. On the other hand, the Service concluded (USDI 1975:215) that the issuance of annual hunting regulations contributes significantly to the long-term productivity of the migratory game bird resource and their habitats, because hunting is allowed for only a few species of migratory birds for a limited period of time, and the revenues from hunting are important in the acquisition and management of migratory game bird habitats. Therefore, the project and existing regulations enhance long-term productivity of migratory game birds and results in no significant adverse impact on long-term productivity.

Growth Inducing Impacts

The 2006 analysis was presented on page 98 of the 2006 Final Environmental Document. Because the hunting of migratory game birds is undertaken for a limited period and generally occurs in sparsely populated regions of the State, it is not likely to add to the growth in population in California or result in large-scale developments in any city or area. Overall numbers of migratory game bird hunters are declining, and because these numbers are declining, there is not likely to be an additional demand for housing in the specific areas in which hunting will occur. Therefore, the project and existing hunting regulations will not result in significant adverse impacts through growth.

Significant Irreversible Environmental Changes

The 2006 analysis was presented on page 98 of the 2006 Final Environmental Document. The proposed project and existing hunting regulations would result in the continued commitment of energy resources by biologists and wardens in data collection, regulation promulgation, and law enforcement, and by hunters traveling to hunting areas. Therefore, the project will not result in significant adverse environmental impacts through irreversible changes.

The 2006 analyses and document referenced is available upon request.

Cultural Resources

The proposed Project would modify current waterfowl hunting regulations for the 2025-26 waterfowl hunting season. The regulations governing the take of migratory game birds in California are selected by the Commission and forwarded to the Service each year. The federal frameworks specify the range of dates, total number of hunting days, bag limits, shooting hours, and methods of take authorized for migratory game birds, statewide. The proposed Project provides continued opportunity for migratory game bird hunting via season lengths and bag limits. The regulations selected by the Commission must be within the frameworks established by the Service.

The proposed Project is statewide on both public and private lands. Hunting on public lands that have identified tribal cultural resources would have restrictions or mitigation measures in place to prevent harm to cultural resources. There is no evidence that suggests the Project (modification or issuance of annual waterfowl hunting regulations) would cause any adverse change in the significance of a tribal cultural resource; cause any change in the significance of an historical or archaeological resource; directly or indirectly destroy a unique paleontological resource site or unique geologic feature; or disturb any human remains. No tribal cultural resources assessments have been conducted because the proposed Project would have no impact to tribal cultural resources.

CHAPTER 3 – ALTERNATIVES

The three California project alternatives evaluated herein are: (1) no project – no change from the 2024-25 hunting regulations; (2) reduced season lengths and bag limits; and (3) elimination of all mechanical decoys.

Alternative 1. No project – No Change from 2024-25 Hunting Regulations

This alternative provides identical season and bag limit regulations as the 2024-25 seasons (Appendix A). Under this alternative, the season length would remain at 98 days.

Advantages of This Alternative

Waterfowl regulations are inherently complicated, and any changes may result in confusion for some members of the public. Maintaining the 2024-25 regulations for the 2025-26 season may result in less confusion to some members of the public.

Disadvantages of This Alternative

Retaining the 2024-25 regulations for the 2025-26 season may place the state out of compliance with federal frameworks because of calendar progression and specific dates in the current regulations. This alternative was rejected because some members of the public prefer starting the season earlier to close the season several days prior to the Youth Hunt Days to reduce possible disturbance while other members of the public prefer the season to end as late as possible, taking advantage of the latest possible closing date of January 31.

Conclusion Regarding Alternative 1

It is unlikely that significant irreversible impacts would occur immediately or statewide as a result of selecting the no change alternative. However, this alternative was not recommended because the public has expressed various preferences on season placement.

Alternative 2. Reduced Season Lengths, Season Timing, and Bag Limits

This alternative provides a suite of restrictions that when taken alone or in combination are expected to reduce harvests. This alternative could be selected by the Commission based on changes in federal frameworks or a conclusion by the Commission that reduced harvests are a better alternative than the project or existing regulations. Under this alternative, for a generalized analysis, the length of each migratory bird season could be reduced by about 50%. For ducks, more conservative AHM regulatory alternatives (86 or 60 days) could be used. For brant, the 27-day season would be reduced to 14 days and for most other geese the season would be reduced from between 107 or 101 days to 51 days.

The AHM alternatives for the Pacific Flyway include total duck bag limits that range from 4 to 7 with differing restrictions on mallards and hen mallards. Other bag limit reductions considered in this alternative include a reduction from as many as 20 to as few as one goose depending on zone; a reduction in brant from two to one; and a reduction in the coot daily limit from 25 to 12 per day. Additionally, species-specific regulations, for pintail, redheads, canvasback or scaup could be further reduced under this alternative.

Advantages of This Alternative

Selecting Alternative 2, reduced season lengths, seasons timing, and bag limits, would reduce total harvest, although the magnitude of this reduction is not precisely predictable. This alternative has advantages only if the levels of harvest are suppressing populations. In 2023-24, the estimated retrieved harvest in California was 3,831,500 ducks, 194,100 geese and 10,200 coots (Appendix H). If harvest regulation restrictions cause a larger than expected decline in hunter participation, harvests might be reduced by more than 50%. If, as experienced in the 1989-90 season, there is a decrease in hunter participation but fall flights are larger or contain higher percentages of juveniles than are expected, harvests would probably not decline by 50%. If harvests declined by exactly 50%; approximately 1,915,750 ducks, 97,050 geese, and 5,100 coots would not be harvested in California. If waterfowl, coots and moorhens have access to sufficient quantity and quality habitat and these populations are being suppressed due to the levels of harvest previously experienced, populations might increase in following years because the selection of this alternative. This alternative would provide recreational opportunity for hunters and meet one of the goals of the Conservation of Wildlife Resources Policy (California Fish and Game Code, Section 1801), which is to include hunting as part of maintaining diversified recreational uses of wildlife.

Non-hunting opportunities to view migratory birds would not differ substantially from the proposed project, because this would increase viewing days on hunting areas. Reduction in possible conflicts between non-hunters and hunters would likely result of this alternative.

Disadvantages of This Alternative

Harvest restrictions for waterfowl, coots and moorhens would probably be a disincentive for many private landowners that provide habitat through flooding of seasonal wetlands and agricultural lands during the fall and winter. These habitats form the majority of available wintering habitat for waterfowl and wetland dependent wildlife in California *(*Heitmeyer et al. 1989*)*. Habitat provided only during the hunting season would be available for a shorter time. For many of these private landowners, the short period of time allowed for hunting may be viewed as not worth the high costs associated with providing water and managing this habitat. This would reduce the amount of available habitat and related food for waterfowl and other wetland-dependent wildlife. Further, this could lead to overcrowding and likely increase losses to disease.

Conclusion Regarding Alternative 2

Selection of this alternative might lead to a greater decline in participation by hunters. The reductions in the number of days that waterfowl, coots and moorhens could be hunted might not be deemed to be worth the costs of licenses, stamps, travel, and entry fees. A change in season timing is not likely to significantly affect the number of active hunters. A reduction in hunter participation would result in reduced revenues to the Department and the Service which are used to acquire, manage, and maintain vital habitats. If the reduced season length resulted in a lower hunting harvest and hunting mortality was additive to natural mortality, an increase in some populations of waterfowl would be possible. However, the Department concludes that this alternative alone would not result in a significant increase in waterfowl numbers in future years.

Alternative 3. Eliminating all mechanically- and artificially-powered spinning wing decoys as a method of take.

The use of mechanical or electronic duck decoys (also known as spinning wing decoys (SWDs), “rotoducks,” “motoducks,” motion wing decoys, etc.) may lead to increases in harvest beyond those anticipated by existing bag limits and season length. Some hunters and other members of the public are opposed to the use of these devices because they believe that the devices exceed the bounds of “fair chase” and eliminate the emphasis on traditional hunting skills needed to successfully hunt ducks, and the advantages detract from the experience and dedication needed to sustain the hunting tradition.

This alternative would eliminate the use of all mechanical and artificially powered spinning wing decoys as a method of take. The Department analyzed several sources of information relative to the possible effects of spinning wing decoys and these analyses are provided in Appendix I.

Advantages of This Alternative

The evidence seems clear that spinning blade and spinning wing decoys increase harvest at the individual hunt level, and level of observed increases in harvest at the individual hunt level are not reflected in overall estimates of harvest (Appendix H). However, the role of harvest in duck population dynamics is not clearly understood and the effect of reducing harvest success at the individual hunt level may or may not result in observable changes in population parameters. Some members of the hunting public have expressed concerns that continual advances in technology ultimately detract from the traditional hunting experience and potentially may lead to a reduction in the support for waterfowl hunting. This is thought to be due to hunters becoming less dedicated to developing skills and investing in the activity to a level that generates support for conservation and potentially increasing the negative view of hunting by those that are currently not opposed to hunting. As technology continues to improve, debates such as the one over spinning blade and spinning wing devices would continue. A new debate over each new technological advance would seem likely and resources would continually be re-directed to assess each new advance.

Disadvantages of This Alternative

As detailed in Appendix I, existing analyses do not clearly establish an effect of harvest on duck population dynamics. To some unmeasured extent, the use of mechanical or electronic duck decoys may influence more hunters to join or remain in hunting, thereby providing support for wetland and waterfowl conservation. Commercial enterprises that develop and market these devices would likely be opposed to their regulation. There is no information regarding other duck attracting devices currently in use and there is no basis to conclude that these devices increase duck harvest. Commercial enterprises exist or may be developed to increase technological improvements for attracting ducks.

Conclusions Regarding Alternative 3

The selection of this alternative would not result in a significant adverse environmental impact. As reported in Appendix I, to date, the Department is unable to scientifically associate observed changes in duck population status, except perhaps for certain cohorts of local mallards, with the use of mechanical or electronic duck decoys. The selection of this alternative would be viewed favorably by those hunters and other members of the public who are opposed to the use of non-traditional methods but would be viewed unfavorably by those hunters who are not opposed to their use. Those commercial enterprises that develop and market these devices would likely be opposed to regulation.

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Appendix A. 2024-25 Regulations Related to Migratory Waterfowl, Coot, Moorhen, (Common Gallinule).

§502. Waterfowl, Migratory; American Coot and Common Moorhen (Common Gallinule).

(a) Definitions.

(1) Dark geese. Dark geese include Canada geese, cackling geese, Aleutian geese and white-fronted geese ("specklebelly").

(2) Large Canada geese. Large Canada geese include western Canada geese ("honker") and lesser Canada geese ("lesser").

(3) Small Canada geese. Small (about the size of a mallard) Canada geese include cackling geese and Aleutian geese. Both are white-cheeked geese nearly identical in appearance to Large Canada geese. Aleutian geese have a thin white neck ring and Cackling geese have dark breasts. Both species have a high-pitched cackle as opposed to the deeper "honking".

(4) White geese. White geese include Ross' geese, snow geese and blue phase of both species.

(b) Waterfowl Hunting Zones.

(1) Northeastern California Zone: In that portion of California lying east and north of a line beginning at the intersection of Interstate 5 with the California-Oregon state line; south along Interstate 5 to its junction with Walters Lane south of the town of Yreka; west along Walters Lane to its junction with Easy Street; south along Easy Street to the junction with Old Highway 99; south along Old Highway 99 to the point of intersection with Interstate 5 north of the town of Weed; south along Interstate 5 to its junction with Highway 89; east and south along Highway 89 to Main Street in Greenville; north and east to its junction with North Valley Road; south to its junction of Diamond Mountain Road; north and east to its junction with North Arm Road; south and west to the junction of North Valley Road; south to the junction with Arlington Road (A22); west to the junction of Highway 89; south and west to the junction of Highway 70; east on Highway 70 to Highway 395; south and east on Highway 395 to the point of intersection with the California-Nevada state line; north along the California-Nevada state line to the junction of the California-Nevada-Oregon state lines west along the California-Oregon state line to the point of origin.

(2) Southern San Joaquin Valley Zone: All of Kings and Tulare counties and that portion of Kern County north of the Southern California Zone.

(3) Southern California Zone: In that portion of southern California (but excluding the Colorado River zone) lying south and east of a line beginning at the mouth of the Santa Maria River at the Pacific Ocean; east along the Santa Maria River to where it crosses Highway 101-166 near the City of Santa Maria; continue north on 101-166; east on Highway 166 to the junction with Highway 99; south on Highway 99 to the junction of Interstate 5; south on Interstate 5 to the crest of the Tehachapi Mountains at Tejon Pass; east and north along the crest of the Tehachapi Mountains to where it intersects Highway 178 at Walker Pass; east on Highway 178 to the junction of Highway 395 at the town of Inyokern; south on Highway 395 to the junction of Highway 58; east on Highway 58 to the junction of Interstate 15; east on Interstate 15 to the junction with Highway 127; north on Highway 127 to the point of intersection with the California-Nevada state line.

(4) Colorado River Zone: In those portions of San Bernardino, Riverside, and Imperial counties lying east of the following lines: Beginning at the intersection of Nevada State Highway 95 with the California-Nevada state line; south along Highway 95 through the junction with Highway 40; continue south on Highway 95 to Vidal Junction; south through the town of Rice to the San Bernardino-Riverside county line on a road known as “Aqueduct Road” also known as Highway 62 in San Bernardino County; southwest on Highway 62 to Desert Center Rice Road; south on Desert Center Rice Road/Highway 177 to the town of Desert Center; continue east 31 miles on Interstate 10 to its intersection with the Wiley Well Road; south on this road to Wiley Well; southeast along the Milpitas Wash Road to the Blythe, Brawley, Davis Lake intersections; south on the Blythe Ogilby Road also known as County Highway 34 to its intersection with Ogilby Road; south on this road to Highway 8 ; east seven miles on Highway 8 to its intersection with the Andrade-Algodones Road/Highway 186; south on this paved road to the intersection of the Mexican boundary line at Los Algodones, Mexico.

(5) Balance of State Zone: That portion of the state not included in Northeastern California, Southern California, Colorado River or the Southern San Joaquin Valley zones.

(6) Special Management Areas

(A) North Coast. All of Del Norte and Humboldt counties.

(B) Humboldt Bay South Spit (West Side). Beginning at the intersection of the north boundary of Table Bluff County Park and the South Jetty Road; north along the South Jetty Road to the South Jetty; west along the South Jetty to the mean low water line of the Pacific Ocean; south along the mean low water line to its intersection with the north boundary of the Table Bluff County Park; east along the north boundary of the Table Bluff County Park to the point of origin.

(C) Klamath Basin. Beginning at the intersection of Highway 161 and Highway 97; east on Highway 161 to Hill Road; south on Hill Road to N Dike Road West Side; east on N Dike Road West Side until the junction of the Lost River; north on N Dike Road West Side until the Volcanic Legacy Scenic Byway; east on Volcanic Legacy Scenic Byway until N Dike Road East Side; south on the N Dike Road East Side; continue east on N Dike Road East Side to Highway 111; south on Highway 111/Great Northern Road to Highway 120/Highway 124; west on Highway 120/Highway 124 to Hill Road; south on Hill Road until Lairds Camp Road; west on Lairds Camp Road until Willow Creek; west and south on Willow Creek to Red Rock Road; west on Red Rock Road until Meiss Lake Road/Old State Highway; north on Meiss Lake Road/Old State Highway to Highway 97; north on Highway 97 to the point of origin.

(D) Sacramento Valley. Beginning at the town of Willows; south on Interstate 5 to the junction with Hahn Road; east on Hahn Road and the Grimes-Arbuckle Road to the town of Grimes; north on Highway 45 to its junction with Highway 162; north on Highway 45-162 to the town of Glenn; west on Highway 162 to the point of beginning.

(E) Morro Bay. Beginning at a point where the high tide line intersects the State Park boundary west of Cuesta by the Sea; northeasterly to a point 200 yards offshore of the high tide line at the end of Mitchell Drive in Baywood Park; northeasterly to a point 200 yards offshore of the high tide line west of the Morro Bay State Park Boundary, adjacent to Baywood Park; north to a point 300 yards south of the high tide line at the end of White Point; north along a line 400 yards offshore of the south boundary of the Morro Bay City limit to a point adjacent to Fairbanks Point; northwesterly to the high tide line on the sand spit; southerly along the high tide line of the sand spit to the south end of Morro Bay; easterly along the Park boundary at the high tide line to the beginning point.

(F) Martis Creek Lake. The waters and shoreline of Martis Creek Lake, Placer and Nevada counties.

(G) Northern Brant. Del Norte, Humboldt and Mendocino counties.

(H) Balance of State Brant. That portion of the state not included in the Northern Brant Special Management Area.

(I) Imperial County. Beginning at Highway 86 and the Navy Test Base Road; south on Highway 86 to the town of Westmoreland; continue through the town of Westmoreland to Route S26; east on Route S26 to Highway 115; north on Highway 115 to Weist Rd.; north on Weist Rd. to Flowing Wells Rd.; northeast on Flowing Wells Rd. to the Coachella Canal; northwest on the Coachella Canal to Drop 18; a straight line from Drop 18 to Frink Rd.; south on Frink Rd. to Highway 111; north on Highway 111 to Niland Marina Rd.; southwest on Niland Marina Rd. to the old Imperial County boat ramp and the water line of the Salton Sea; from the water line of the Salton Sea, a straight line across the Salton Sea to the Salinity Control Research Facility and the Navy Test Base Road; southwest on the Navy Test Base Road to the point of beginning.

(c) Seasons and Bag and Possession Limits for American Coots, and Common Moorhens.

(1) Statewide Provisions.

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
American Coot and Common Moorhen	Concurrent with duck season(s)	Daily bag limit: 25, either all of one species or a mixture of these species. Possession limit: triple the daily bag limit.

(d) Seasons and Bag and Possession Limits for Ducks and Geese by Zone.

(1) Northeastern California Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers)	From the first Saturday in October extending for 103 days. Scaup: from the first Saturday in October extending for a period of 58 days and from the third Thursday in December extending for a period of 28 days.	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 2 scaup (either sex). Possession limit: triple the daily bag limit.

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Geese	Regular Season: Canada Geese: from the first Saturday in October extending for 100 days. White-fronted and white geese from the first Saturday in October extending for a period of 58 days and from January 3 extending for a period of 13 days. Late Season: White-fronted and white geese White-fronted and white geese from February 5 extending for 34 days. During the Late Season, hunting is only permitted on Type C wildlife areas listed in sections 550-552, navigable waters, and private lands with the permission of the landowner under provisions of Section 2016, Fish and Game Code. Hunting is prohibited on Type A and Type B wildlife areas, the Klamath Basin National Wildlife Refuge Complex, the Modoc National Wildlife Refuge, and any waters which are on, encompassed by, bounded over, flow over, flow through, or are adjacent to any Type A and Type B wildlife areas, the Klamath Basin National Wildlife Refuge Complex, or the Modoc National Wildlife Refuge.	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese but not more than 2 Large Canada geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(2) Southern San Joaquin Valley Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers)	From the fourth Saturday in October extending for 98 days. Scaup: from November 7 extending for 86 days.	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 2 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	From the fourth Saturday in October extending for 98 days.	Daily bag limit: 30 Daily bag limit may include: • 20 white geese.

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
		• 10 dark geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(3) Southern California Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers)	From the fourth Saturday in October extending for 98 days. Scaup: from November 7 extending for 86 days.	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 2 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	From the fourth Saturday in October extending for 98 days.	Daily bag limit: 23 Daily bag limit may include: • 20 white geese. • 3 dark geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(4) Colorado River Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers).	From October 23 extending for 101 days. Scaup: from November 7 extending for 86 days.	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females or Mexican ducks. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 2 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	From October 23 extending for 101 days.	Daily bag limit: 25 Daily bag limit may include:

		• 20 white geese. • 5 dark geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(5) Balance of State Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers).	From the fourth Saturday in October extending for 98 days. Scaup: from November 7 extending for 86 days.	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 2 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	Early Season: Large Canada geese only from the Saturday closest to October 1 for a period of 3 days EXCEPT in the North Coast Special Management Area where Large Canada geese are closed during the early season. Regular Season: Dark and white geese from the fourth Saturday in October extending for 98 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season will close after December 21. Late Season: Canada geese from the second Saturday in February extending for 2 days. White-fronted and white geese from the second Saturday in February extending for a period of 5 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season is closed. During the Late Season, hunting is not permitted on wildlife areas listed in sections 550-552 EXCEPT on Type C	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese EXCEPT in the Sacramento Valley Special Management Area where only 3 may be white-fronted geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
	wildlife areas in the North Central and Central regions.	

(6) Special Management Areas (see descriptions in 502(b)(6))

	(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
1. North Coast	All Canada Geese	From October 5 extending for a period of 78 days (Regular Season) and from February 12 extending for a period of 27 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the landowner under provisions Section 2016, Fish and Game Code.	Daily bag limit: 10 Canada Geese of which only 1 may be a Large Canada goose (see definitions: 502(a)), EXCEPT during the Late Season, the bag limit on Large Canada geese is zero. Possession limit: triple the daily bag limit.
2. Humboldt Bay South Spit (West Side)	All Species	Closed during brant season	
3. Klamath Basin	Geese	Canada Geese from the first Saturday in October extending for 100 days. White-fronted and white geese from the first Saturday in October extending for 105 days.	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese but not more than 2 Large Canada geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.
4. Sacramento Valley	White-Fronted Geese	Open concurrently with the goose season through December 21, and during Youth Waterfowl Hunting Days.	Daily bag limit: 3 white-fronted geese. Possession limit: triple the daily bag limit.

	(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
5. Morro Bay	All species	Open in designated area only from the opening day of brant season through the remainder of waterfowl season.	
6. Martis Creek Lake	All species	Closed until November 16.	
7. Northern Brant	Black Brant	From November 18 extending for 27 days.	Daily bag limit: 2 Possession limit: triple the daily bag limit.
8. Balance of State Brant	Black Brant	From November 19 extending for 27 days.	Daily bag limit: 2 Possession limit: triple the daily bag limit.
9. Imperial County	White Geese	From November 4 extending-for a period of 89 days (Regular Season) and-February 3-9, 2025 and February 12-20, 2025 (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the landowner under provisions of Section 2016, Fish and Game Code.	Daily bag limit: 20 Possession limit: triple the daily bag limit.

(e) Youth Waterfowl Hunting Days Regulations (NOTE: To participate in these Youth Waterfowl Hunts, youth must be accompanied by a non-hunting adult 18 years of age or older. Federal regulations require that hunters must be 17 years of age or younger.

(1) Statewide Provisions.

(A) Species	*(B) Season*	*(C) Daily Bag Limit*
Ducks (including Mergansers), American Coot, Common Moorhen, Black Brant, Geese	1. Northeastern California Zone: The Saturday fourteen days before the opening of waterfowl season extending for 2 days. 2. Southern San Joaquin Valley Zone: The first Saturday in February extending for 2 days. 3. Southern California Zone: The first Saturday in February extending for 2 days.	Same as regular season.

	4. Colorado River Zone: The second Saturday in February extending for 2 days. 5. Balance of State Zone: The first Saturday in February extending for 2 days.	

(f) Veterans and Active Military Personnel Waterfowl Hunting Days Regulations. NOTE: Veterans (as defined in Section 101 of Title 38, United States Code) and members of the Armed Forces on active duty, including members of the National Guard and Reserves on active duty (other than training), may participate. Persons participating in this special hunt must possess and present upon demand verification of eligibility to participate in this hunt. Verification includes: Veteran's ID Card, or Military ID Card for active duty, or a State-issued driver's license or Identification Card with Veteran Designation.

(1) Statewide Provisions.

(A) Species	*(B) Season*	*(C) Daily Bag Limit*
Ducks (including Mergansers), Geese, American Coot, Common Moorhen	1. Northeastern California Zone: The Saturday following the closing of the regular duck season extending for 2 days. Goose hunting in this zone is not permitted during these days. 2. Southern San Joaquin Valley Zone: The second Saturday in February extending for 2 days. 3. Southern California Zone: The second Saturday in February extending for 2 days. 4. Balance of State Zone: The second Saturday in February extending for 2 days.	Same as regular season.

(g) Falconry Take of Ducks (including Mergansers), Geese, American Coots, and Common Moorhens.

(1) Statewide Provisions.

(A) Species	*(B) Season*	*(C) Daily Bag and Possession Limits*
Ducks (including Mergansers), Geese, American Coot and Common Moorhen	1. Northeastern California Zone. Open concurrently with duck season through January 15, 2025. 2. Balance of State Zone. Open concurrently with duck season, February 1-2, 2025 and February 15-19, 2025 EXCEPT in the North Coast Special Management Area where the	Daily bag limit: 3 Daily bag limit makeup: • Either all of 1 species or a mixture of species allowed for take. Possession limit: 9

(A) Species	(B) Season	(C) Daily Bag and Possession Limits
	falconry season for geese runs concurrently with the season for Canada geese (see 502(d)(6)). 3. Southern San Joaquin Valley Zone. Open concurrently with duck season, February 1-2, 2025, and February 15-19, 2025. Goose hunting in this zone by means of falconry is not permitted. 4. Southern California Zone. Open concurrently with duck season, February 1-2, 2025 and February 15-19, 2025 EXCEPT in the Imperial County Special Management Area where the falconry season for geese runs concurrently with the season for white geese. 5. Colorado River Zone. Open concurrently with duck season and February 1-4, 2025. Goose hunting in this zone by means of falconry is not permitted. Federal regulations require that California's hunting regulations conform to those of Arizona, where goose hunting by means of falconry is not permitted.	

Appendix B. Possible Effects of Climate Change Impacts on Waterfowl

Over the long-term, climate change models suggest temperature increases in many areas, both increases and decreases in precipitation, precipitation timing, sea level rise, changes in the timing and length of the four seasons, declining snow pack and increasing frequency and intensity of severe weather events. Many uncertainties make it difficult to predict the precise impacts that climate change will have on wetlands and waterfowl. The effects of climate change on waterfowl populations, including their size and distribution, will probably be species specific and variable, with some effects considered negative and others considered positive (Anderson and Sorenson 2001). For example, a longer and warmer ice-free season in the Arctic would be expected to result in higher overall reproductive success for Arctic nesting geese (Batt 1998).

Breeding Season

Increasing spring temperatures have led to earlier arrival of waterfowl on northern breeding areas (Murphy-Klassen et al. 2005), yet nest survival has not decreased at this point of time (Drever and Clark 2007). In fact, earlier nest initiations are often more successful (Emery et al. 2005, Sedinger et al. 2008). However, future changes in wetland distribution and type (Johnson et al. 2005) on northern breeding grounds may impact settling patterns (Johnson and Grier 1988), and potentially recruitment for certain species through differences in breeding probability (Krapu et al. 1983), nest survival, and duckling survival. In California, areas with wetland brood habitat may become more limited if precipitation decreases with increasing temperatures, as predicted for the prairie pothole region of the United States and Canada (Sorenson et al 1998). Production of waterfowl that rely on agricultural habitats may be similarly affected if water availability (amounts and or timing) change.

Non-breeding Season

The Central Valley of California has one of the world's largest concentrations of over-wintering waterfowl (Heitmeyer et al. 1989). The primary expected response of waterfowl to climate change is redistribution as birds seek to maintain energy balance. Increased fall and winter temperatures in northern regions would make it unnecessary for waterfowl to migrate as far south and the wintering populations of waterfowl in California may be reduced. Shifting patterns of precipitation and temperatures may cause decreased availability of water for managed wetlands and agricultural production in the Central Valley. Changes in water availability and timing (Miller et al. 2003) would likely have the greatest impact on rice agriculture, an important component of wintering waterfowl habitat in California. Decreasing habitats may cause a decline in body condition which may impact recruitment and survival in waterfowl populations. Ultimately, this will cause decreased recruitment as birds shift out of optimal nesting habitats (e. g. Ward et al. 2005), and a decrease in over-wintering populations.

Summary of Findings

There is substantial evidence that climate change will cause changes in habitats and other factors that affect waterfowl populations over the long term. Waterfowl populations are assessed in many ways on an annual basis (See pages 38–40 of the 2006 Final Environmental Document for Migratory Game Bird Hunting, SCH #2006042115, incorporated by reference, available at 1010 Riverside Parkway, West Sacramento 95605). In summary, the condition of breeding habitats is assessed annually during the breeding population surveys conducted by the Service with assistance from some states and the Canadian Wildlife Service (CWS) in the spring and summer. The specific methodology of these surveys is provided in Chapter 3, pages 55–57, 2006 Final Environmental Document for Migratory Game Bird Hunting, SCH #2006042115, incorporated by reference, available at 1010 Riverside Parkway, West Sacramento 95605).

Because the effect of regulated harvest is minimal (pages 57–67 of 2006 Final Environmental Document for Migratory Game Bird Hunting, SCH #2006042115, incorporated by reference, available at 1010 Riverside Parkway, West Sacramento 95605) implementation of the proposed project in the current year is not expected to result in significant negative effects to waterfowl populations. The effect is minimal because the weight of historic scientific evidence leans toward the compensatory mortality hypothesis, though there are enough ambiguities to make complete reliance on this hypothesis as a management strategy an unwise approach (USDI 1988a:96). Accordingly, restrictive regulations have been established when populations reached low levels. For example, duck seasons were reduced from 93 days to 59 days, and bag limits were reduced from seven birds per day to four birds per day during the late 1980s in response to declines in duck populations caused by drought (Page 66, 2006 Final Environmental Document for Migratory Game Bird Hunting, SCH #2006042115, incorporated by reference, available at 1010 Riverside Parkway, West Sacramento 95605).

Appendix C. Western Mallard and California Breeding Population Status

Western Mallard Population Status

Year	Alaska Index	Alaska SE	British Columbia Index	British Columbia SE	Washington Index	Washington SE	Oregon Index	Oregon SE	California Index	California SE	Total Index	Total SE
1977	459,778	55,724										
1978	318,842	36,342										
1979	275,779	36,047										
1980	399,102	39,399										
1981	476,251	48,716										
1982	254,727	29,708										
1983	321,687	28,506										
1984	504,182	52,275										
1985	219,055	24,633										
1986	233,539	26,196										
1987	185,802	19,422										
1988	356,711	36,604										
1989	411,507	34,261										
1990	366,933	37,017										
1991	385,319	36,279										
1992	345,708	38,708							375,844	59,873		
1993	282,983	29,533							359,008	50,253		
1994	350,875	37,142					116,430	13,280	311,692	40,362		
1995	524,200	67,975					77,515	7,265	368,526	42,126		
1996	522,006	43,552					102,168	8,886	536,709	79,656		
1997	584,247	51,997					121,155	12,503	511,344	103,580		
1998	836,216	67,284					124,942	10,548	353,901	47,746		
1999	713,054	69,568					125,631	9,255	560,063	106,201		
2000	770,333	52,159					110,854	9,055	347,559	52,463		
2001	718,286	54,127							302,204	44,361		
2002	667,339	50,687					104,481	9,030	265,295	31,385		

Western Mallard Population Status, continued.

Year	Alaska Index	Alaska SE	British Columbia Index	British Columbia SE	Washington Index	Washington SE	Oregon Index	Oregon SE	California Index	California SE	Total Index	Total SE
2003	843,497	66,823					89,032	8,047	337,056	49,485		
2004	811,135	63,878					82,461	6,900	262,424	34,483		
2005	703,140	54,748					74,115	6,379	317,869	46,930		
2006	515,821	46,935	90,404	8,628			81,108	6,775	399,436	57,229		
2007	581,493	55,053	98,840	7,900			92,461	7,425	388,324	54,106		
2008	532,414	46,797	81,124	5,914			75,363	6,725	297,129	47,349		
2009	502,970	44,896	72,505	5,287			72,616	5,867	301,960	63,641		
2010	605,556	53,070	81,131	6,121	92,911	11,680	66,762	5,657	367,891	55,412	1,214,251	78,056
2011	415,825	38,767	69,726	6,872	71,375	9,456	61,556	4,637	314,715	44,975	933,197	60,694
2012	505,583	51,067	75,561	8,401	89,468	8,203	88,803	7,505	387,061	54,532	1,146,476	75,998
2013	338,379	38,215	82,944	7,613	74,406	8,917	84,336	6,431	298,636	52,290	878,701	66,132
2014	500,879	57,351	82,633	6,805	86,344	10,250	85,259	8,572	238,666	54,606	993,781	80,597
2015	470,915	50,867	81,377	6,873	86,417	9,041	87,361	8,611	173,865	28,175	899,935	59,870
2016	584,200	65,389	73,991	6,216	59,864	4,681	87,346	8,038	263,774	35,602	1,069,175	75,289
2017	538,451	51,882	70,903	6,944	103,384	9,770	71,720	6,138	198,392	31,863	982,850	62,356
2018	450,750	45,061	79,309	5,697	124,935	10,013	97,148	11,407	272,859	42,037	1,025,001	63,722
2019	361,060	35,347	74,535	7,495	126,243	12,114	83,867	6,992	239,831	32,223	885,535	50,393
2020												
2021	641,300	59,100					76,259	8,574				
2022	614,400	69,800	80,883	5,872	87,374	7,408	79,388	8,645	179,393	29,275	1,041,500	76,800
2023	380,917	42,110	70,757	6,058	102,011	10,547	68,587	7,026	202,108	28,506	824,380	101,519
2024	506,600	57,500	96,676	7,567	86,360	9,553	71,047	6,915	177,828	21,576		

Averages	Alaska Index	Alaska SE	Brit. Col. Index	Brit, Col. SE	Washington Index	Washington SE	Oregon Index	Oregon SE	California Index	California SE	Total Index	Total SE
LTA*	487,016	46,777	80,194	6,839	91,622	9,356	88,268	8,038	319,721	49,106	987,176	66,570
3-yr	500,639	56,470	82,772	6,499	91,915	9,169	73,007	7,529	186,443	26,452	934,500	64,100

% Change from	Alaska Index	Alaska SE	Brit. Col. Index	Brit. Col. SE	Washington Index	Washington SE	Oregon Index	Oregon SE	California Index	California SE	Total Index	Total SE
LTA*	0.04	0.23	0.21	0.11	-0.06	0.02	-0.20	-0.14	-0.44	-0.56	-0.05	-0.05
3-yr	0.01	0.02	0.17	0.16	-0.06	0.04	-0.03	-0.08	-0.05	-0.18	0.00	-0.02
2023	0.33	0.37	0.37	0.25	-0.15	-0.09	0.04	-0.02	-0.12	-0.24	0.14	0.20

LTA= Long-term average, 1977-2024

California Waterfowl Breeding Population Estimates with Standard Errors

Species	2024	SE	2023	SE	LTA[1]	% Change 2023	% Change LTA
Mallard	177,828	21,576	202,108	28,506	319,518	-12	-44
Gadwall	54,011	11,946	88,251	21,369	85,176	-39	-37
American Wigeon	1,573	825	5,097	1,576	4,418	-69	-64
Green-winged Teal	2,493	1,811	11,845	5,274	,341	-79	-43
Cinnamon Teal	46,097	20,415	33,477	8,229	42,251	38	9
Northern Shoveler	47,015	16,994	107,490	30,790	34,933	-56	35
Northern Pintail	18,349	9,765	6,056	2,080	7,329	203	150
Wood Duck	10,577	5,344	4,032	1,790	8,160	162	30
Redhead	7,981	5,137	9,852	5,704	4,179	-19	91
Canvasback	0	0	4,145	1,927	1,111	-100	-100
Lesser Scaup	0	0	489	469	4,391	-100	-100
Ring-necked Duck	0	0	239	245	945	-100	-100
Goldeneye	0	0	338	315	282	-100	-100
Bufflehead	2,093	790	2,024	880	3,291	3	-36
Ruddy Duck	5,847	4,661	19,996	17,529	15,059	-71	-61
Common Merganser	0	0	0	0	486	-100%	-100%
TOTAL DUCKS	**373,864**	**99,264**	**495,438**	**38,606**	**585,870**	**-25%**	**-30%**
Canada Geese[2]	34,242	10,048	60,353	14,900	44,117	-43	-22%
Goslings[2,3]	5,461	2,823	2,119	1,305	3103	158	76%
American Coot	262,447	195,193	209,078	78,337	244,336	26	7%
Sandhill Crane[2,3]	4,481	2,985	2,691	3,723	2,082	67	115%
Mute Swan[3,4]	6,912	3,838	4,045	1,205	1,147	71%	503%

[1]Long-term average (LTA); 1992 – 2023 for ducks and coots.
[2]Northeastern stratum estimates only, LTA for Canada geese = 1993 – 2023, LTA for goslings and Sandhill cranes = 2003 – 2023
[3]VCF = 1, due to insufficient data.
[4]LTA = 2003 – 2023.

Appendix D. Mallard, Pintail, Canvasback and Scaup Breeding Population Estimates from the Traditional Survey Area.

Year	Mallard	Pintail	Canvasback	Scaup
1955	8,777,294	9,775,075	589,257	5,620,130
1956	10,452,690	10,372,801	698,509	5,994,080
1957	9,296,888	6,606,886	626,072	5,766,942
1958	11,234,244	6,037,921	746,830	5,350,372
1959	9,024,288	5,872,740	488,684	7,037,610
1960	7,371,652	5,722,160	605,698	4,868,569
1961	7,329,954	4,218,159	435,251	5,380,045
1962	5,535,905	3,623,524	360,238	5,286,098
1963	6,748,828	3,846,015	506,235	5,438,402
1964	6,063,865	3,291,227	643,636	5,131,798
1965	5,131,702	3,591,918	522,120	4,639,964
1966	6,731,878	4,811,934	663,114	4,439,240
1967	7,509,548	5,277,693	502,576	4,927,671
1968	7,089,238	3,489,395	563,691	4,412,682
1969	7,531,615	5,903,888	503,530	5,139,780
1970	9,985,873	6,391,987	580,100	5,662,477
1971	9,416,373	5,847,204	450,674	5,143,262
1972	9,265,550	6,978,954	425,912	7,996,967
1973	8,079,202	4,356,220	620,451	6,257,416
1974	6,880,153	6,598,182	512,842	5,780,464
1975	7,726,878	5,900,370	595,098	6,460,024
1976	7,933,588	5,475,644	614,389	5,818,746
1977	7,397,061	3,926,093	664,042	6,260,238
1978	7,424,968	5,108,179	373,174	5,984,411
1979	7,883,440	5,376,133	582,004	7,657,943
1980	7,706,483	4,508,077	734,570	6,381,655
1981	6,409,701	3,479,479	620,843	5,990,883
1982	6,408,475	3,708,758	513,265	5,531,964
1983	6,456,007	3,510,642	526,612	7,173,798
1984	5,415,271	2,964,801	530,129	7,024,320
1985	4,960,868	2,515,493	375,929	5,097,956
1986	6,124,236	2,739,747	438,350	5,235,304
1987	5,789,776	2,628,344	450,109	4,862,729
1988	6,369,341	2,005,522	435,048	4,671,351
1989	5,645,440	2,111,902	477,439	4,342,050
1990	5,452,385	2,256,630	539,318	4,293,141
1991	5,444,580	1,803,385	491,151	5,254,899
1992	5,976,077	2,098,139	481,529	4,639,232
1993	5,708,293	2,053,418	472,055	4,080,144

Mallard, Pintail, Canvasback and Scaup Breeding Population Estimates from the Traditional Survey Area, continued.

Year	Mallard	Pintail	Canvasback	Scaup
1994	6,980,066	2,972,266	525,604	4,529,044
1995	8,269,415	2,757,866	770,593	4,446,443
1996	7,941,315	2,735,862	848,487	4,217,405
1997	9,939,695	3,557,991	688,754	4,112,349
1998	9,640,364	2,520,649	685,862	3,471,916
1999	10,805,682	3,057,888	716,039	4,411,723
2000	9,470,212	2,907,559	706,754	4,026,322
2001	7,903,955	3,295,994	579,826	3,694,010
2002	7,503,707	1,789,710	486,597	3,524,142
2003	7,949,743	2,558,229	557,575	3,734,444
2004	7,425,314	2,184,602	617,227	3,807,191
2005	6,755,268	2,560,530	520,574	3,386,893
2006	7,276,538	3,386,425	691,013	3,246,663
2007	8,307,296	3,335,302	864,924	3,452,233
2008	7,723,809	2,612,841	488,667	3,738,349
2009	8,512,378	3,224,957	662,135	4,172,097
2010	8,430,138	3,508,558	585,164	4,244,429
2011	9,182,591	4,428,650	691,560	4,319,289
2012	10,601,516	3,473,083	759,935	5,238,630
2013	10,371,890	3,334,993	786,978	4,165,678
2014	10,899,822	3,220,296	685,262	4,611,054
2015	11,643,321	3,043,012	757,281	4,395,305
2016	11,792,529	2,618,468	736,472	4,991,714
2017	10,488,461	2,889,231	732,531	4,371,725
2018	9,255,153	2,365,322	686,084	3,989,325
2019	9,423,411	2,268,466	651,925	3,590,799
2020	No Survey			
2021	No Survey			
2022	7,434,293	1,783,613	586,643	3,590,799
2023	6,125,722	2,218,505	618,898	3,517,135
2024	6,609,303	1,974,976	566,319	4,069,075

Appendix E. Effects of Adding Up to Five Additional Days to the General Duck and Goose Season by Closing on January 31.

Introduction

Traditionally, federal frameworks mandated that general duck and goose seasons closed on the last Sunday in January; weekend open and close dates were most common to ensure hunting opportunities existed for those who work Monday through Friday and hunt on public hunt areas. Federal frameworks were changed prior to the 2019-20 season to allow a closing date of no later than January 31 (regardless of the day it occurred).

Members of the public requested a later closing date while still opening on a Saturday in late October. Depending on the year, an additional 5 days would be used to achieve the January 31 closing option. In most California waterfowl hunting zones, only 100-day seasons were used (Southern Joaquin Valley, Southern California, and Balance of State zones), even though 107 days are allowed for ducks while in the AHM liberal regulatory package. Most goose populations that winter in California are at or above population goals allowing season lengths of 107 days (based on harvest strategies described in management plans) for most populations.

Closing on January 31 while maintaining a Saturday opener for the subsequent four seasons (through 2024-25) requires an annual adjustment to season length for both general and falconry seasons. Depending on the season, between 0 and 5 additional weekdays would be added to the general duck and goose seasons.

Department Analysis on Using Five Additional Days

The Department analyzed harvest data to estimate the potential increase in duck harvest. The analyses focused on dabbling duck harvest because the sample size and the amount of data available. Goose harvest was not analyzed because most goose populations are at or above population objectives, and bag limits have been liberalized commensurate with population status.

The Department conducted a regression analysis of harvest (dabbling ducks and mallards) and season length to estimate the potential increase in duck harvest. Harvest data was obtained from the Cooperative Waterfowl Parts Collection Survey (PCS) from 2004 to 2017. The Northeastern California Zone harvest data was excluded from the query because of differences in both weather and season timing. Harvest data was arranged by date and the cumulative total harvest by day for each season was calculated. Harvest data was then aggregated to derive a mean and variance for each day. A regression equation was generated to predict cumulative harvest by additional hunt day for both total dabbling ducks and mallards.

Total dabbling ducks followed a curvilinear trend (R^2 = 0.99; Figure E-1). A 5-day increase in season length is predicted to increase total dabbling duck harvest to 1,262,690 (95% CI 1,139,790 – 1,385,696), an additional 72,193 ducks representing a 5.7% increase.

Total mallard harvest and season length was best fit by a linear relationship with an R^2 of 0.99 (Figure E-2). A 5-day increase in season length is predicted to increase the average daily mallard harvest by 2,083 (95% CI 1,665 – 2,502), like the previous analysis presented on page 68 in the 2006 Final Environmental Document (incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605). The previous analysis estimated an increase of 2,500 per day (95% CI = 2,200 – 2,800). The slight reduction in the new analysis is a result of the overall decline in mallard harvest over time. A 5-day increase in season length would increase total mallard harvest to 218,734 (95% CI 174,810 – 262,657), an additional 11,916 ducks. This represents a 5.4% increase.

Analyses for predicting the increase in goose harvest were not conducted because most wintering goose populations in California are at or above their population goals (Appendix F). Bag limits have been raised considerably during the past 10 years to provide: hunting opportunities commensurate with population status, a tool to minimize depredation on private lands and to reduce population size. One-hundred-day goose seasons were maintained in the Southern San Joaquin Valley and the Southern California zones to mimic duck seasons (minimize regulation complexity) because goose hunting opportunity in those zones is negligible, especially that late in the season. Increasing the goose season length in the Southern San Joaquin Valley and Southern California zones will not affect those goose populations who have season and or bag limit restrictions (Tule greater white-fronted geese in the Sacramento Valley Special Management Area and Large Canada geese in Northeastern California).

Figure E–1. California Mean Season Cumulative Dabbling Duck Harvest, 2004–2017

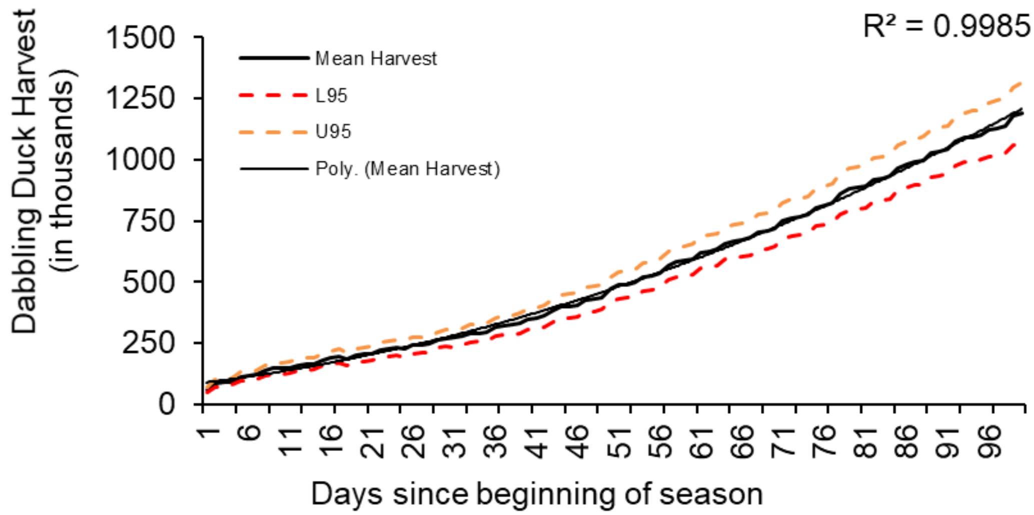
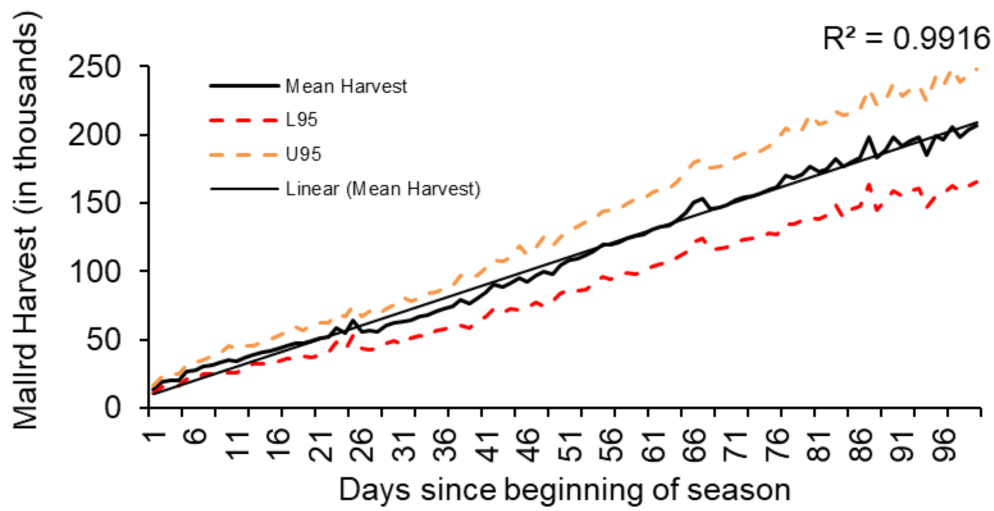


Figure E–2. California Mean Season Cumulative Mallard Harvest, 2004–2017



Discussion

As described in Chapter 3 of the 2006 Final Environmental Document (incorporated by reference, State Clearinghouse Number 2006042115, available at 1010 Riverside Parkway, West Sacramento 95605), all measures of the status and harvest of waterfowl have unmeasured degrees of uncertainty. These uncertainties are inherent due to annual changes in the system (weather, agricultural practices, predation), limitations in monitoring programs (sampling error), and the variable effort and success of hunters. An estimated harvest increase of 5% by selecting 107-day seasons will not likely negatively impact duck populations. Most hunters in California, especially those in drier and more southerly portions of the State, believe that hunting opportunity is best late in the hunting season and the later closing date will provide better hunting. Many hunters believe that better hunting serves as an incentive to own and manage wetland habitats for ducks and other wildlife.

Closing on January 31 rather than on the last Sunday in January, has not been fully vetted by the hunting public or local county commissions and communities. Traditionally, most waterfowl opening and closing days occur on the weekend to allow hunting opportunities for hunters who work Monday through Friday and hunt on public hunt areas. In addition, closing January 31 for the 2019-20 season eliminated the falconry-only season; the extended falconry season would have to be eliminated because the season length would exceed what is allowed under the frameworks. Falconers prefer a small number of days dedicated to falconry-only to avoid conflicts with the general (gun) seasons. Lastly, closing January 31 while maintaining the traditional Saturday opener for the subsequent seasons requires an annual adjustment to season length for both general and falconry seasons.

For example:

Season	**Traditional Saturday Opening Day**	**Closing Day**	**General Season Length**	**Falconry-only Season Length**
2019-20	October 19	Friday, January 31	105-days	Zero
2020-21	October 24	Sunday, January 31	100-days	5-days*
2021-22	October 23	Monday, January 31	101-days	4-days
2022-23	October 22	Tuesday, January 31	102-days	3-days
2023-24	October 21	Wednesday, January 31	103-days	2-days
2024-25	October 26	Friday, January 31	98-days	5-days
2025-26	October 25	Saturday, January 31	99-days	4-days
2026-27	October 24	Sunday, January 31	100-days	3-days

* Veteran and Active Military Personnel Waterfowl Hunt Days implemented, reducing the total days available for the general season

Making annual adjustments to season length and closing on a fixed date rather than the last Sunday in January may not be preferred by hunters and considered confusing.

Conclusion

Closing January 31 and using up to five additional days would not result in a significant adverse environmental impact and would be viewed favorably by those hunters who prefer to use the maximum allowable days. However, selecting this alternative eliminates the 5-day falconry-only season (as in 2019-20) in some years. This alternative would be viewed unfavorably by those hunters who prefer an established set of days and closing on the last Sunday of January.

Appendix F. Pacific Flyway Goose Status

Aleutian Canada Goose abundance indices from direct count and mark-resight methods, 1975–current.

Year	Estimate	SE	L95% C.I.	U95% C.I.	Method
1975	790				Direct count
1976	900				Direct count
1977	1,280				Direct count
1978	1,500				Direct count
1979	1,590				Direct count
1980	1,740				Direct count
1981	2,000				Direct count
1982	2,700				Direct count
1983	3,500				Direct count
1984	3,800				Direct count
1985	4,200				Direct count
1986	4,300				Direct count
1987	5,000				Direct count
1988	5,400				Direct count
1989	5,800				Direct count
1990	6,300				Direct count
1991	7,000				Direct count
1992	7,680				Direct count
1993	11,680				Direct count
1994	15,700				Direct count
1995	19,150				Direct count
1996[a]	21,420				Direct count
1997[a]	22,800				Direct count
1998[a]	27,600				Direct count
1999[a]	35,550	3,122	29,431	41,669	Mark-resight
2000[a]	34,278	763	18,898	21,887	Mark-resight
2001[a]	32,440	1,070	30,343	34,536	Mark-resight
2002	65,211	12,822	39,963	90,459	Mark-resight
2003	72,855	2,761	67,618	78,441	Mark-resight
2004	110,731	4,375	102,517	119,666	Mark-resight
2005	87,152	4,841	78,353	97,329	Mark-resight
2006	100,259	4,524	88,358	106,091	Mark-resight
2007	107,615	9,797	98,144	136,550	Mark-resight
2008	112,629	7,438	101,539	130,698	Mark-resight
2009	84,488	13,347	55,605	107,926	Mark-resight
2010	106,865	8,986	89,078	124,305	Mark-resight
2011	101,628	8,405	88,797	121,745	Mark-resight
2012	132,745	10,925	114,501	157,328	Mark-resight
2013	162,458	15,857	135,213	197,371	Mark-resight
2014	150,446	13,087	124,318	175,618	Mark-resight

Aleutian Canada Goose abundance indices from direct count and mark-resight methods, 1975–current, continued.

Year	Estimate	SE	L95% C.I.	U95% C.I.	Method
2015	209,549	18,271	173,738	245,360	Mark-resight
2016	154,369	13,139	128,616	180,122	Mark-resight
2017	164,019	17,990	128,759	199,279	Mark-resight
2018	169,742	14,577	141,171	198,313	Mark-resight
2019	192,837	25,590	142,681	242,993	Mark-resight
2020	122,011	12,053	98,387	145,634	Mark-resight
2021	173,386	16,087	141,855	204,916	Mark-resight
2022	231,709	28,499	175,850	287,567	Mark-resight
2023	192,561	36,797	120,440	264,683	Mark-resight
2024	193,655	37,944	119,284	268,025	Mark-resight

Averages:	Estimate	SE	L95% C.I.	U95% C.I.
Long-term	65,032			
3-yr	205,975	34,670	138.022	273,927

% Change from:	Estimate	SE	L95% C.I.	U95% C.I.
Long-term	223	259.9	50.6	110.7
3-yr	5.5	33.8	-4.2	11.3
2023	-3.3	26.6	-13.2	2.6

Pacific Brant population indices from the Mid-winter Waterfowl Survey, 1936-current.

Year	CA	Other PF	Mexico	Total	3-yr Avg	Izembek
1936*	19,910	11,287		31,197		
1937*	13,460	19,385		32,845		
1938*	38,200	35,035		73,235		
1939*	16,890	35,097		51,987		
1940*	35,050	40,870		75,920		
1941*	31,785	29,100		60,885		
1942*	28,983	60,800		89,783		
1943*	18,000	37,575		55,575		
1944*	20,250	41,200		61,450		
1945*	30,100	35,650		65,750		
1946*	60,452	25,517		85,969		
1947*	39,640	28,450		68,090		
1948*	32,750	23,510		56,260		
1949*	66,515	21,453		87,968		
1950*	57,792	19,174		76,966		
1951**	48,131	23,749	93,200	165,080		
1952**	43,840	19,778	102,945	166,563		
1953**	37,557	28,982	87,905	154,444		
1954**	28,750	16,936	86,316	132,002		
1955**	34,070	23,601	76,679	134,350		
1956**	38,510	17,987	52,743	109,240		
1957**	35,848	22,194	73,380	131,422		
1958**	26,560	27,997	71,309	125,866		
1959**	10,750	11,936	72,705	95,391		
1960	3,771	18,266	114,202	136,239		
1961	6,853	18,005	142,980	167,838		
1962	23,510	28,081	118,645	170,236		
1963	2,388	23,039	114,815	140,242		
1964	8,353	36,169	140,760	185,282		
1965	3,372	21,263	142,265	166,900		
1966	3,284	22,973	135,106	161,363		
1967	3,824	22,758	153,070	179,652		
1968	1,729	16,611	136,000	154,340		
1969	166	10,445	132,475	143,086		
1970	207	9,879	131,600	141,686		
1971	130	12,289	136,800	149,219		
1972	0	5,375	119,400	124,775		
1973	950	8,455	115,600	125,005		
1974	470	6,881	123,300	130,651		

Pacific Brant population indices from the Mid-winter Waterfowl Survey, 1936-current, continued.

Year	CA	Other PF	Mexico	Total	3-yr Avg	Izembek
1975	480	7,670	115,280	123,430	126,362	
1976	680	9,309	112,056	122,045	125,375	
1977	0	16,211	130,756	146,967	130,814	
1978	560	19,210	143,117	162,887	143,966	
1979	10	9,333	120,070	129,413	146,422	
1980	135	8,680	137,550	146,365	146,222	
1981	540	15,168	181,760	197,468	157,749	
1982	485	7,157	113,402	121,044	154,959	
1983	565	3,831	104,918	109,314	142,609	
1984	700	9,638	124,703	135,041	121,800	
1985	800	12,717	131,568	145,085	129,813	
1986	706	18,796	114,725	134,227	138,118	
1987	736	23,259	86,913	110,908	130,073	
1988	947	27,378	116,696	145,021	130,052	
1989	1,033	26,811	107,721	135,565	130,498	
1990	992	20,864	129,865	151,721	144,102	
1991	1,340	22,816	108,555	132,711	139,999	
1992	2,424	22,228	93,185	117,837	134,090	
1993	9,415	22,861	92,724	125,000	125,183	
1994	2,299	26,768	100,265	129,332	124,056	
1995	3,987	32,683	96,815	133,485	129,272	
1996	2,008	18,497	107,485	127,990	130,269	
1997	3,598	20,971	130,738	155,307	138,927	
1998	6,091	20,642	112,105	138,838	140,712	
1999	4,296	27,236	100,760	132,292	142,146	
2000	3,389	23,740	108,440	135,569	135,566	
2001	4,197	29,936	91,860	125,993	131,285	
2002	4,092	29,089	105,050	138,231	133,264	
2003	3,124	20,792	82,226	106,142	123,455	
2004	6,372	29,945	84,955	121,272	121,882	
2005	5,224	27,956	74,028	107,208	111,541	
2006	5,069	34,150	101,737	140,956	123,145	
2007	7,387	44,025	79,182	130,594	126,253	
2008	4,827	48,831	103,299	156,957	142,836	
2009*	6,392	54,122		60,514	142,836	
2010***	13,553	54,841	95,077	163,471	150,341	
2011***	15,610	66,808	80,050	162,468	160,965	
2012	2,227	63,670	111,444	177,341	167,760	

Pacific Brant population indices from the Mid-winter Waterfowl Survey, 1936-current, continued.

Year	CA	Other PF	Mexico	Total	3-yr Avg	Izembek
2013	7,448	60,679	95,173	163,300	167,703	
2014	7,916	68,240	97,159	173,315	171,319	
2015	4,906	63,144	68,432	136,482	157,699	
2016	5,105	62,530	72,390	140,025	149,941	
2017	8,765	64,859	82,096	155,720	144,076	377,029
2018	2,466	60,123	68,114	132,450	142,732	227,450
2019	5,353	55,927	99,879	161,159	149,776	272,468
2020	5,788	60,151	76,945	142,884	145,388	
2021	4,646	68,480	77,461	150,587	151,543	
2022	5,167	80,848	72,665	158,680	150,717	199,946
2023	6,023	63,080	50,785	119,888	143,052	245,172
2024	3,246	54,773	49,753	107,772	128,780	

Averages:	CA	Other PF	Mexico	Total	3-yr Avg	Izembek
LTA	12,076	29,596	105,089	141,679	128,780	269,223
1936-53	35,517	29,812	94,683	81,109		
1954-63	21,101	20,804	92,377	134,283	158,772	
1964-73	2,202	16,622	134,308	153,131	155,662	
1974-83	393	10,345	128,221	138,958	140,129	
1984-93	1,909	20,737	110,666	133,312	132,373	
1994-03	3,708	25,035	103,574	132,318	132,895	
2004-13	7,411	48,503	91,661	138,408	141,526	
2014-23	5,614	64,738	76,593	147,119	150,635	

Flyway Objective: 322,000

*No survey in Mexico
**Baja Mexico only
***No survey in Oregon

Pacific White-fronted Goose abundance indices from breeding pair surveys in Alaska (Yukon-Kuskokwim Delta Coastal Zone Survey and Alaska-Yukon Waterfowl Breeding Population and Habitat Survey) and fall counts in California, 1979–current.

Year	YK Delta	YK Interior	Bristol Bay	Total	Projected Fall Population	Fall Survey[a]
1979						73,100
1980						93,500
1981						116,500
1982						91,700
1983						112,900
1984						100,200
1985	17,384	9,563	6,241	36,046	107,663	93,900
1986	12,710	8,984	5,273	27,685	88,960	107,100
1987	13,618	6,665	4,520	26,938	81,171	130,600
1988	23,761	12,365	4,842	45,254	132,334	124,690
1989	27,229	9,853	6,672	49,709	141,161	263,350
1990	36,246	14,973	2,475	58,307	173,166	237,050
1991	30,399	11,205	5,596	49,075	152,189	215,655
1992	33,287	11,012	8,716	57,833	171,515	230,675
1993	39,838	19,320	1,614	63,844	197,242	253,820
1994	56,600	8,694	5,058	73,571	226,773	298,930
1995	77,929	8,501	3,228	90,537	288.188	251,970
1996	77,948	27,241	5,380	118,928	355,966	350,850
1997	83,334	20,286	4,520	117,324	348.536	318,954
1998	81,680	18,643	2,367	124,177	333,599	413,100
1999	90,405	25,107	4,304	126,323	389.385	285,514
2000	85,601	16,080	2,045	110,363	335,388	284,044
2001	110,471	23,414	7,533	144,158	457,541	337,848
2002	87,611	16,644	6,564	113,105	359,442	402,565
2003	115,843	16,644	2,690	137,515	436,958	424,900
2004	97,898	15,891	2,260	119,051	374,800	337,971
2005	103,758	17,772	8,071	146,113	422,505	508,890
2006	138,145	27,739	5,811	171,748	552,158	426,300
2007	165,250	27,269	2,690	209,180	631,213	476,009
2008	162,076	53,025	1,291	217,937	698,819	602,699
2009	143,955	31,313	6,349	182,527	588,127	457,802
2010	173,094	42,503	9,792	226,881	727,880	783,648
2011	169,455	32,535	7,533	209,009	676,993	646,501
2012	181,750	45,229	4,627	232,513	747,120	831,955
2013	163,896	28,869	6,779	199,452	639,934	No Survey

Pacific White-fronted Goose abundance indices from breeding pair surveys in Alaska (Yukon-Kuskokwim Delta Coastal Zone Survey and Alaska-Yukon Waterfowl Breeding Population and Habitat Survey) and fall counts in California, 1979–current, continued.

Year	YK Delta	YK Interior	Bristol Bay	Total	Projected Fall Population	Fall Survey[a]
2014	203,211	16,268	1,184	220,663	713,491	700,181
2015	155,980	18,315	1,399	174,878	565,452	634,478
2016	205,398	23,884	2,260	231,083	747,185	727,419
2017	212,303	28,869	450	240,690	778,247	743,488
2018	187,264	11,284	1,291	198,707	642,500	646,965
2019	144,365	14,105	1,076	159,669	516,273	647,040
2020	NS	NS	NS	NS	NS	NS
2021	128,628	28,586	2,152	159,037	514,230	NS
2022	171,091	37,989	861	209,758	678,233	NS
2023	120,293	13,165	0	133,458	431,522	570,391
2024	109,856	19,371	1,563	130,790	422,896	457,773

Averages:	YK Delta	YK Interior	Bristo l Bay	Total	Projected Fall Population	Fall Survey[a]
Long Term	108,544	21,033	4,092	133,669	432,207	420,867
3-yr	133,747	23,508	808	167,418	529,850	556,401

% Change from:	YK Delta	YK Interior	Bristo l Bay	Total	Projected Fall Population	Fall Survey[a]
Long Term	11.1	-38.0	-100	-0.2	-0.2	34.7
3-yr	-14.0	-50.5	-100	-20.3	-20.3	-16.0
2023	-29.6	-65.3	-100	-36.4	-36.4	-11.8

[a]Fall surveys were initiated in 1979 and guided management actions until 1998. Management actions after 1998 were based on total indicated birds (AK Total) from the breeding ground survey and a factor derived from the historic relationship between the fall survey and breeding ground survey (1985–1998). Timing of the Fall survey is as follows: 1979–1988 (November) and 1989–2015 (October).

[b]Projected fall population = (Alaska total * 2.5498) + 71,339.

White goose abundance indices in the Pacific Flyway December Survey, 1979–current.

Year	Skagit-Fraser	Washington/ Oregon	California	Total
1979	35,600		492,500	528,100
1980	22,400		181,800	204,200
1981	48,600		711,300	759,900
1982	26,100		328,000	354,100
1983	24,500		523,100	547,600
1984	26,600		439,700	466,300
1985	46,200		503,600	549,800
1986	39,900		481,800	521,700
1987	47,700		477,600	525,300
1988	43,800		397,200	441,000
1989	32,200		431,700	463,900
1990	31,700		676,800	708,500
1991	39,100		651,000	690,100
1992	34,300		605,000	639,300
1993	49,100		520,100	569,200
1994	42,600		435,600	478,200
1995	37,000		464,400	501,400
1996	45,800		320,500	366,300
1997	47,000		369,400	416,400
1998	47,100		307,200	354,300
1999	28,600		550,400	579,000
2000	56,300		600,500	656,800
2001	52,000		396,200	448,200
2002	73,100		523,700	596,800
2003	66,800		521,000	587,800
2004	68,141		682,128	750,269
2005	80,040		630,686	710,726
2006	79,891		719,810	799,701
2007	94,859		978,622	1,073,481
2008	57,000		900,403	957,403
2009	73,964		827,055	901,019
2010	63,641		800,156	863,797
2011	69,964		1,027,887	1,097,851
2012	56,973		824,432	881,405
2013	75,313		1,275,890	1,351,203
2014	58,007		1,141,579	1,199,586
2015	66,501	19,866	No Survey	Incomplete

White goose abundance indices from the Pacific Flyway December Survey, 1979–current, continued.

Year	Skagit-Fraser	Washington/ Oregon	California	Total
2016	103,617	29,678	1,773,493	1,906,788
2017	86,553	51,354	1,217,295	1,355,202
2018	109,993	71,108	1,232,663	1,413,764
2019	No Survey	185,249	1,414,392	Incomplete
2020	133,306	153,690	No Survey	Incomplete
2021	120,725	155,795	No Survey	Incomplete
2022	91,608	84,192	1,093,828	1,269,628
2023	No Survey	179,757	1,238,593	Incomplete

Averages:	Skagit/Fraser	Washington/ Oregon	California	Total
Long Term	58,935	93,867	693,913	745,401
3-yr	115,213	131,226	1,246,961	1,346,198

% Change from:	Skagit/Fraser	Washington/ Oregon	California	Total
Long Term	55.4	-10.3	57.6	72.2
3-yr	-20.5	-35.8	-12.3	-5.7
2021	-24.1	-46.0	-22.7	-10.2

Snow Goose population and productivity indices from Wrangel Island, Russia, 1966–current.

Year	Adults	Breeding Adults	% Juvenile	Total Spring
1966				
1967				
1968				
1969		114,000		
1970	120,000	120,000	20.0	150,000
1971	120,000	24,000	9.1	132,000
1972	106,000	36,000	0.6	107,000
1973	85,900	12,000	0.0	86,000
1974	69,500	32,000	0.7	70,000
1975	56,000	56,000	0.0	56,000
1976	46,000	46,000	20.7	58,000
1977	57,200	10,000	16.1	68,200
1978	64,900	42,000	0.8	65,400
1979	62,100	60,000	26.5	84,500
1980	80,300	20,000	11.5	90,700
1981	86,200	78,000	3.2	89,000
1982	81,000	28,000	18.5	100,000
1983	92,800	3,400	2.4	95,000
1984	85,000	42,000	0.0	85,000
1985	80,000	50,000	5.4	85,000
1986	70,000	58,000	20.4	90,000
1987	85,000	47,000	15.0	100,000
1988	80,000	13,000	17.7	80,000
1989	70,000	60,000	1.4	70,000
1990	60,000	53,000	0.0	60,000
1991	56,000	41,600	6.6	60,000
1992	56,000	46,200	20.0	70,000
1993	64,500	52,200	0.8	65,000
1994	52,500	30,000	25.0	70,000
1995	64,000	8,800	0.8	65,000
1996	75,000	75,400	0.0	75,000
1997	70,000	55,200	15.0	85,000
1998	80,000	31,800	10.0	90,000
1999	85,000	20,800	5.6	90,000
2000	87,400	49,600	8.0	95,000
2001	92,400	48,000	12.0	105,000

Snow Goose population and productivity indices from Wrangel Island, Russia, 1966–current, continued.

Year	Adults	Breeding Adults	% Juvenile	Total spring
2002		60,600		110,000
2003		55,000		115,000
2004	111,700	56,800	4.9	117,500
2005		95,800		117,500
2006	100,800	93,200	23.9	132,500
2007		79,000		140,000
2008		35,000		140,000
2009		108,800		132,500
2010	127,000	25,000		150,000
2011	144,800	143,000	3.5	155,000
2012[a]				
2013				160,000
2014[a]				
2015	228,500	215,400	4.8	240,000
2016	251,000	237,000	20.0	300,000
2017	294,800	201,500	14.8	346,000
2018	297,000	281,800	3.2	306,000
2019		313,200	29.1	442,000
2020	256,920	428,200	22.3	685,120
2021	624,870	356,600	11.5	706,068
2022	750,00	502,000		750,000
2023	NS	NS	NS	NS

Averages	Adults	Breeding Adults	% Juvenile	Total Spring
Long-term	128,995	93,175	10.0	154,019
3-yr	516,823	428,933	18.0	686,390

% Change from	Adults	Breeding Adults	% Juvenile	Total Spring
Long-term	556.7%	490.6%		427.8%
3-yr	45.1%	17.0%		9.3%
2021	38.0%	40.8%		20.2%

Estimated Retrieved Harvest of Geese in California, 1962–2023.

Year	CAGO	GWFG	SNGO	ROGO	BRAN	TOTAL
1962	53,532	50,088	28,826	0	9,433	141,879
1963	99,888	56,694	66,810	0	8,008	231,400
1964	77,920	51,735	55,151	0	3,748	188,554
1965	49,685	42,211	33,771	0	10,735	136,402
1966	72,415	65,321	155,543	1,022	7,155	301,456
1967	8,756	62,819	72,413	533	6,929	151,450
1968	72,935	47,345	53,308	0	8,298	181,886
1969	72,613	68,443	72,545	2,514	10,056	226,171
1970	95,112	70,639	112,614	5,114	393	283,872
1971	74,008	34,216	94,123	3,646	2,524	208,517
1972	148,888	51,813	41,998	0	13,698	256,397
1973	69,701	44,615	106,721	4,398	2,161	227,596
1974	72,166	40,682	50,764	8,464	1,693	173,769
1975	62,002	30,193	81,993	6,968	0	181,156
1976	58,444	44,044	127,678	7,726	515	238,407
1977	42,610	33,572	77,771	3,395	9,700	167,048
1978	46,530	34,719	28,578	2,360	674	112,861
1979	31,373	21,399	26,179	4,419	0	83,370
1980	26,950	18,693	28,459	2,795	0	76,897
1981	52,089	21,781	28,591	6,316	0	108,777
1982	46,418	15,004	26,263	7,298	0	94,983
1983	56,384	16,157	43,223	6,789	3,573	126,126
1984	38,004	6,686	49,609	8,373	0	102,672
1985	40,313	15,157	65,085	8,913	0	129,468
1986	21,999	7,542	31,839	3,477	0	64,857
1987	1,348	9,634	28,601	2,375	0	41,958
1988	26,296	4,707	30,571	884	0	62,458
1989	24,486	9,519	30,263	5,106	566	69,940
1990	32,691	7,003	8,104	2,438	475	50,711
1991	9,474	9,828	25,839	3,253	211	48,605
1992	28,546	11,705	26,407	3,076	1,810	71,544
1993	21,066	12,311	46,461	7,430	2,368	89,636
1994	28,469	12,597	21,847	7,476	2,774	73,163
1995	21,119	11,476	30,679	4,833	328	68,435
1996	25,487	16,530	46,849	12,405	2,639	103,910
1997	23,659	22,448	27,628	8,058	4,029	85,822
1998	23,299	21,984	38,371	6,049	12,097	101,800
1999	14,017	23,925	35,563	23,545	2,639	99,689
2000	25,877	21,184	31,721	6,749	1,800	87,331
2001	30,228	27,080	33,167	13,015	4,100	107,590
2002	37,762	31,497	30,279	15,662	1,100	116,300
2003	41,946	24,685	32,851	16,333	2,300	118,115

Estimated Retrieved Harvest of Geese in California, 1962–2023, continued.

Year	CAGO	GWFG	SNGO	ROGO	BRAN	TOTAL
2004	44,492	39,924	35,355	10,329	800	130,900
2005	49,182	42,156	46,653	7,729	900	146,620
2006	41,381	52,492	43,296	5,875	2,900	145,944
2007	50,484	59,416	52,038	7,961	1,800	171,699
2008	49,252	110,523	70,946	13,779	1,000	245,500
2009	53,865	56,101	30,693	8,740	900	150,299
2010	68,666	67,810	54,548	14,974	541	206,539
2011	51,870	55,760	43,718	14,635	750	166,733
2012	47,877	41,842	45,261	14,886	1,093	150,959
2013	44,071	65,071	38,747	13,310	952	162,151
2014	52,735	74,976	66,492	18,343	3,080	215,626
2015	40,431	62,484	51,947	12,007	2,238	169,107
2016	41,280	34,885	56,979	6,977	4,786	144,907
2017	52,876	64,098	91,867	25,017	3,200	237,058
2018	83,139	57,589	48,059	8,922	500	198,223
2019	59,936	46,221	61,720	12,207	1,200	181,254
2020	54,616	101,598	115,337	17,979	900	290,478
2021	60,626	59,693	88,421	19,773	1,200	229,669
2022	35,592	44,423	82,958	29,169	600	194,072
2023	116,886	65,531	54,030	14,444	451	251,341

Averages:	CAGO	GWFG	SNGO	ROGO	BRAN	TOTAL
LTA*	47,993	39,230	52,647	8,230	2,715	150,822
1962-72	75,068	54,666	71,555	1,166	7,362	209,817
1973-82	50,828	62,913	93,285	5,414	6,566	146,486
1983-92	85,353	40,304	75,120	4,695	4,015	76,834
1993-02	25,098	20,103	34,257	10,522	3,387	93,368
2003-12	49,902	55,071	45,536	11,524	1,298	163,331
2013-23	55,633	61,506	68,778	16,195	1,737	203,889

% Change from:	CAGO	GWFG	SNGO	ROGO	BRAN	TOTAL
2022	228.4%	47.5%	-34.9%	-50.5%	-24.8%	29.5%
LTA*	143.5%	67.0%	2.6%	75.5%	-83.4%	66.6%

	CAGO	GWFG	SNGO	ROGO	BRAN
Species Composition	46.5%	26.1%	21.5%	5.7%	0.2%

*LTA=Long-term average 1962-2023

CAGO=includes Cacklers and Canada geese

Appendix G. Effects of Habitat Change Analyses

Table G-1. Model Akaike's Information Criterion corrected for small sample size (AIC_c), model relative differences (ΔAIC_c), Log likelihood (LogLik), measure of mode fits (Adjusted R^2), Akaike weight (w_i) and model coefficients with 95% confidence Intervals contrasting Sacramento Valley mallard breeding population estimates within three model sets. Models are divided into sets by variable types: Land use (i.e., agriculture and urban), Habitat conservation (i.e., governmental land acquisitions and Conservation Reserve Program) and Climatic (i.e., precipitation and temperature measured at one station per stratum). Type A = managed governmental habitat, Type C = unmanaged governmental habitat, CRP = Conservation Reserve Program, TMAX = maximum daily temperature, TMIN = minimum daily temperature, TOBS = average hourly temperature.

Model Formula	AIC_c	ΔAIC_c	LogLik	Adj.R^2	w_i	E.R.	Variable Coeff. and CI	Intercept Coeff. and CI
Land Use Models								
Rangeland	598.1	0.0	-295.5	0.61	0.77	0.1	0.342 (0.236− 0.449)	-629663.7 (-851472.5407854.9)
Tree Crops	602.3	4.3	-297.6	0.54	0.09	1.0	-0.385 (-0.524− -0.247)	205724.0 (159911.2− 251536.8)
Urban	603.2	5.1	-298.0	0.52	0.06	1.5	-1.625 (-2.226− -1.024)	309838.3 (224608.5− 395068.2)
Row Crops	603.7	5.7	-298.3	0.51	0.05	2.0	0.467 (0.291− 0.644)	-13208.2 (-49780.1− 23363.7)
Irrigated Pasture	604.2	6.1	-298.5	0.50	0.04	2.5	1.687 (1.040− 2.333)	-96191.3 (-164579.4− 27−803.3)
Vine Crops	614.1	16.0	-303.5	0.27	0.00	353.8	3.690 (1.433− 5.946)	16339.3 (-24581.4− 57260.0)
Field Crops	615.2	17.2	-304.1	0.24	0.00	625.2	0.355 (0.120− 0.589)	-48155.7 (-134026.7− 37715.3)
Intercept	620.8	22.7	-308.1	0.00	0.00	10034.7		80608.8 (6707.6− 93910.0)
Rice	623.3	25.3	-308.1	-0.04	0.00	36254.7	0.002 (-0.307− 0.310)	79688.2 (-79012.5− 238388.9)
Habitat Conservation Models								
Type A	612.6	0.0	-302.8	0.31	0.49	1.0	-40.168 (-62.67517.661)	1746797.0 (813133.2680460.0)
Type C	612.7	0.1	-302.8	0.31	0.47	1.0	-8.885 (-13.887− -3.883)	405456.7 (222243.8− 588669.5)
CRP	618.5	5.9	-305.7	0.14	0.03	18.9	3.237 (0.372− 6.102)	28900.8 (-18508.2− 76309.8)
Intercept	620.8	8.1	-308.1	0.00	0.01	58.6		80608.8 (6707.6− 93910.0)
Climatic Models								
TMAX	619.1	0.0	-306.0	0.12	0.54	1.0	-5042.5 (-9827.2−257.7)	407418.9 (97058.7− 717779.1)
Intercept	620.8	1.7	-308.1	0.00	0.23	2.3		80608.8 (6707.6− 93910.0)
TOBS	622.8	3.7	-307.9	-0.02	0.08	6.4	3187.5 (5577.511952.4)	-72046.6 (-49035.0− 347941.9)
PRCP	623.1	4.0	-308.0	-0.03	0.07	7.4	499.1 1−485.8−2−483.9)	74059.6 (44718.4− 103400.9)
TMIN	623.3	4.2	-308.1	-0.04	0.07	8.3	-548.4 (-0712.6−9615.9)	1040740.1 (-31090.3−539238.5)

Table G-2. Model Akaike's Information Criterion corrected for small sample size (AIC_c), model relative differences (ΔAIC_c), Log likelihood (LogLik), measure of mode fits (Adjusted R^2), Akaike weight (w_i) and model coefficients with 95% confidence Intervals contrasting Yolo – Delta mallard breeding population estimates within three model sets. Models are divided into sets by variable types: Land use (i.e., agriculture and urban), Habitat conservation (i.e., governmental land acquisitions and Conservation Reserve Program) and Climatic (i.e., precipitation and temperature measured at one station per stratum). Type A = managed governmental habitat, Type C = unmanaged governmental habitat, CRP = Conservation Reserve Program, TMAX = maximum daily temperature, TMIN = minimum daily temperature, TAVG = average daily temperature.

Model Formula	AIC_c	ΔIC_c	LogLik	Adj.R^2	w_i	E.R.	Variable Coeff. and CI	Intercept Coeff. and CI
Land Use Models								
Urban	566.5	0.0	-279.7	0.37	0.64	0.3	-0.396 (-0.593− -0.199)	139741.5 (92987.9−186495.0)
Row Crops	568.9	2.3	-280.9	0.31	0.20	1.0	0.138 (0.060− 0.215)	-6466.7 (-36350.7− 23417.2)
Tree Crops	570.5	4.0	-281.7	0.26	0.09	2.3	-0.217 (-0.351− -0.082)	86950.7 (61097.3−112804.0)
Irrigated Pasture	571.7	5.1	-282.3	0.23	0.05	4.0	1.066 (0.350− 1.782)	-34278.9 (-88486.2−19928.4)
Vine Crops	573.8	7.2	-283.3	0.17	0.02	11.5	-0.240 (-0.432− -0.047)	74210.6 (51018.5− 97402.7)
Field Crops	575.5	8.9	-284.2	0.11	0.01	27.0	-0.096 (-0.190− -0.003)	82714.5 (46657.7− 118771.3)
Intercept	577.0	10.4	-286.2	0.00	0.00	57.2		46040.3 (40310.4− 51770.2)
Rangeland	578.1	11.6	-285.5	0.01	0.00	102.4	0.096 (-0.067− 0.260)	-11835.7 (-110249.4− 86578.1)
Rice	578.6	12.1	-285.8	-0.01	0.00	131.2	-3.14 (-3.14 − 1.13)	61597.4 (28123.7 − 95071.2)
Habitat Conservation Models								
Type A	567.7	0.0	-280.3	0.34	0.95	1.0	-0.988 (-1.509− -0.467)	67142.9 (55084.3− 79201.5)
Type C	574.0	6.3	-283.5	0.16	0.04	23.6	-3.201 (-5.838− -0.564)	66662.3 (48877.1− 84447.5)
Intercept	577.0	9.3	-286.2	0.00	0.01	102.5		46040.3 (40310.4− 51770.2)
CRP	578.6	10.9	-285.7	0.00	0.00	227.2	1.919 (-2.002− 5.839)	34982.2 (11667.7− 58296.6)
Climatic Models								
TMAX	576.3	0.0	-284.6	0.08	0.40	1.0	-2121.2 (-4461.8−219.4)	181185.8 (31959.5−330412.0)
Intercept	577.0	0.6	-286.2	0.00	0.29	1.4		46040.3 (40−310.4−51770.2)
TAVG	578.3	2.0	-285.6	0.01	0.15	2.7	-1910.0 (-5405.5− 1585.5)	148007.7 (-38691.3− 334706.8)
PRCP	579.5	3.1	-286.2	-0.04	0.08	4.8	162.7 (-1044.6− 1370.1)	44232.0 (29600.300− 58863.8)
TMIN	579.5	3.1	-286.2	-0.04	0.08	4.8	430.2 (-2994.7− 3855.1)	27507.0 (-120169.2− 175183.1)

Table G-3. Model Akaike's Information Criterion corrected for small sample size (AICc), model relative differences (Δ AICc), Log likelihood (LogLik), measure of mode fits (Adjusted R2), model weight (wi) and model coefficients with 95% confidence Intervals contrasting San Joaquin mallard breeding population estimates within three model sets.. Models are divided into sets by variable types: Land use (i.e., agriculture and urban), Habitat conservation (i.e., governmental land acquisitions and Conservation Reserve Program) and Climatic (i.e., precipitation and temperature measured at one station per stratum). Type A = managed governmental habitat, Type C = unmanaged governmental habitat, CRP = Conservation Reserve Program, TMAX = maximum daily temperature, TMIN = minimum daily temperature.

Model Formula	AIC_c	$\Delta\ AIC_c$	LogLik	Adj.R^2	w_i	E.R.	Variable Coeff. and CI	Intercept Coeff. and CI
Land Use Models								
Rice	543.3	0.0	-268.0	0.16			3.442 (0.535− 6.350)	21108.3 (1482.9− 40733.7)
Urban	585.3	0.0	-289.1	0.22	0.34	1.0	-0.789 (-1.329− -0.249)	136004.4 (71027.7− 200981.1)
Field Crops	585.6	0.3	-289.3	0.21	0.29	1.2	0.283 (0.084− 0.482)	-41634.3 (-100409.4− 17140.8)
Tree Crops	586.2	0.9	-289.6	0.20	0.21	1.6	-0.097 (-0.168− -0.026)	81294.9 (51255.9− 111334.0)
Irrigated Pasture	587.9	2.6	-290.4	0.14	0.09	3.7	0.194 (0.026− 0.362)	19796.6 (-200.3− 39793.6)
Intercept	590.4	5.1	-292.9	0.00	0.03	12.8		41490.6 (34080.8− 48900.4)
Vine Crops	590.7	5.4	-291.8	0.04	0.02	14.9	0.405 (-0.143− 0.953)	-14034.1 (-89549.1− 61480.9)
Rangeland	592.5	7.2	-292.7	-0.02	0.01	36.6	-0.061 (-0.249− 0.127)	128927.0 (-139061.0− 396915.0)
Row Crops	592.9	7.6	-292.9	-0.04	0.01	44.7	-0.033 (-0.353− 0.287)	61012.4 (-126399.3− 248424.1)
Habitat Conservation Models								
Type C	578.5	0.0	-285.7	0.40	0.89	1.0	-28.5 (-41.7− -15.2)	470199.3 (271064.6− 669333.9)
Type A	582.7	4.2	-287.8	0.30	0.11	8.2	-2.077 (-3.273− -0.881)	125421.2 (76707.2− 174135.2)
Intercept	590.4	11.9	-292.9	0.00	0.00	383.8		41490.6 (34080.8− 48900.4)
CRP	591.8	13.3	-292.3	0.00	0.00	772.8	-0.926 (-2.669− 0.817)	47297.0 (34099.2− 60494.8)
Climatic Models								
MINT	587.9	0.0	-290.4	0.14	0.66	1.0	3718.6 (490.0− 6947.3)	-123787.7 (-267454.0− 19878.7)
Intercept	590.4	2.5	-292.9	0.00	0.19	3.5		41490.6 (34080.8− 48900.4)
PRCP	591.9	4.0	-292.4	0.00	0.09	7.4	1073.0 (-1020.7− 3166.7)	33149.9 (15267.9− 51032.0)
MAXT	592.8	4.9	-292.8	-0.04	0.06	11.6	-594.3 (-3801.5− 2612.8)	80185.4 (-128760.8− 289131.7)

Table G-4. Model Akaike's Information Criterion corrected for small sample size (AIC_c), model relative differences (Δ AIC_c), Log likelihood (LogLik), measure of mode fits (Adjusted R^2), Akaike weight (w_i) and model coefficients with 95% confidence Intervals contrasting Tulare breeding mallard population estimates within three model sets. Models are divided into sets by variable types: Land use (i.e., agriculture and urban), Habitat conservation (i.e., governmental land

acquisitions and Conservation Reserve Program) and Climatic (i.e., precipitation and temperature measured at one station per stratum). Type A = managed governmental habitat, Type C = unmanaged governmental habitat, CRP = Conservation Reserve Program, TMAX = maximum daily temperature, TMIN = minimum daily temperature, TAVG = average daily temperature.

Model Formula	AIC_c	ΔAIC_c	LogLik	Adj.R^2	w_i	E.R.	Variable Coeff and CI	Intercept Coeff and CI
Land Use Models								
Rice	464.7	0.0	-228.7	-0.04			1.100 (-3.557− 5.757)	23546.9 (3076.0− 44017.8)
Row Crops	566.1	0.0	-279.5	0.21	0.36		0.019 (0.006− 0.033)	3968.2 (-11824.2− 19760.7)
Urban	566.9	0.8	-279.9	0.19	0.24	1.5	-0.153 (-0.267− -0.038)	75387.7 (37645.0− 113130.4)
Tree Crops	567.4	1.3	-280.2	0.17	0.19	1.9	-0.028 (-0.051− -0.006)	46090.9 (29362.3− 62819.4)
Rangeland	568.1	2.0	-280.5	0.15	0.13	2.7	0.024 (0.004− 0.045)	-57315.0 (-126889.1− 12259.1)
Intercept	570.9	4.8	-283.2	0.00	0.03	10.8		25543.4 (20449.9− 30636.8)
Irrigated Pasture	572.3	6.2	-282.6	0.00	0.02	22.5	-0.089 (-0.259− 0.082)	36838.3 (14509.7− 59166.8)
Field Crops	572.5	6.4	-282.7	0.00	0.01	24.4	-0.015 (-0.048− 0.017)	40302.6 (9049.2− 71556.0)
Vine Crops	572.8	6.7	-282.8	-0.02	0.01	28.1	0.093 (-0.141− 0.327)	-5935.0 (-85071.6− 73201.6)
Habitat Conservation Models								
CRP	567.0	0.0	-279.9	0.19	0.38	1.0	2.34 (0.58− 4.10)	14201.1 (4491.7− 23910.5)
Type C	567.8	0.8	-280.4	0.16	0.38	1.0	-0.852 (-1.545− -0.159)	43470.1 (28156.7− 58783.4)
Type A	568.4	1.4	-280.7	0.14	0.12	3.1	-1.10 (-2.05− -0.14)	62181.9 (29995.2− 94368.5)
Intercept	570.9	3.9	-283.2	0.00	0.12	3.2		25543.4 (20449.9− 30636.8)
Climatic Models								
Intercept	570.9	0.0	-283.2	0.00	0.43	1.0		25543.4 (20449.9− 30636.8)
MINT	572.8	2.0	-282.9	-0.02	0.16	2.7	-1070.4 (-3888.5− 1747.6)	73288.0 (-52510.1− 199086.1)
TAVG	573.0	2.1	-283.0	-0.02	0.15	2.9	-828.0 (-3424.2− 1768.1)	71868.4 (-73466.0− 217202.8)
PRCP	573.1	2.3	-283.0	-0.03	0.14	3.1	721.5 (-1888.8 3331.8)	22620.8 (10852.1− 34389.4)
MAXT	573.2	2.3	-283.0	-0.03	0.13	3.2	-529.5 (-2682.6− 1623.6)	61177.9 (-83808.4− 206164.2)

Figure G-5. Land use types based on Cropscape 2017 (U.S. Department of Agriculture) within Central Valley Joint Venture Planning regions and California counties. Panel A: Sacramento Valley, Panel B: Yolo–Delta, Panel C: San Joaquin, Panel D: Tulare.

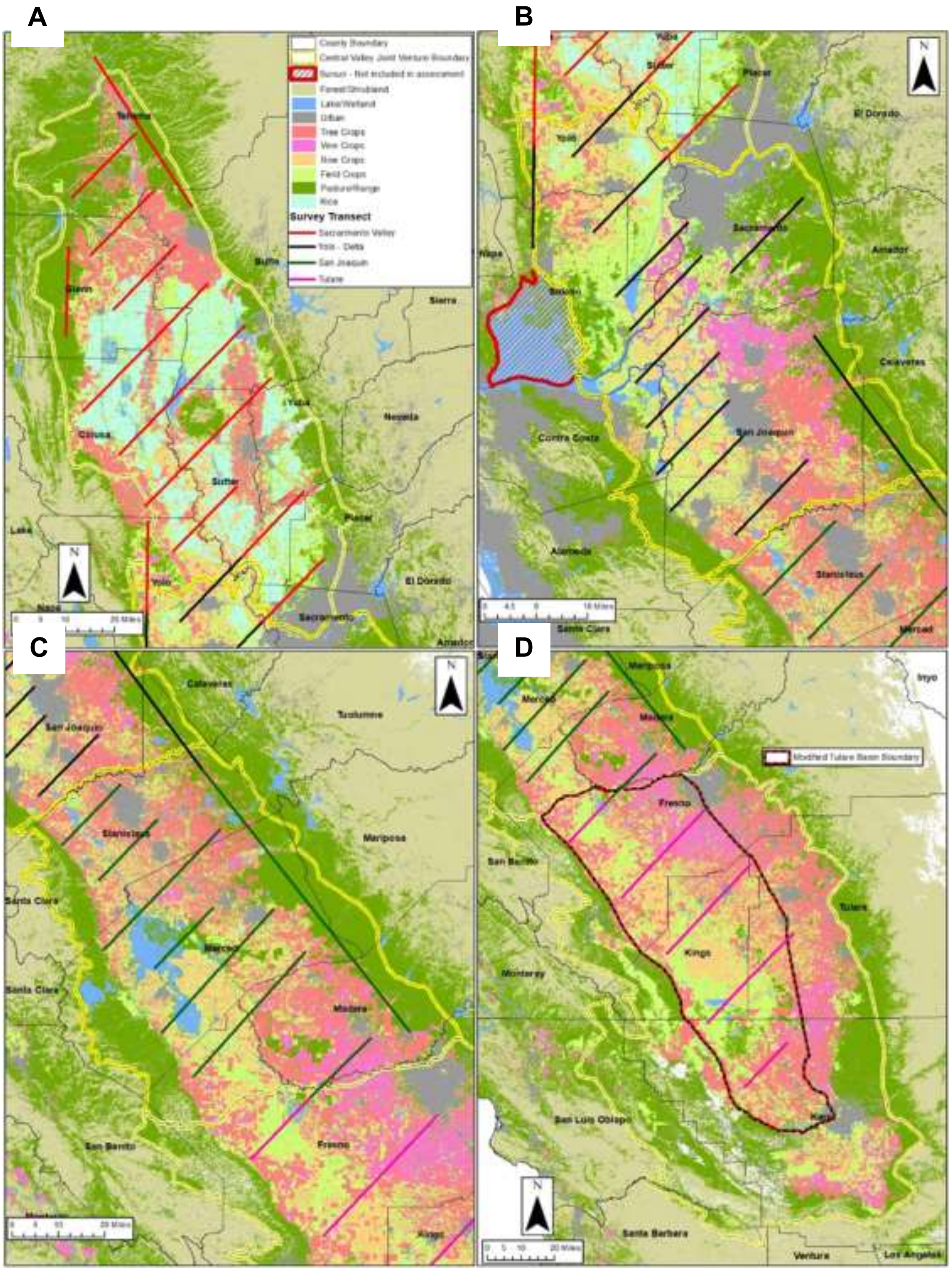


Figure G-6. Central Valley mallard breeding population trends 1992–2017 by Central Valley Joint Venture Planning Region. Panel A: Sacramento, Panel B: Yolo–Delta, Panel C: San Joaquin, Panel D: Tulare. Estimates are adjusted from Department of Fish and Wildlife surveys. Graphs include regression formulas, fit (R^2) and regression lines.

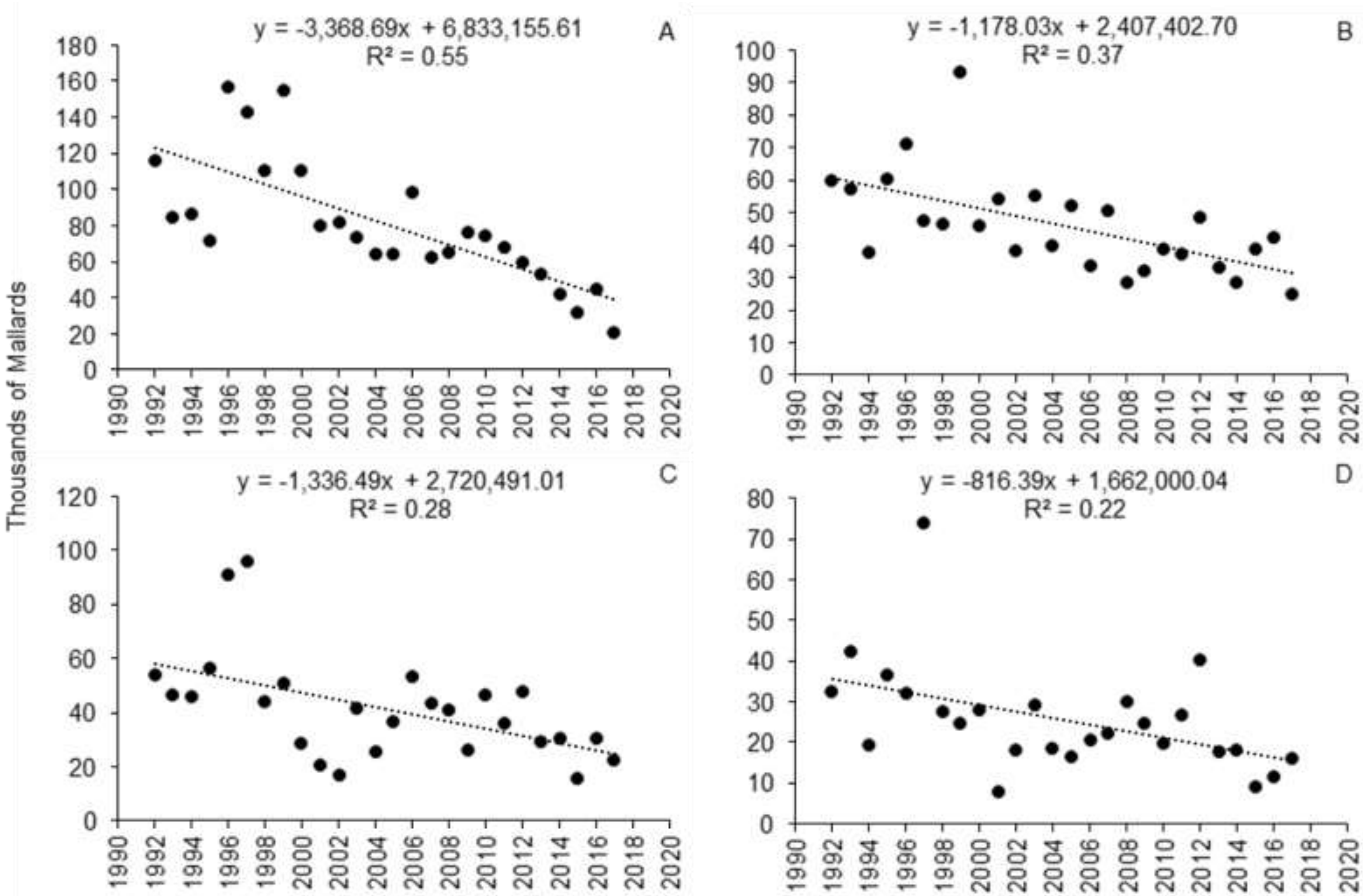


Figure G-7. Effects plots of top models contrasting Sacramento Valley mallard breeding population (svbpop) against land use acreage 1992–2017. This analysis used nine models, each graph is listed from lowest AIC$_c$ to highest. Blue shading = confidence interval.

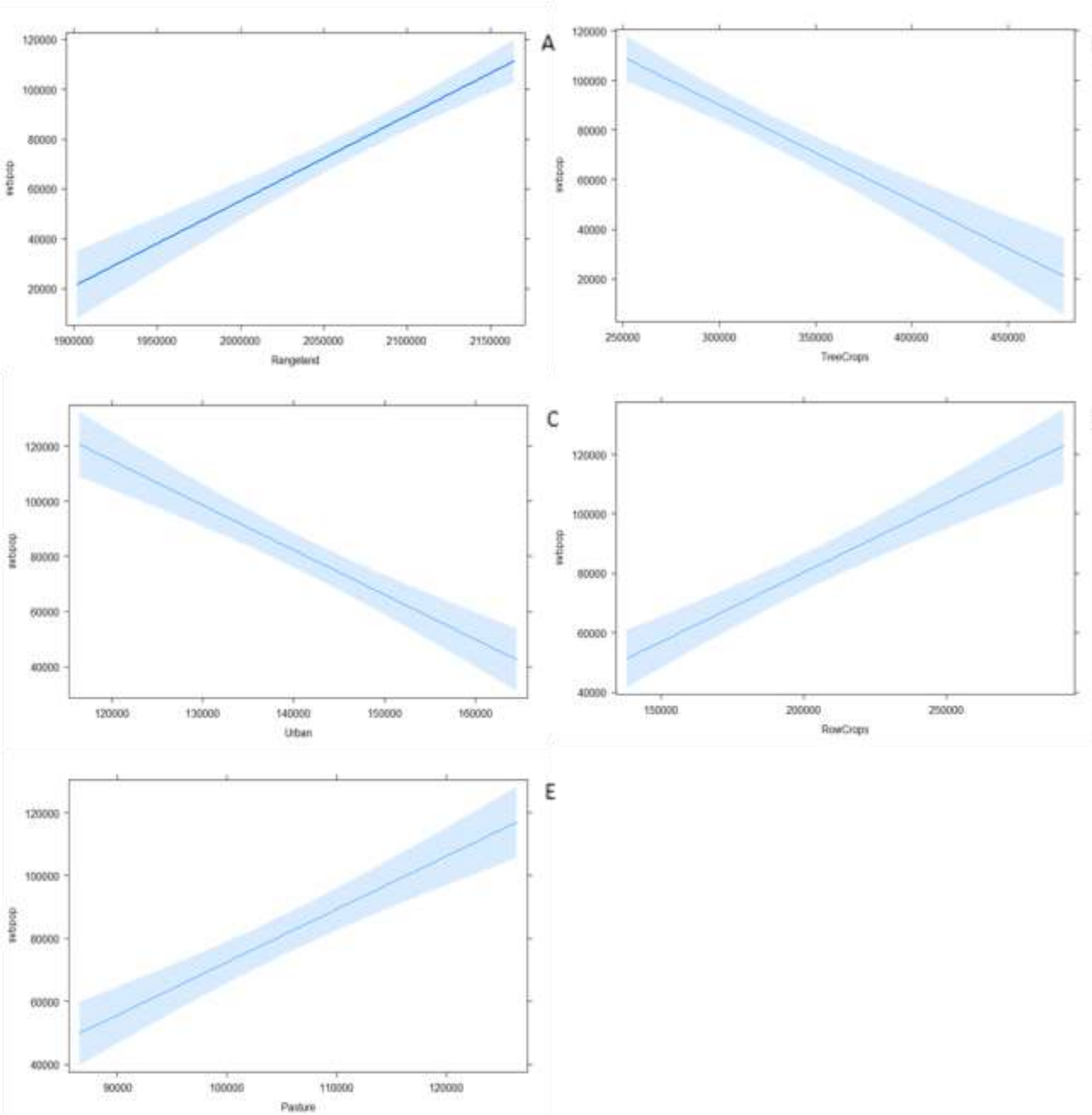


Figure G-8. Effects plots of top models contrasting Sacramento Valley mallard breeding population (svbpop) against habitat conservation acreages (panels A–C) and climactic variables (panel D) 1992–2017. The habitat assessment used four models and the climactic analysis used five. Each graph is listed from lowest AIC$_c$ to highest for each model set. TypeA = managed governmental habitat, TypeC = unmanaged governmental habitat, CRP = Conservation Reserve Program easement acreage. Maximum temperature (TMAX) was the only model ranked above the null model in the climactic set. Blue shading = confidence interval.

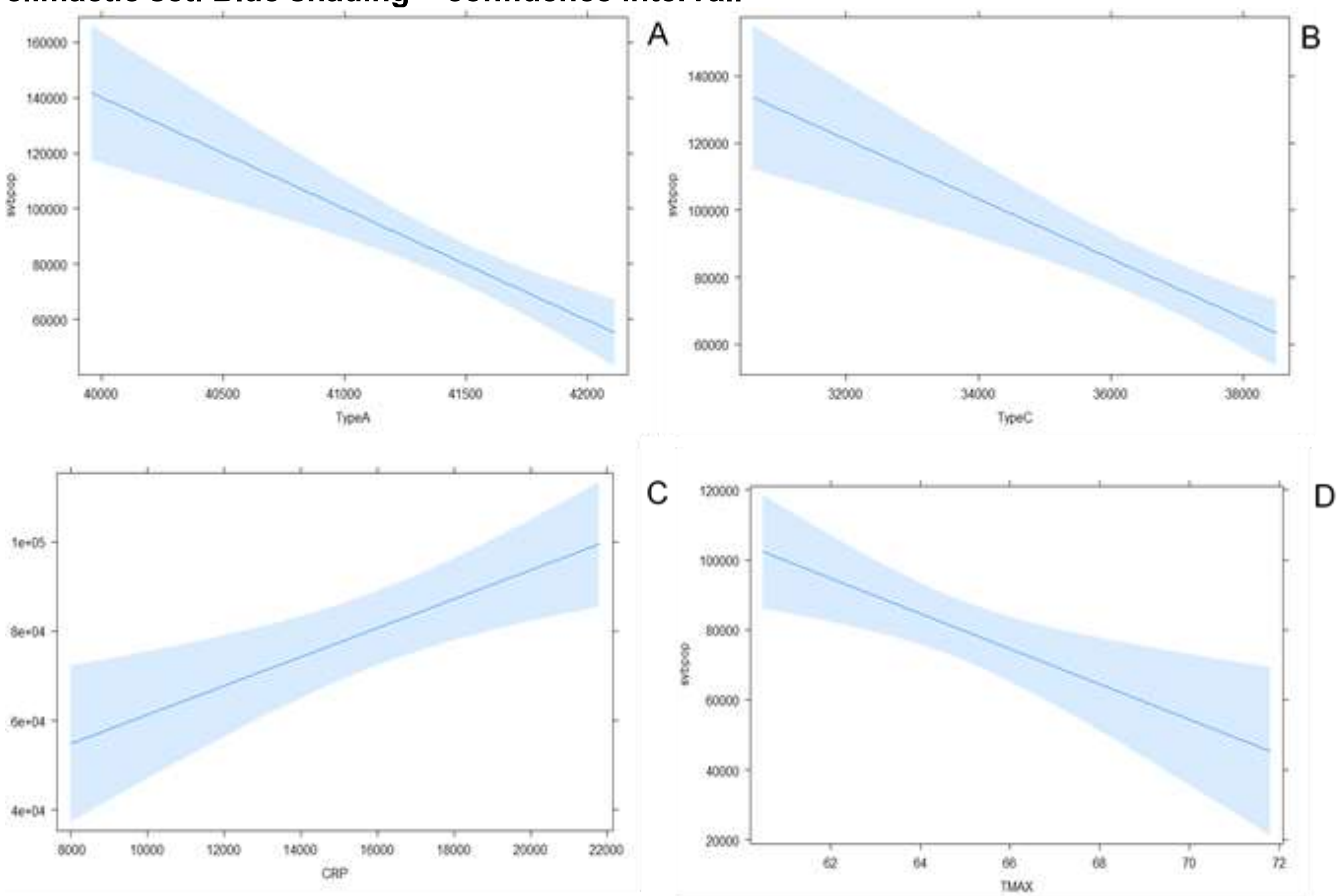


Figure G-10. Effects plots of top models contrasting San Joaquin mallard breeding population (sjbpop) against changes in land use acreage 1992–2017. This analysis used nine models. Each graph is listed from lowest AIC$_c$ to highest. Blue shading = confidence interval.

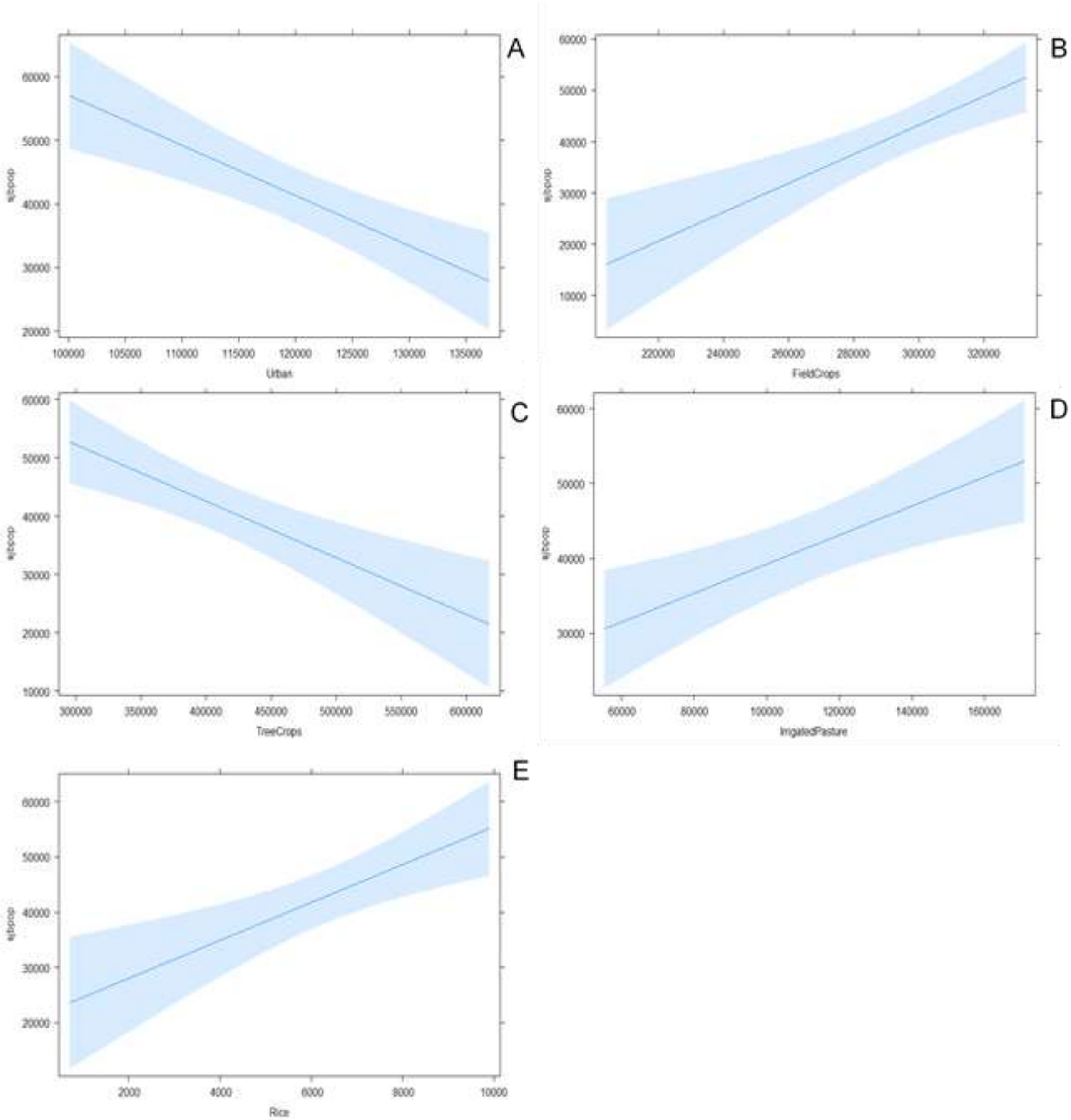


Figure G-11 Effects plots of top models contrasting San Joaquin mallard breeding population (sjbpop) against habitat conservation acreages (panels A–B) and climactic variables (panel C) 1992–2017. The habitat conservation assessment used four models and the climactic analysis = used five. Each graph is listed from lowest AIC$_c$ to highest for each model set. TypeA = managed governmental habitat, TypeC = unmanaged governmental habitat. Blue shading = confidence interval.

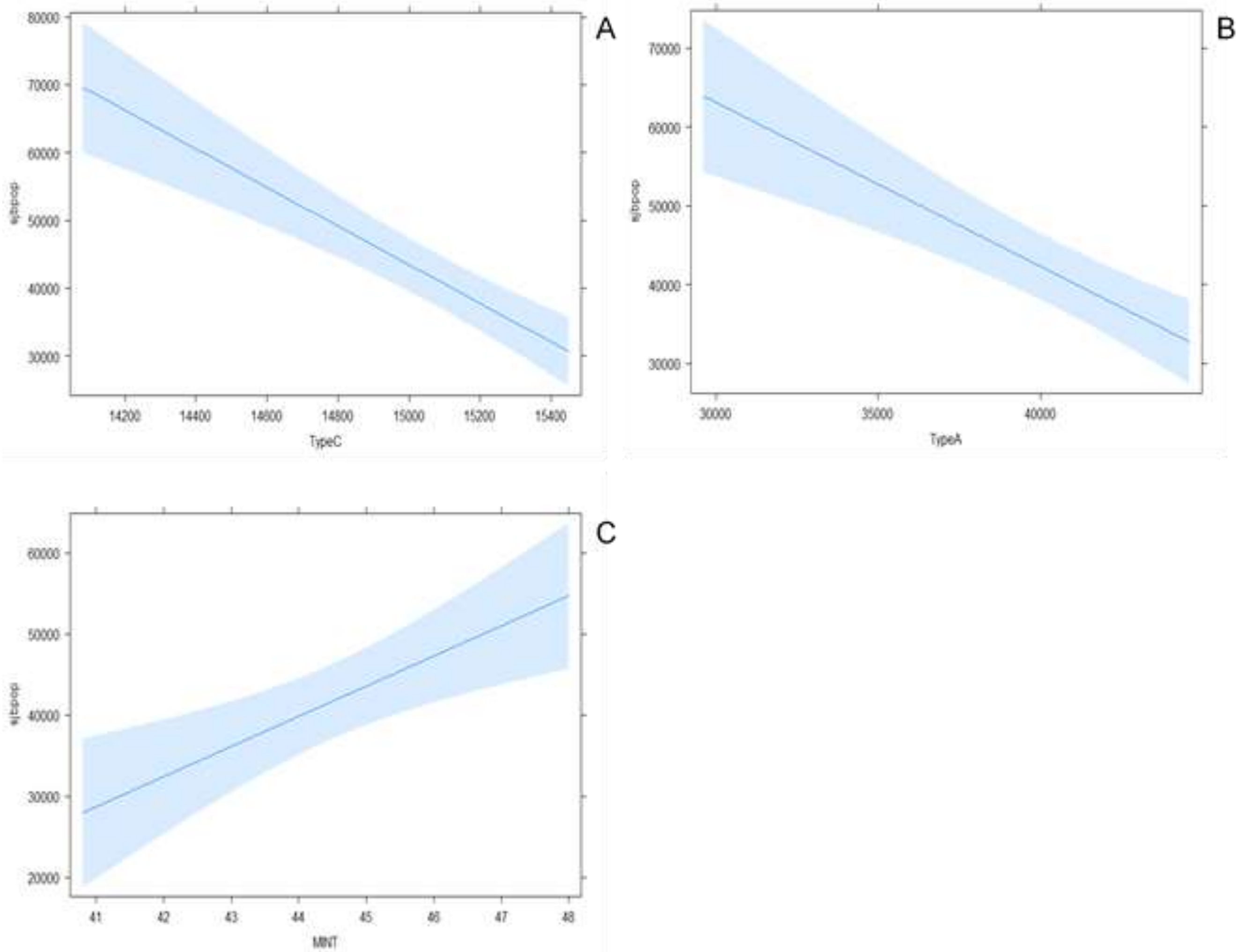


Figure G-12. Effects plots of top models contrasting Tulare mallard breeding population (tubpop) against changes in land use (panels A–D) and habitat conservation acreages (panel E–G), 1992–2017. The land use analysis used nine models, while the habitat conservation analysis used four. Each graph is listed from lowest AIC_c to highest for each model set. TypeC = unmanaged governmental habitat, CRP = Conservation Reserve Program easement acreage TypeA = managed governmental habitat. Blue shading = confidence interval.

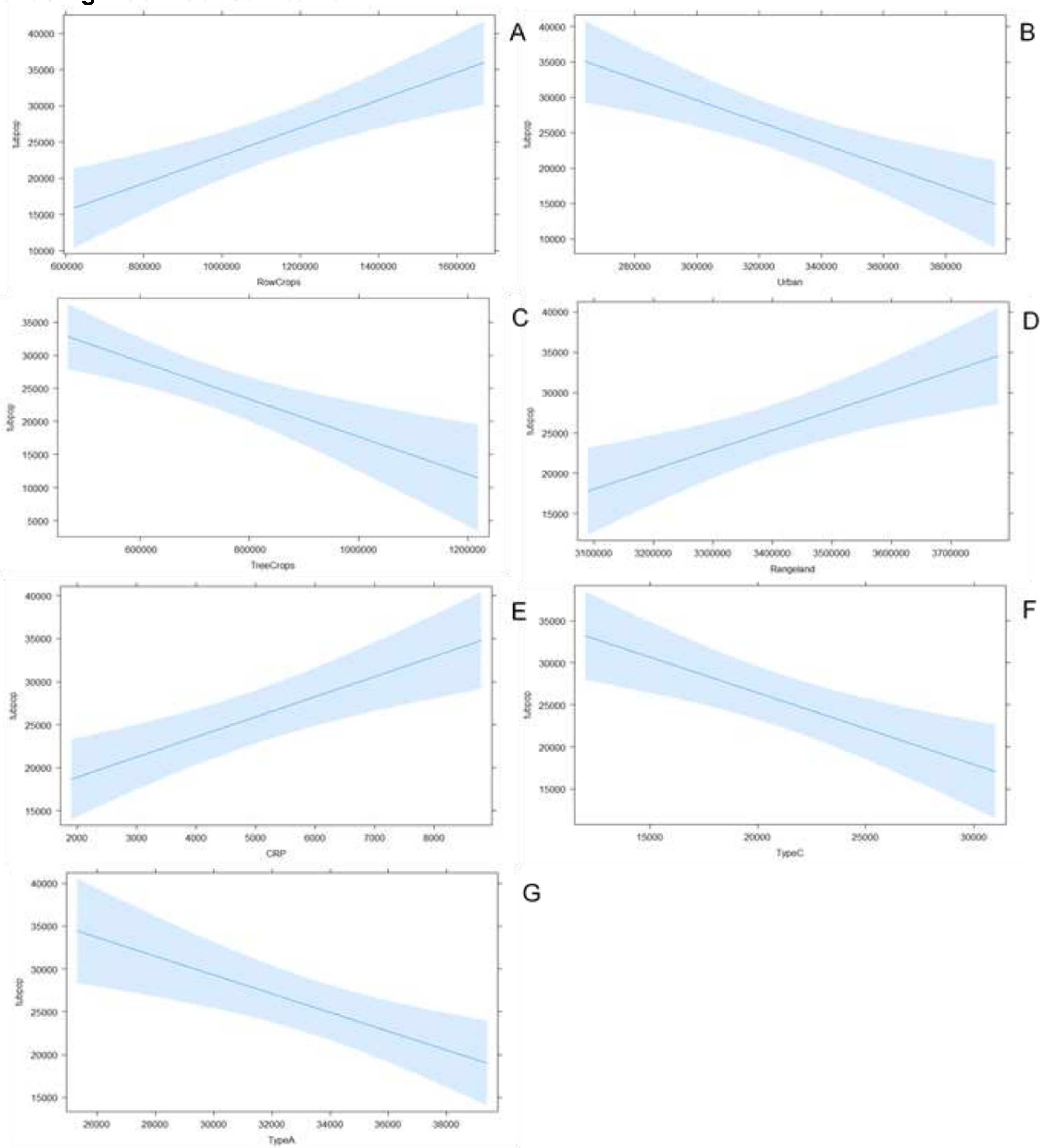


Figure G-13. Composition of land use types (Panel A) derived from adjusted U.S. Department of Agriculture data and acres of rangeland (Panel B) in the Sacramento Valley 1992–2017. Most rangeland occurs outside of the Central Valley, thus estimates used in this analysis are an overestimate but considered an index. Counties: Tehama, Butte, Glenn, Colusa, Yuba, Sutter, Placer, Yolo and Sacramento. See appendix table G17 for adjustments.

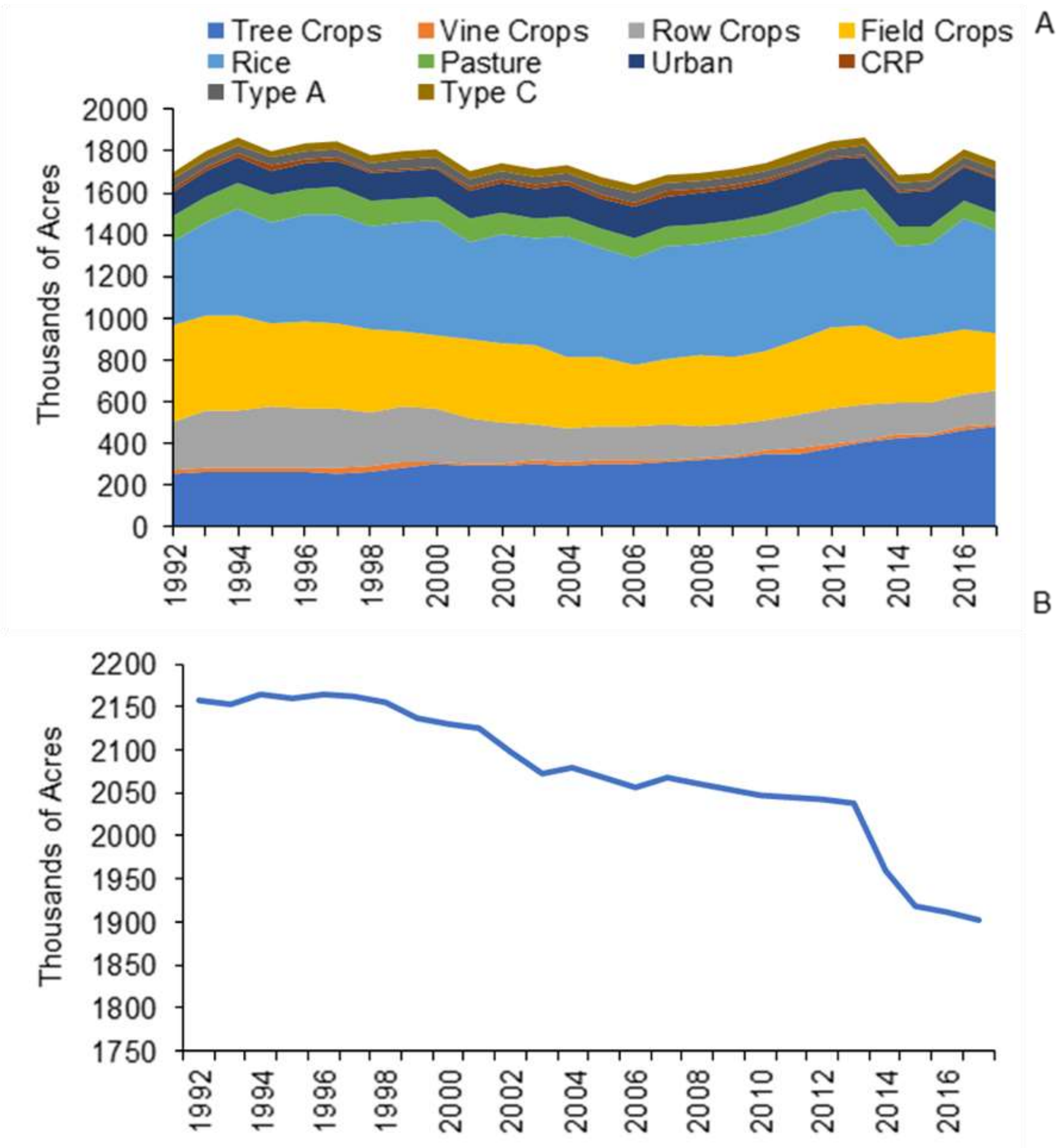
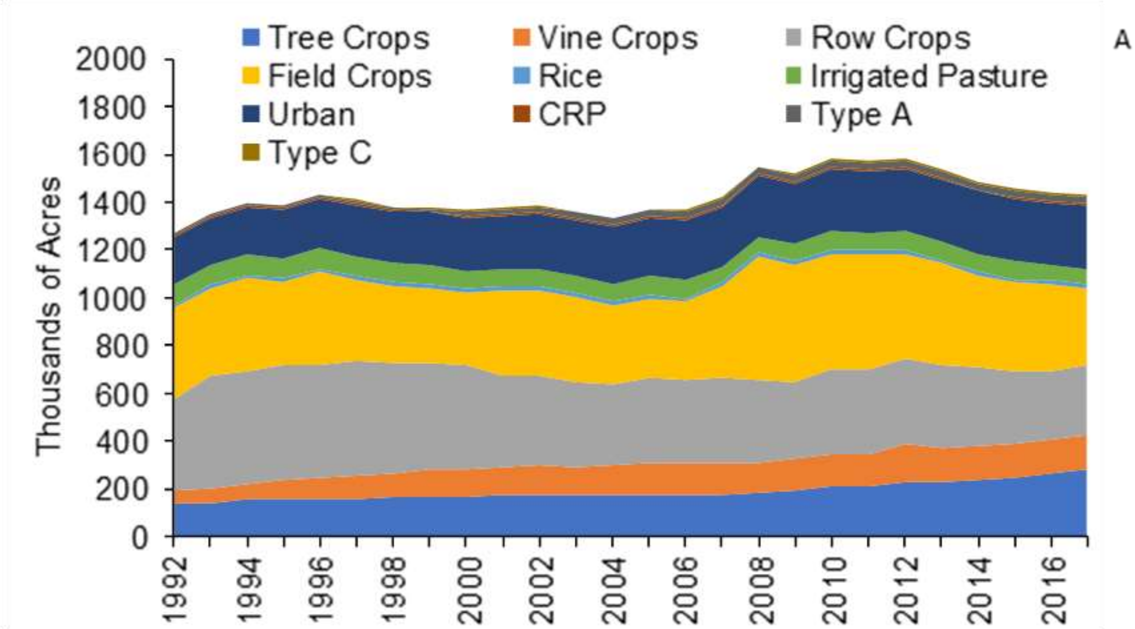


Figure G-14. Composition of land use types (Panel A) derived from adjusted U.S. Department of Agriculture data and acres of rangeland (Panel B) in the Delta–Yolo 1992–2017. Most rangeland occurs outside of the Central Valley, thus estimates used in this analysis are an overestimate but considered an index. Counties: Yolo, Sacramento, Solano, Contra Costa, San Joaquin and Stanislaus. See appendix Table G-17 for adjustments.



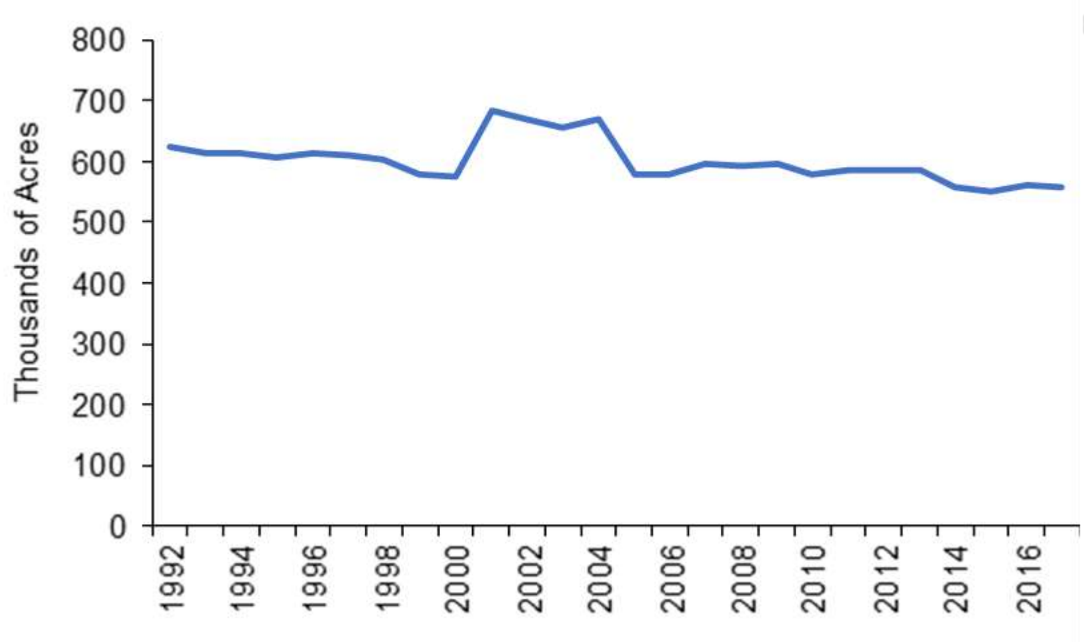


Figure G-15. Composition of land use types (Panel A) derived from adjusted U.S. Department of Agriculture data and acres of rangeland (Panel B) in the San Joaquin, 1992–2017. Most rangeland occurs outside of the Central Valley, thus estimates used in this analysis are an overestimate but considered an index. Counties include: San Joaquin, Stanislaus, Merced, Madera and Fresno. See appendix table G17 for adjustments.

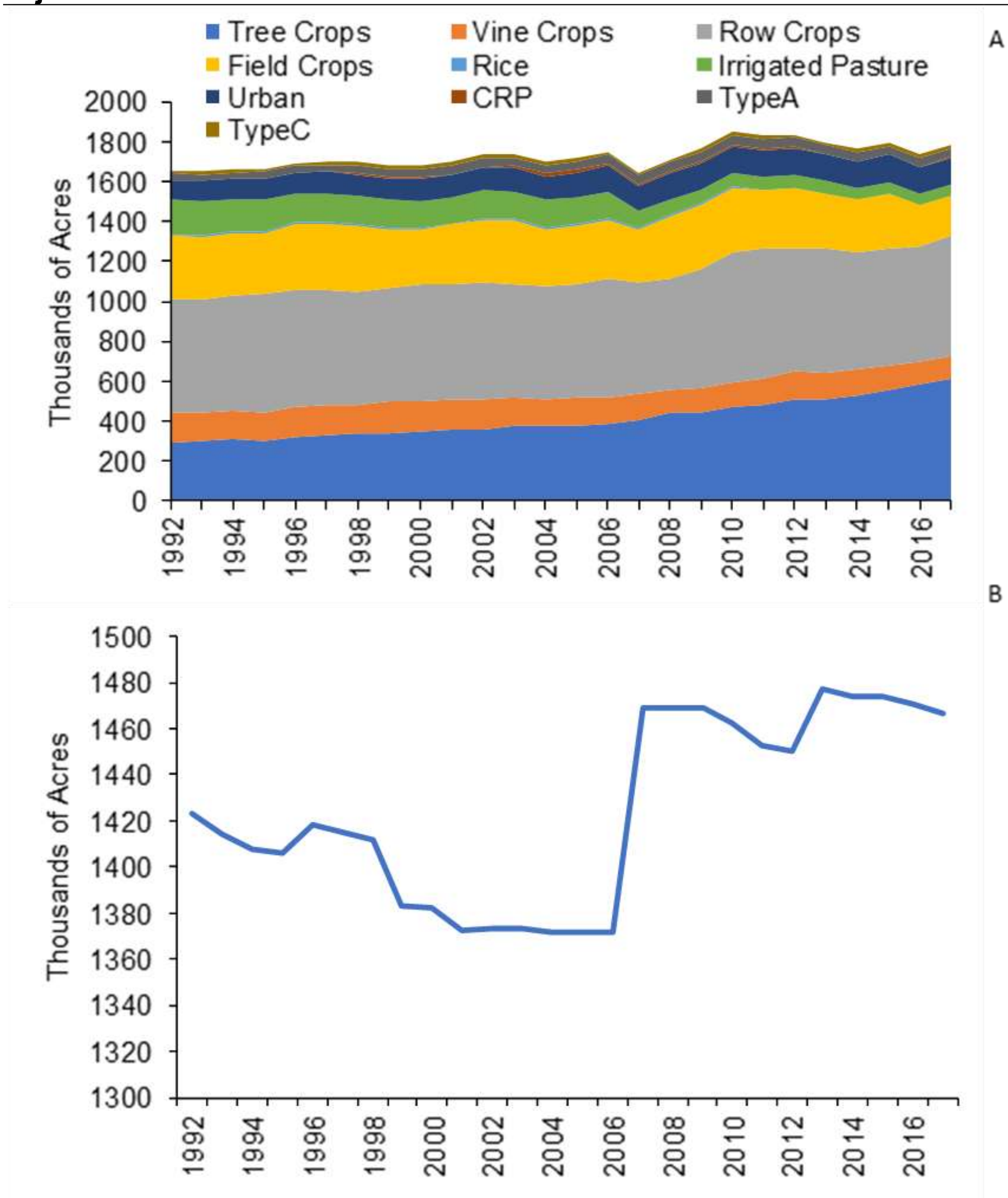


Figure G-16. Composition of land use types (Panel A) derived from adjusted U.S. Department of Agriculture data and acres of rangeland (Panel B) in Tulare,1992–2017. Most rangeland occurs outside of the Central Valley, thus estimates used in this analysis are an overestimate but considered an index. Counties: Fresno, Kings, Tulare and Kern. See appendix table G17 for adjustments.

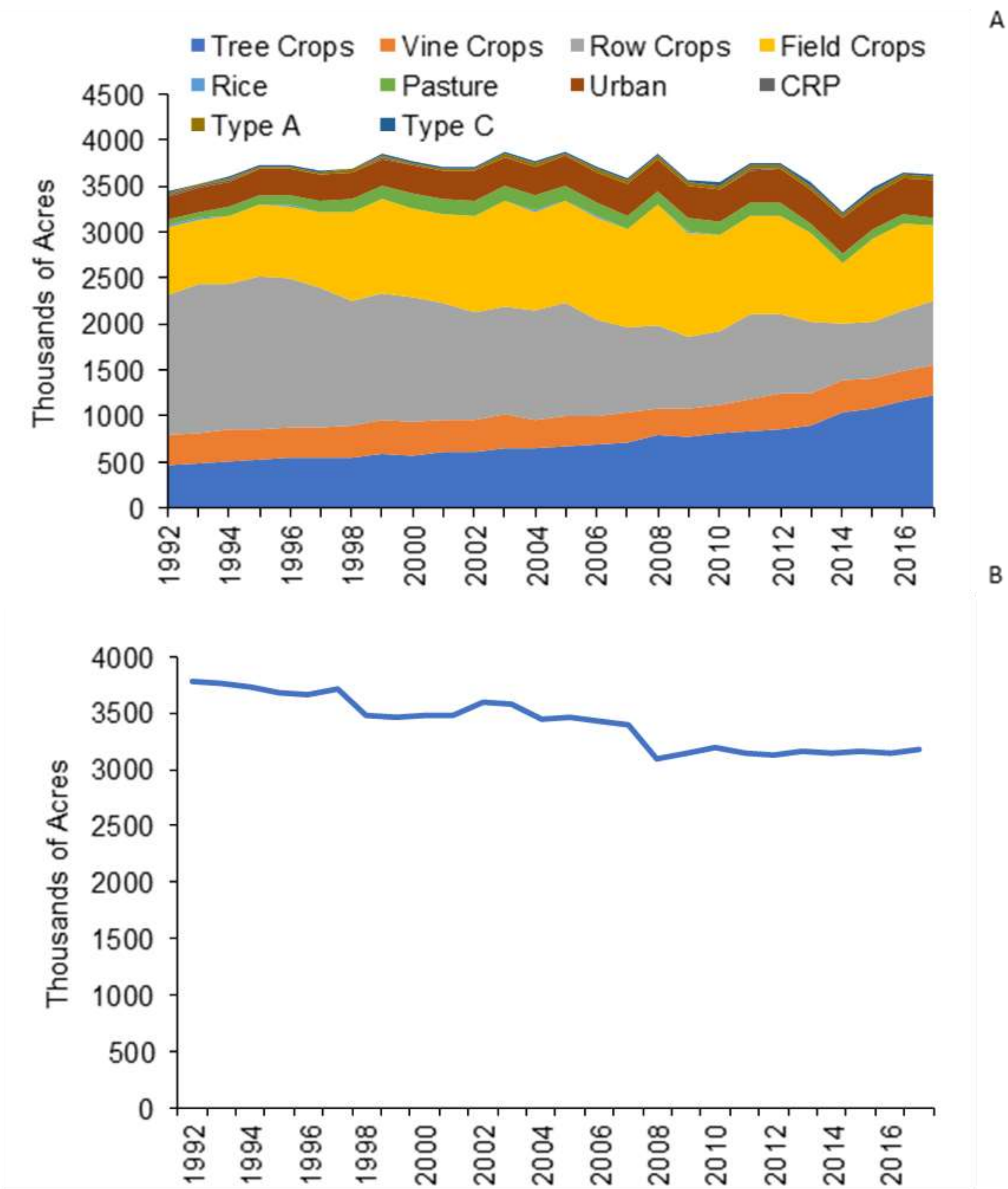


Table G-17. Adjustments to cropland and urban based on spatial assessment and overlap of Central Valley Joint Venture Planning regions and California counties.

County	Basin 1	Basin 2	Adjustment	Adjustment Notes
Tehama	100% SV		Urban	Most crops inside, city of Red Bluff outside of JV. 80.9% of urban in Tehama County lies within JV, satellite trace estimate used. Cropscape estimates higher than reported by county.
Butte	100% SV		Urban	Some of Oroville and Chico outside of JV. 62.9% of urban in Butte County lies within JV
Placer	100% SV		Urban	Much of Placer lies outside JV but most crops are inside. 39% of urban in Placer in the SV.
Yolo	69% YD	31% SV	Both	All urban to YD, everything else proportional breakdown. 69% of crops go to YD, 31% to SV, all urban goes to YD.
Sacramento	87% YD	13% SV	Both	95% of rice to SV, 29.7% of urban to SV, 53.2% to YD Region, remainder is outside JV. 86.8% of ag lands fall in YD, 13.2% in SV.
Solano	45% YD	55% SU	Urban	Include all crops in YD. Mostly range and urban outside JV, 26% of urban in YD, 35% in SU. 48.5% of county lies in YD, 26.3 lies in SU.
Contra Costa	10% YD		Urban	No adjustment for crops, 16% of urban to YD.
Fresno	85% TU	15% SJ	Both	All urban to TU, 14.9% of crops to SJ, 85.1% TU.
Glenn	100% SV		No	Mostly range and trees outside of JV.
Colusa	100% SV		No	Chunk of almonds between Dunnigan and Arbuckle west of I-5 not in JV. Not a small chunk, ~36000 acres including Arbuckle, too difficult to handle so left in SV.
Sutter	99% SV	1% YD	No	Small area in YD but left in SV.
Yuba	100% SV		No	Most crops and urban inside JV, some rangeland outside JV.
San Joaquin	99% YD	1% SJ	No	All crops and urban to YD.
Stanislaus	95% SJ	5% YD	No	Vast majority of crops to SJ, YD area is largely range.
Merced	100% SJ		No	Most ag and urban fit within SJ, very little rangeland outside.
Madera	100% SJ		No	All ag in Madera in SJ, rangeland extends eastward over Sierra.
Tulare	100% TU		No	Most ag and urban in TU, everything outside of JV is rangeland.
Kings	100% TU		No	Kings is almost entirely in TU.
Kern	100% TU		No	Most ag and urban in TU, everything outside JV is rangeland.
San Benito	3% TU		Exclude	Not enough to use, all rangeland.
Mariposa	5% SJ		Exclude	Just a little rangeland in JV.
Santa Clara	2% YD		Exclude	Not enough to use, all rangeland.
Alameda	2% YD		Exclude	Not enough to use, all rangeland.

SV = Sacramento Valley, YD = Yolo-Delta, SJ = San Joaquin, SU = Suisun, TU = Tulare, JV = Joint-Venture

Figure G-18. Crop specific trends by category in the Sacramento Planning Region, 1992–2017. Panel A: Tree Crops, Panel B: Vine Crops, Panel C: Row Crops, Panel D: Field Crops. Other Fruit Trees = Apples, Apricots, Cherry's, Citrus, Nectarines, Oranges, Pears, Persimmons, Pomegranates and Tangerines. Fruit and Nut trees are unknown crops. Miscellaneous crops are also unknown.

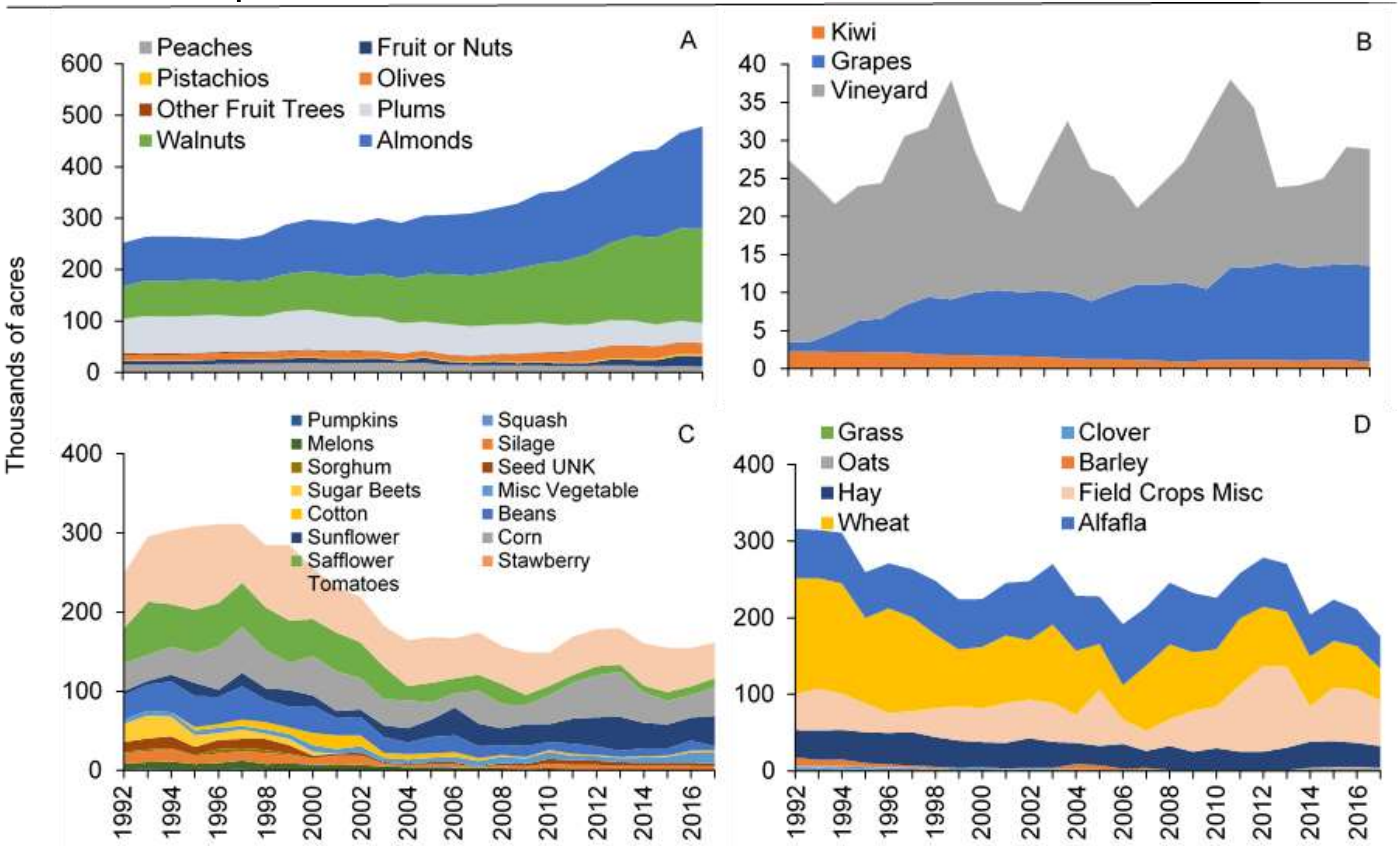


Figure G-19. Crop specific trends by category in the Yolo–Delta Planning Region, 1992–2017. Panel A: Tree Crops, Panel B: Vine Crops, Panel C: Row Crops, Panel D: Field Crops. Other Trees = Citrus, Olives, Persimmons, Pistachios and unknown fruit and nut trees. Miscellaneous Row Crops = Broccoli, Cabbage, Cauliflower, Fresh Bean, Herbs, Lettuce, Snap Bean, Snow peas, Spinach, Strawberry's and Sweet Potatoes. Some Miscellaneous crops are unknown. Berries = Blueberries, Boysenberries and Loganberries.

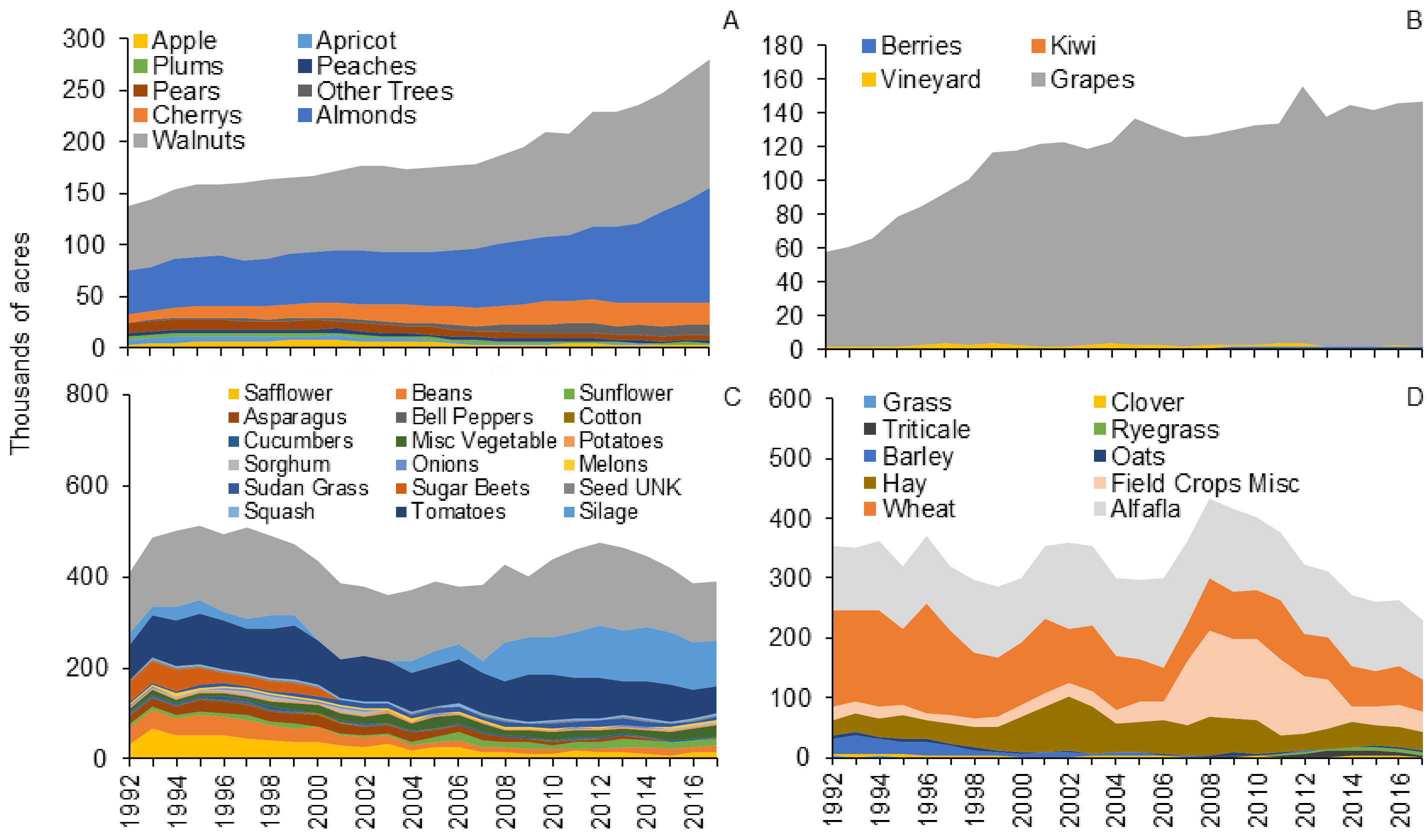


Figure G-20. Crop specific trends by category in the San Joaquin Planning Region, 1992–2017. Panel A: Tree Crops, Panel B: Vine Crops, Panel C: Row Crops, Panel D: Field Crops. Other Trees = Citrus, Lemons, Pears, Pecans, Persimmons, Plumcots, Pomegranates, Tangerines, and unknown fruit and nut trees. Miscellaneous Field Crops = unknown, Misc. Row Crops = Asparagus, Bell Peppers, Carrots, Cherry Tomatoes, Chili Peppers, Eggplant, Fresh Beans, Herbs, Snap Bean, Snow Pea, Sorghum, Spinach, Pumpkins, Squash, Strawberry. Miscellaneous vegetables are unknown. Berries = Blueberry and Boysenberry.

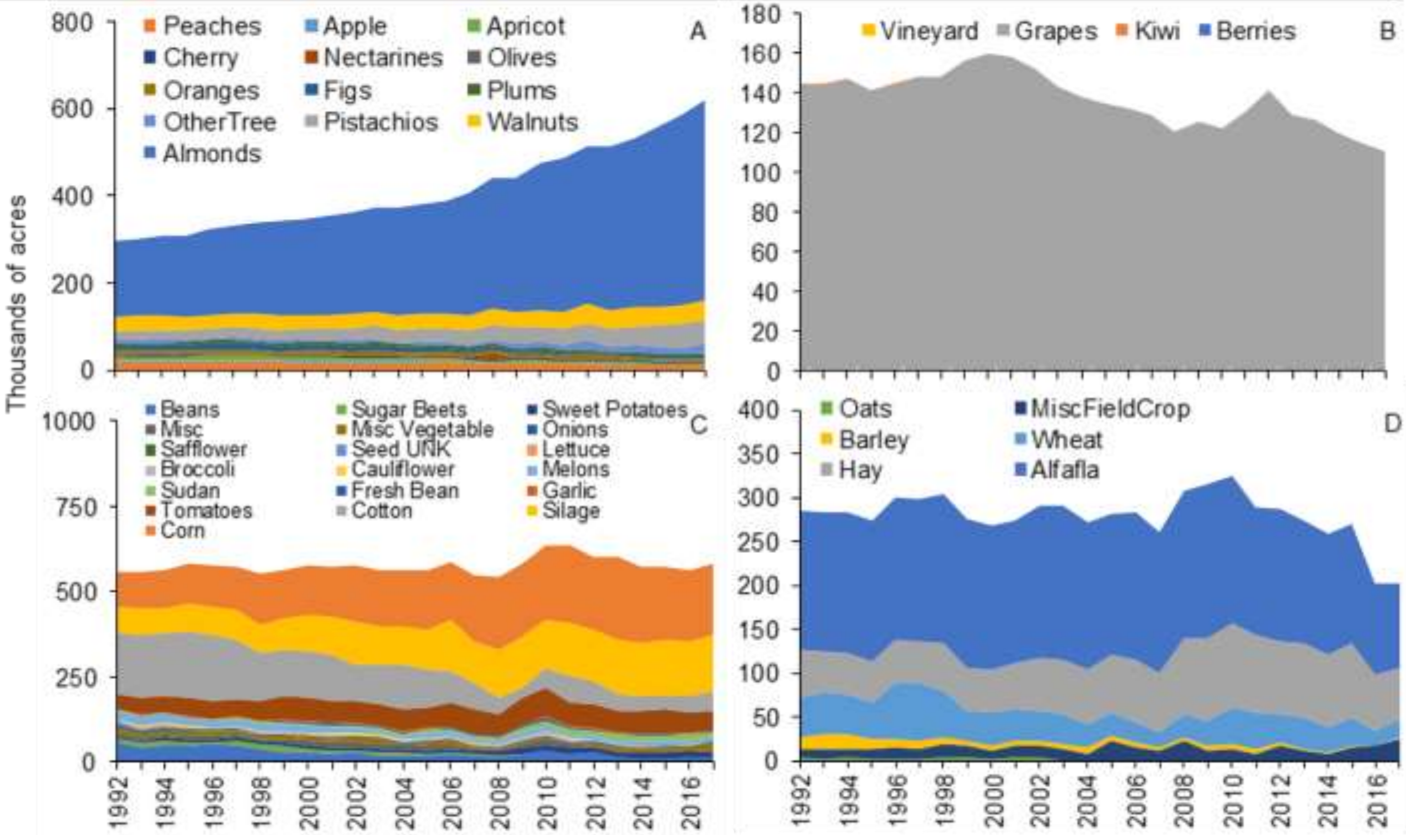


Figure G-21. Crop specific trends by category in the Tulare Planning Region, 1992–2017. Panel A: Tree Crops, Panel B: Vine Crops, Panel C: Row Crops, Panel D: Field Crops. Other Trees = Citrus, Lemons, Pears, Pecans, Persimmons, Plumcots, Pomegranates, Tangerines, and unknown fruit and nut trees. Misc. Row Crops = Asparagus, Cauliflower, Cherry Tomatoes, Chili Peppers, Cucumbers, Eggplant, Unknown Vegetable Seed, Snap Bean, Squash, Strawberry, Sweet Potatoes and Turnips. Miscellaneous vegetables are unknown. Berries = Blueberry and Loganberry.

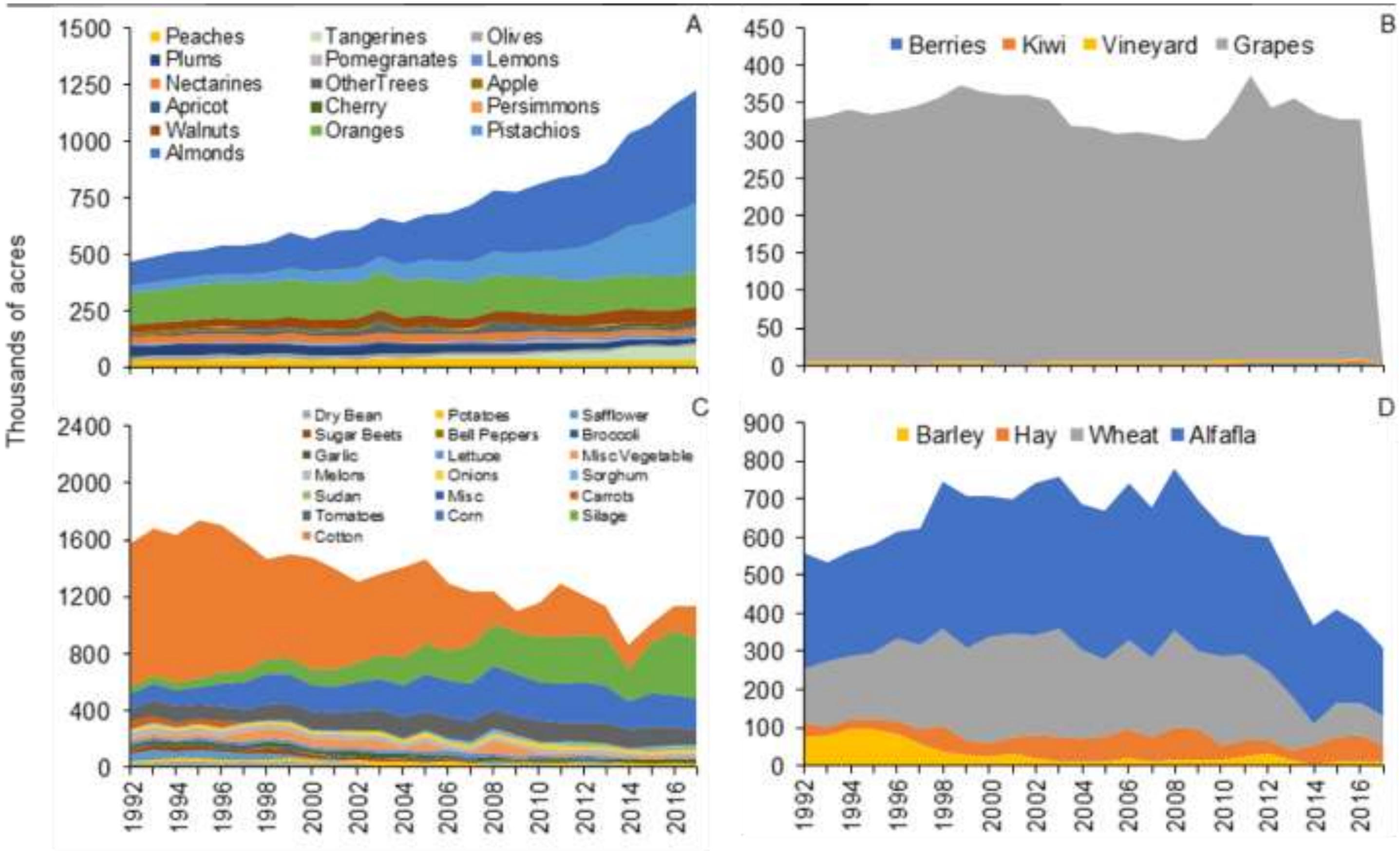


Figure G-22. Habitat conservation by way of managed governmental habitat acquisitions (i.e., Type A) unmanaged governmental habitat acquisitions (i.e., Type C) and Conservation Reserve Program acres (i.e., CRP) in the Central Valley Joint Venture Planning Region 1992–2017, by Cent Panel A : Sacramento, Panel B: Yolo–Delta, Panel C: San Joaquin, Panel D: Tulare. Type A and Type C are U.S. Fish and Wildlife Service and California Department of Fish and Wildlife properties.

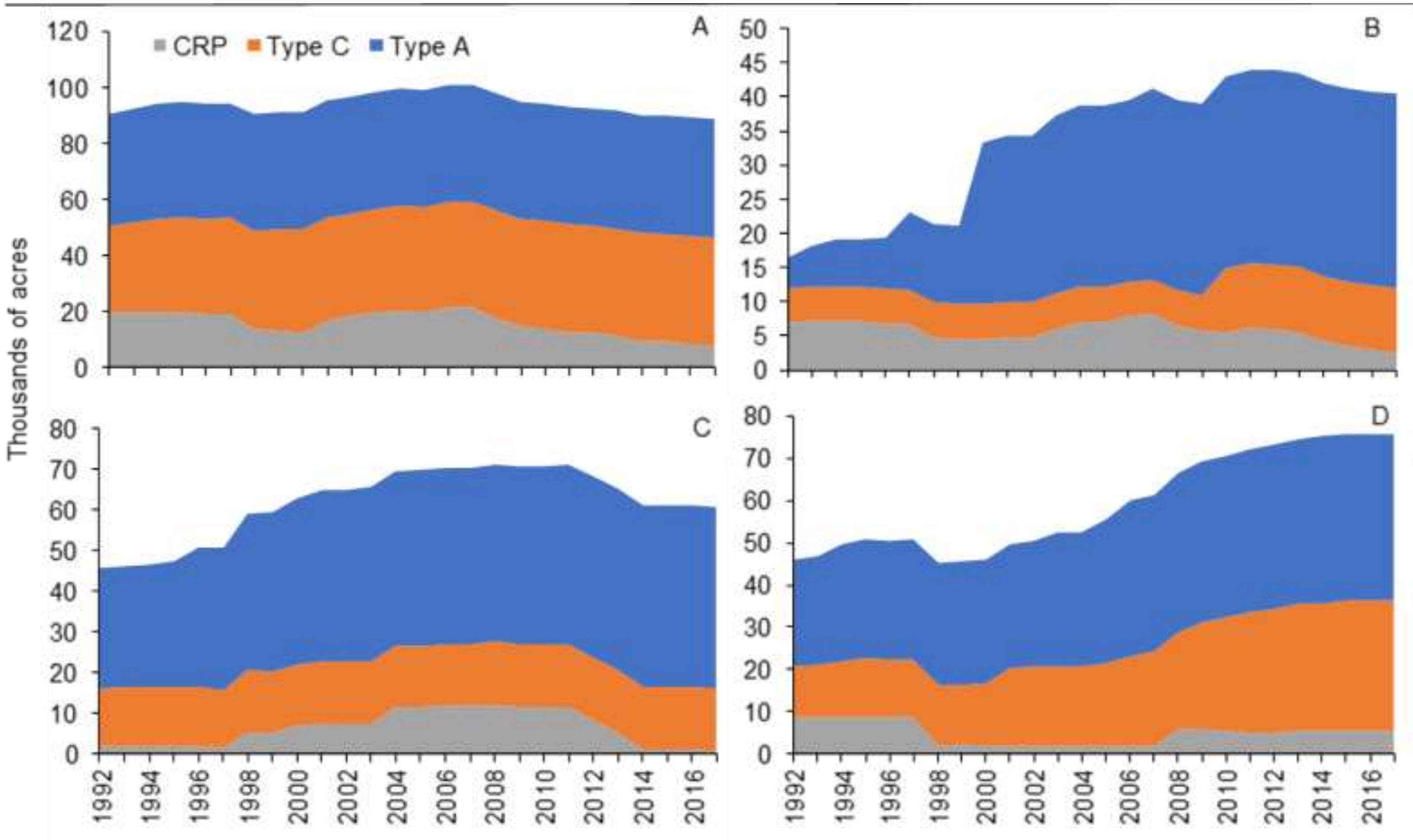
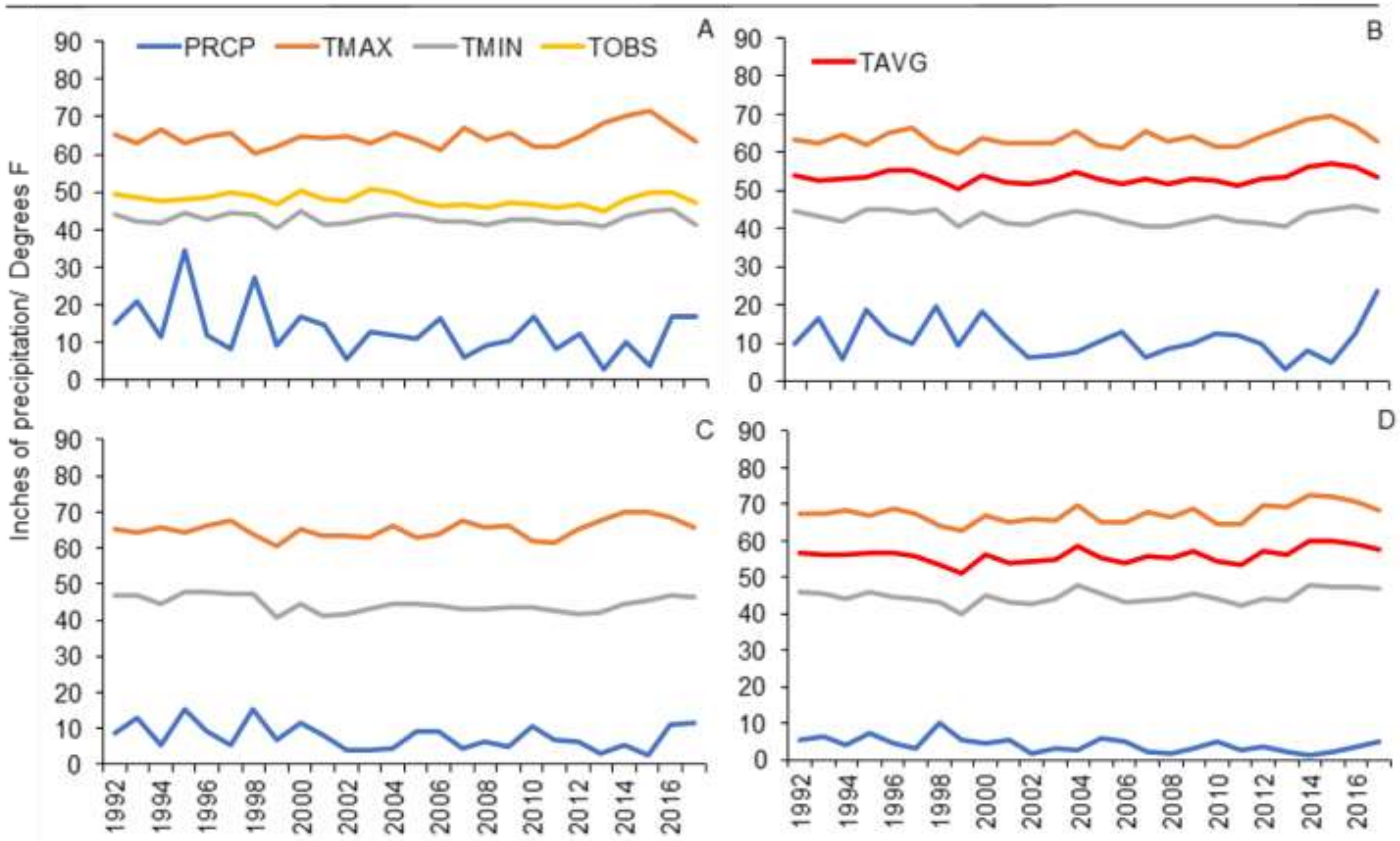


Figure G-23. Climactic data at one weather station by Central Valley Joint Venture Planning Region, California, 1992–2017. Panel A: Sacramento, Panel B: Yolo–Delta, Panel C: San Joaquin, Panel D: Tulare. PRCP = precipitation, TMAX = average maximum daily temperature, TMIN = average minimum daily temperature, TOBS = average daily temperature taken each hour, TAVG = average of average daily temperature. Precipitation is sum-total January–April, Temperature is average of January–April. Sacramento station = Marysville, Yolo – Delta station = Stockton Airport, San Joaquin Station = Modesto Airport, Tulare Station = Kettleman City.



Appendix H. Estimated Retrieved Harvest of Certain Ducks in California, 1962–2023.

Year	Mallard	Gadwall	American Wigeon	Green-wing Teal	Blue-winged/ Cinnamon Teal	Northern Shoveler	Northern Pintail	Wood Duck	Redhead	Canvas-back	All Other Species	Total
1961	197.0	19.2	183.9	153.3	28.9	108.4	299.3	7.3	0.8	0.4	49.3	1,047.8
1962	167.0	17.5	128.5	145.1	48.8	86.8	285.3	12.1	1.0	0.0	70.1	962.2
1963	267.5	42.3	159.2	242.5	59.5	182.3	415.7	14.7	4.3	0.0	72.0	1,460.0
1964	249.0	40.5	166.3	214.6	49.4	77.2	342.0	17.0	7.8	9.2	74.2	1,247.3
1965	295.0	41.7	202.2	216.2	59.1	139.6	373.0	34.7	10.6	8.3	79.9	1,460.3
1966	288.4	51.5	215.2	267.1	36.6	162.3	563.0	13.1	8.6	39.9	97.5	1,743.2
1967	446.0	85.3	311.8	363.1	73.1	194.2	798.5	24.3	9.8	15.5	133.6	2,455.2
1968	236.2	34.2	169.6	262.5	42.6	111.5	381.1	11.3	5.5	10.5	68.3	1,333.4
1969	331.7	43.3	229.9	332.2	49.2	197.4	900.5	18.8	6.0	12.3	94.4	2,215.8
1970	371.0	43.5	264.0	361.3	38.2	201.8	1,032.9	21.4	12.9	26.9	77.7	2,451.5
1971	313.4	66.0	255.3	295.9	44.6	189.3	752.1	14.2	13.2	34.4	96.6	2,075.0
1972	321.8	49.3	231.5	332.6	64.9	157.4	715.3	21.2	5.8	0.9	90.2	1,991.0
1973	219.4	32.4	145.6	245.2	94.8	101.1	477.0	32.7	9.5	13.8	79.5	1,451.0
1974	292.3	60.2	194.3	319.6	59.8	167.4	712.4	21.7	8.9	27.1	59.4	1,923.0
1975	293.1	46.5	193.9	344.7	47.7	184.5	746.9	19.3	5.4	28.1	49.5	1,959.6
1976	305.6	37.6	278.7	403.0	42.5	185.6	680.6	23.4	6.6	34.2	82.9	2,080.6
1977	229.7	27.4	162.4	306.4	44.8	115.3	350.8	24.3	7.1	22.4	82.9	1,373.5
1978	294.3	39.2	179.4	405.1	64.9	161.0	596.0	29.0	8.2	14.1	66.0	1,857.2
1979	260.7	47.9	168.3	292.0	42.4	112.6	641.5	12.4	6.6	14.8	63.1	1,662.3
1980	238.6	64.2	165.6	259.1	27.1	108.4	410.0	40.2	10.8	10.3	67.6	1,401.8
1981	239.0	33.6	125.8	211.8	28.9	120.4	261.0	23.8	7.9	14.3	73.8	1,140.3
1982	284.2	53.8	122.8	266.5	50.3	140.2	327.9	26.2	10.9	10.6	59.6	1,353.1
1983	298.6	59.2	103.7	203.7	58.9	112.4	334.3	23.1	14.8	6.9	71.4	1,287.0

Estimated Retrieved Harvest of Certain Ducks in California, 1962–2023, continued.

Year	Mallard	Gadwall	American Wigeon	Green-wing Teal	Blue-winged/ Cinnamon Teal	Northern Shoveler	Northern Pintail	Wood Duck	Redhead	Canvas-back	All Other Species	Total
1984	265.1	43.3	94.6	178.2	52.6	91.9	194.9	15.7	6.6	12.2	50.8	1,005.9
1985	261.8	53.6	106.0	180.7	28.6	99.6	200.3	9.5	6.7	27.5	52.7	1,027.0
1986	257.6	57.7	113.9	176.8	19.0	86.6	194.5	20.2	4.4	16.3	43.2	990.2
1987	228.4	50.4	124.3	214.1	29.4	113.1	243.8	11.8	5.3	12.6	49.8	1,083.0
1988	139.7	23.2	62.7	122.1	16.0	44.1	70.3	9.6	2.3	0.1	23.7	513.8
1989	175.8	42.1	71.8	185.0	31.9	64.2	91.6	15.9	4.6	7.2	33.3	723.3
1990	179.7	45.2	80.1	149.9	19.4	69.5	80.3	11.4	2.5	4.2	28.7	671.0
1991	161.2	40.4	94.3	169.7	13.7	49.4	81.3	14.3	1.8	4.7	23.0	653.9
1992	182.7	33.3	72.9	183.9	18.4	74.1	75.0	16.4	3.5	8.8	39.2	708.1
1993	228.4	63.1	77.3	219.2	25.7	60.2	90.5	31.9	5.6	10.2	37.1	849.2
1994	197.4	68.7	97.6	183.0	14.7	106.0	92.0	20.8	5.8	14.4	51.0	851.3
1995	259.8	85.4	159.2	291.2	35.4	101.5	162.7	28.8	9.0	10.2	59.6	1,202.8
1996	374.4	104.1	175.6	306.5	39.4	164.1	182.0	26.4	10.8	12.7	66.4	1,462.4
1997	312.2	79.4	162.0	311.6	36.9	172.6	188.2	22.5	11.7	17.1	67.3	1,381.5
1998	452.6	129.6	166.5	352.4	62.0	217.1	146.3	33.4	15.9	21.4	55.2	1,652.4
1999	328.2	69.4	153.9	285.5	66.8	116.1	123.3	25.6	5.0	13.8	47.9	1,235.5
2000	309.5	62.4	113.1	207.2	31.3	87.5	85.4	32.0	4.7	10.6	39.6	983.3
2001	307.9	65.4	146.9	200.5	36.1	111.6	89.7	32.5	4.3	6.6	51.5	1,053.0
2002	191.3	83.7	134.4	239.7	35.6	103.9	79.9	24.7	4.9	0.7	52.4	951.2
2003	288.1	79.7	112.8	218.0	46.2	96.2	79.2	25.2	8.2	7.0	51.5	1,012.1
2004	359.7	132.6	196.8	348.7	57.3	147.7	98.8	22.5	9.6	11.5	94.1	1,479.3
2005	349.8	105.0	176.8	297.6	58.2	128.8	115.7	39.4	7.8	4.8	43.3	1,327.2
2006	349.1	124.2	165.7	331.3	56.9	224.6	123.2	31.3	9.1	17.5	47.9	1,480.8
2007	270.3	122.2	218.8	402.9	43.4	275.3	137.9	33.7	9.5	32.6	86.4	1,632.9

Estimated Retrieved Harvest of Certain Ducks in California, 1962–2023, continued.

Year	Mallard	Gadwall	American Wigeon	Green-wing Teal	Blue-winged/ Cinnamon Teal	Northern Shoveler	Northern Pintail	Wood Duck	Redhead	Canvas-back	All Other Species	Total
2008	255.9	110.2	271.8	468.5	39.9	209.5	169.4	36.3	7.0	0.6	64.2	1,633.7
2009	262.4	117.9	195.3	387.5	35.3	157.7	177.1	27.1	6.6	9.8	63.6	1,591.4
2010	332.0	124.4	226.2	394.9	48.2	220.8	242.6	34.1	7.7	17.6	85.6	1,734.1
2011	308.1	106.2	169.8	311.9	36.9	253.9	201.6	21.0	14.3	15.9	47.2	1,489.1
2012	243.5	95.3	193.7	371.2	31.9	291.5	201.1	21.9	14.6	23.4	25.0	1,738.1
2013	127.9	60.7	152.5	258.8	22.0	197.3	130.5	5.5	7.7	30.0	67.9	1,062.3
2014	106.3	56.4	161.5	240.5	18.1	155.1	115.6	9.3	3.8	15.5	66.7	948.8
2015	119.3	83.4	221.1	327.5	19.2	233.0	161.5	8.0	4.4	25.3	62.2	1,266.3
2016	143.6	71.2	158.7	381.9	33.7	139.4	135.4	11.9	4.1	17.7	55.7	115.3
2017	209.3	112.4	185.4	356.7	45.0	169.3	119.4	23.8	8.3	15.6	60.3	1,305.5
2018	144.5	61.7	157.4	316.9	30.6	141.5	138.7	12.3	7.2	14.9	57.5	1,083.2
2019	147.7	53.5	141.2	288.9	25.5	122.7	99.5	13.6	6.7	12.4	49.5	962.2
2020	136.2	60.4	196.8	294.8	33.9	160.9	102.4	12.6	8.8	21.5	60.8	1,089.6
2021	87.5	43.4	141.3	291.9	14.7	166.8	76.7	13.3	4.3	15.8	73.3	929.0
2022	96.1	46.7	112.8	181.0	16.1	149.4	59.2	68.4	29.5	59.1	35.3	726.5
2023	151.1	63.1	125.7	305.3	51.1	162.5	79.2	24.0	5.9	12.6	53.9	1,034.4

% Change From:	Mallard	Gadwall	American Wigeon	Green-wing Teal	Blue-winged/ Cinnamon Teal	Northern Shoveler	Northern Pintail	Wood Duck	Redhead	Canvas-back	All Other Species	Total
2022	57.2%	35.1%	11.4%	68.7%	217.4%	8.8%	33.8%	-64.9%	-80.0%	-78.7%	52.7%	42.4%
LTA*	-39.5%	-2.3%	-22.7%	10.7%	27.0%	13.1%	-71.7%	9.2%	-23.1%	-16.2%	-12.5%	-21.7%

% State's Total Duck Harvest:	Mallard	Gadwall	American Wigeon	Green-wing Teal	Blue-winged/ Cinnamon Teal	Northern Shoveler	Northern Pintail	Wood Duck	Redhead	Canvas-back	All Other Species
2023	14.6%	6.1%	12.2%	29.5%	4.9%	15.7%	7.7%	2.3%	0.6%	1.2%	5.2%
LTA*	18.9%	4.9%	12.3%	20.9%	3.0%	10.9%	21.2%	1.7%	0.6%	1.1%	4.7%

*LTA = Long-term Average, 1961-2022.

Appendix I. Possible Effects of Spinning Wing Decoys in California

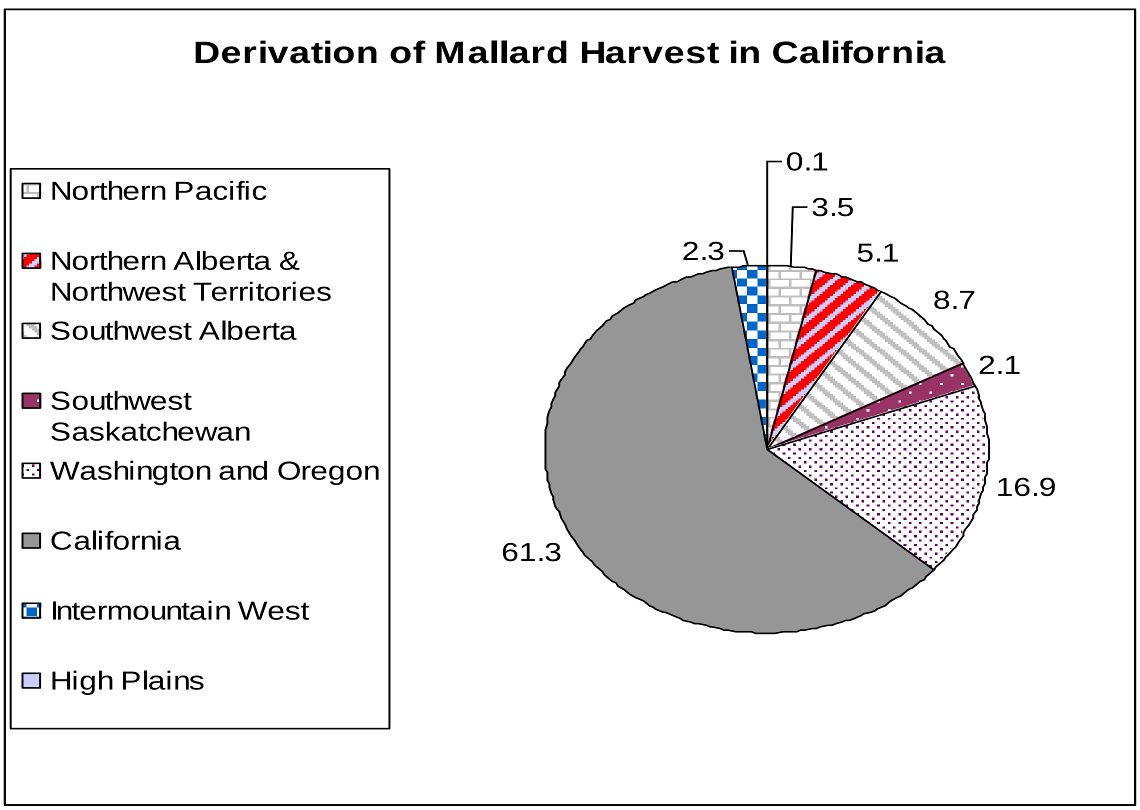
Introduction

The use of mechanical or electronic duck decoys (also known as spinning wing decoys (SWDs), “rotoducks”, “motoducks”, motion wing decoys, etc.) may lead to increases in harvest beyond those anticipated by existing bag limits and season length. Some hunters and other members of the public are opposed to the use of these devices because they believe that the devices may lead to excessive harvest or exceed the bounds of “fair chase” and eliminate the emphasis on traditional hunting methods.

The Department examined the results of studies, existing monitoring programs, and initiated additional analyses to assess the potential effects of SWDs on the harvest of ducks. Monitoring programs (i.e. estimates of breeding populations, total harvests) are not designed to measure the effectiveness of a single harvest method, such as a SWD.

These analyses mostly focus on mallards because mallards are the most abundant breeding duck in the State, are the most frequently occurring duck species in the harvest (Appendix H) and, unlike other species of ducks, are mostly derived from within California (62%; J. Dubovsky, USFWS, unpub data, Figure I-1).

Figure I-1. Derivation of Mallard Harvest in California.



Department Surveys on the Use and Effectiveness of SWDs

The widespread use of SWDs in California began in 1998. The Department compared the daily harvest of hunters on public hunting areas who said they used SWDs to those that said they did not during the 1999-00 to 2001-02 seasons.

Hunters were sampled on five public hunting areas (Delevan National Wildlife Refuge, Upper Butte Basin Wildlife Area, Grizzly Island Wildlife Area, Los Banos Wildlife Area, and Mendota Wildlife Area) on 10 randomly-selected dates during the 1999-00 hunting season and again on five areas (Sacramento National Wildlife Refuge, Upper Butte Basin Wildlife Area, Grizzly Island Wildlife Area, Los Banos Wildlife Area, and Mendota Wildlife Area) on 14 random days during the 2000-01 hunting season. During the 2001-02 hunting season, sampling occurred on 10 days picked at random on the Delevan National Wildlife Refuge, Upper Butte Basin Wildlife Area, Grizzly Island Wildlife Area, Los Banos Wildlife Area, and Mendota Wildlife Area. The results from nearly 23,000 hunter-days from the three-year survey are summarized in Table I-1. Use of SWDs generally increased in the second year of study, especially in the Sacramento Valley, but use declined on some areas during the third year of study on some areas. SWD use varied from 16 to 59% of hunters. There were no other differences between years. Total ducks harvested was significantly greater for hunters using SWDs on all five areas, and the overall average increase was about 1 bird per hunter.
Although the average number of mallards taken by hunters using mechanical duck decoys trended higher, harvest on only one of the five areas was higher at a statistically significant level in one year. The overall average increase in mallards bagged for hunters using SWDs was about 0.5 mallards per hunter-day.

Although average numbers of ducks taken by hunters using SWDs were higher than the averages by hunters that did not use the devices, and use of the devices was common, overall duck harvest on the public hunting areas in 1999 (201,000); 2000 (165,000); and 2001 (157,000); was lower than in 1998 and the overall ducks per hunter per day was essentially unchanged.

Effectiveness of December 1st Regulation

Beginning in 2001, the Commission adopted a prohibition on the use of electronic or mechanically operated spinning-wing decoys from the beginning of the waterfowl season until November 30th. Before and after the regulation change, a variety of changes have occurred with mallard harvest regulations (i.e. opening days, bag limits, season length). The Department analyzed public hunt results to see if any changes have occurred with mallard harvest in relation to the regulation change. Mallards were chosen for this analysis, since the December 1st regulation was created when the breeding population of mallards in California was declining. Beginning in December, a larger percentage of migrant mallards start appearing in the harvest.

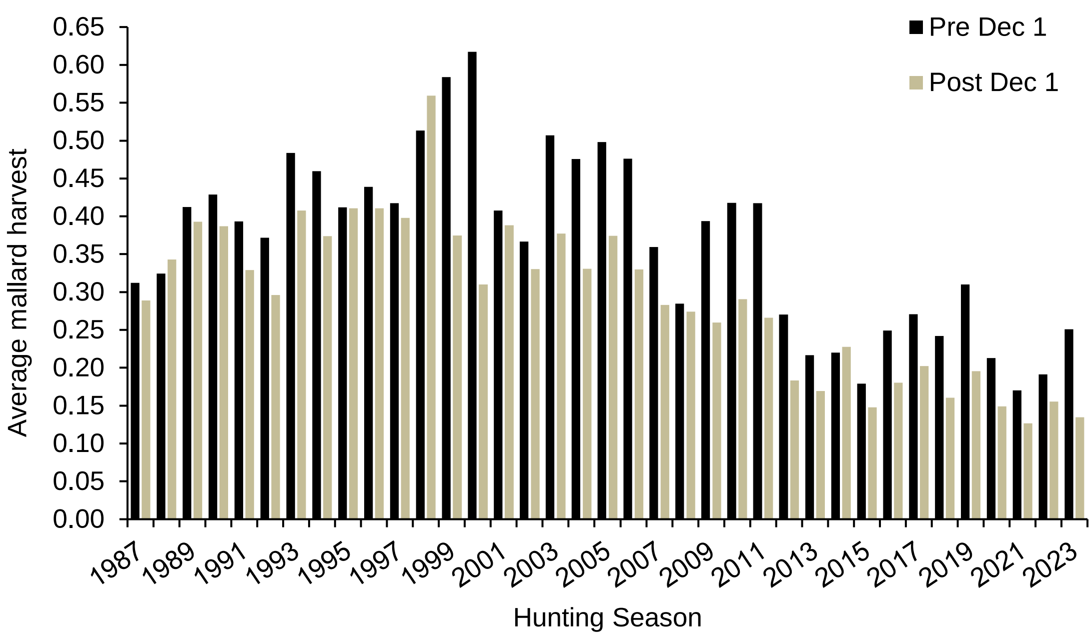
Table I-1. Use and success of hunters using SWD on selected public hunting areas.

Area/Year	% Who Used Decoy	Total Duck Harvest	% Mallard	Avg Mallards per Hunter	Avg Ducks per Hunter	Sample Size	Total Hunter Visits
Little Dry Creek 1999-00	52 – YES 48 - NO	2431 1610	36 34	1.4 1	3.9 2.8	1197	5030
Little Dry Creek 2000-01	59 – YES 41 - NO	2707 1006	47 51	1.4 0.8	2.9 1.6	1550	4650
Little Dry Creek 2001-02	52 – YES 47 - NO	2697 1553	42 47	1.86 1.32	4.42 2.79	1165	4188
Delevan 1999-00	52 – YES 48 - NO	1643 1177	17 18	0.5 0.4	2.6 2	1210	7061
Delevan 2000-01	not sampled						
Delevan 2001-02	45 – YES 54 - NO	1831 1251	30 30	1.09 0.6	3.55 2.02	1132	5941
Sacramento 1999-00	not sampled						
Sacramento 2000-01	57 – YES 43 - NO	1271 904	24 32	0.5 0.6	1.8 1.7	1212	8656
Sacramento 2001-02	not sampled						
Grizzly Island 1999-00	29 – YES 71 - NO	1129 1998	14 18	0.3 0.3	2 1.4	1978	8658
Grizzly Island 2000-01	36 – YES 64 - NO	1508 1852	28 26	0.5 0.3	1.8 1.2	2305	7176
Grizzly Island 2001-02	39 – YES 60 - NO	699 652	17 17	0.24 0.14	1.42 0.85	1250	5880
Los Banos 1999-00	24 – YES 76 - NO	416 786	31 28	0.6 0.3	1.8 1.1	981	4314
Los Banos 2000-01	41 – YES 59 - NO	802 448	31 35	0.7 0.3	2.1 0.9	914	4698
Los Banos 2001-02	34 – YES 65 - NO	454 502	16 23	0.32 0.26	2 1.17	654	4427
Mendota 1999-00	16 – YES 84 - NO	790 3179	16 13	0.4 0.2	2.4 1.8	2133	9886
Mendota 2000-01	24 – YES 76 - NO	1224 2716	29	0.6	2 1.3	2638	10196
Mendota 2001-02	28 – YES 71 - NO	1842 3056	12 12	0.33 0.22	2.59 1.71	2497	11132

A mallard per hunter visit was calculated for all public hunt areas. Although waterfowl zones and other issues exist (e.g. delay due to rice harvest), these were controlled for by computing an average mallard take per hunter day on all areas before and after December 1 (including this date). Additionally, for analysis, data from 1992–2006 was partitioned into three categories: 1992–1997, 1998–2000, and 2001–2006). Use of SWDs began during the 1998-1999 hunting season in California and continued without limitations until the December 1st regulation starting with the 2001-02 waterfowl hunting season. Therefore, we have a five-year buffer (before and after restriction) on each side of their uncontrolled use on public hunting areas (Figure I-2). Also Included are past years (2007–2023) average mallard take per day on public areas.

Based on statistical tests (ANOVAs), there was no difference in mallard harvest per hunter day during the three time periods after December 1 ($P = 0.617$). However, there were significant differences in hunter harvest per day among the three time periods before December 1 ($P = .005$). On average, the mallard harvest per hunter-day was 33% larger from 1998–2000 than 1992–1997 before December 1. The mallard harvest per hunter day was 26% larger for the same period when compared to 2001–2006 seasons. Based on public hunt results, it appears that the December 1st regulation has significantly decreased harvest on mallards on public hunt areas (on a hunter-day basis).

Figure I-2. Average Mallard harvest on the public hunting areas relative to December 1, 1992-2023 hunt seasons.

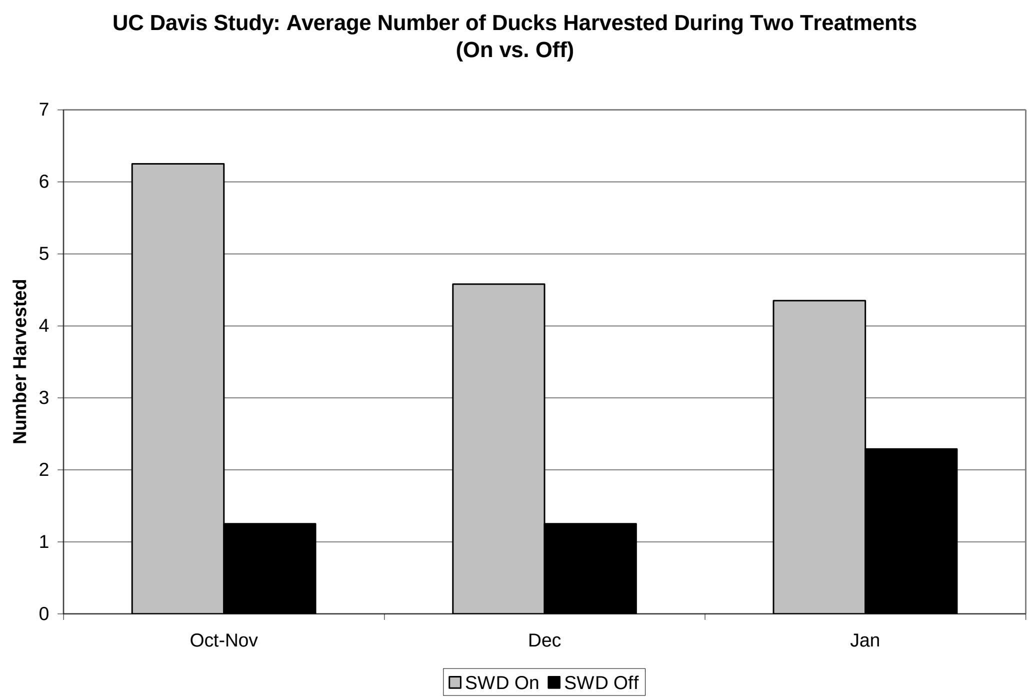


Studies and Scientific Literature on Spinning Wing Decoys (SWDs)

University of California Davis Study

A more rigorous study during the 1999-00 hunting season by the University of California, Davis, also indicated an increase in harvest, particularly early in the season. In this study, hunters were observed during alternating 30-minute periods with SWDs in use and not in use. A total of 37 hunts were conducted. Overall, when hunters used a mechanical duck decoy, they shot about 2.5 times as many ducks as when they didn't use one. Early in the season, hunters using the device shot nearly 7 times more ducks than when the same hunters didn't use the device (Eadie et al. 2001). Summary information from this study is provided in the Figure I-3.

Figure I-3. Summary results from University of California, Davis Study



Arkansas Study

In Arkansas, a study was conducted for 2 years (2001-02 and 2002-03) to evaluate their effectiveness. Overall, 272 hunters killed 537 ducks during 101 hunts. Mallards comprised 57% of the harvest. Of ducks taken, 64% were harvested during periods when decoys were on and only 36% when off. Results of paired observations indicate that kill per hunter was 1.8 times greater with decoys on versus off. Similarly, 1.3 times as many flocks were seen per hunt, 1.8 times as many shots were fired per hunter and 1.2 times as many cripples were lost during periods when SWDs were on versus off. Age ratios of harvested mallards were similar with decoy use (Imm./Adult ratio = 0.26 when ON and Imm./Adult ratio = 0.23 when OFF), however, adult mallards were 2 times more likely to be shot during periods with a robo" decoy on than off. Body mass was similar for mallards shot and retrieved during both treatments (ON and OFF) (M. Checkett, Arkansas Game & Fish Commission, unpub. data).

Manitoba, Canada, Study

In Manitoba, Canada, during the falls of 2001 and 2002, 99 experimental marsh and 55 experimental field hunts were conducted. Each hunt consisted of a series of equal and alternating 15-minute experimental (SWD on) and control (SWD off) periods, separated by a 3-minute buffer. Duration of total hunts ranged from 1.0 to 3.0 hours with an average of 1.4 ± 0.5 hours. Experimental marsh hunts indicated that mallards were 1.9 times more likely to fly within gun range, the kill rate was 5.0 times greater, size adjusted body mass of harvested mallards was greater, and the crippling rate was 1.6 times lower in experimental than control periods. Field hunts indicated that mallards were 6.3 times more likely to fly within gun range, kill rate was 33 times greater, and crippling rate was 2.2 times lower in experimental than control periods. A SWD activity*age interaction indicated that adult males harvested during experimental periods had higher size adjusted body mass than that of juvenile mallards harvested during experimental periods. However, body condition of harvested adult and juvenile mallards did not differ significantly during control periods (Caswell and Caswell 2004).

Minnesota study

In Minnesota, due to concerns about the potential increased harvest of local mallards, 219 experimental hunts with 367 volunteer hunters were conducted during 1,556 sampling periods (both ON and OFF treatments) during the 2002 waterfowl season. When using a SWD, mallards were 2.91 times more likely to respond to the decoy (within 40 m) as compared to when off. Flock size was larger when the decoy was on, as compared to off. The number of mallards killed/hour/hunter was 4.71 times higher when the SWD was on. There was no difference in crippling loss in treatment types (ON vs. OFF). Age ratios of mallards were 1.89 (HY/AHY birds) versus 0.61 when ON and OFF, respectively. Overall, the study predicted an increase in mallard harvest, if SWDs became widely used in Minnesota (Szymanski and Afton 2004).

Missouri Study

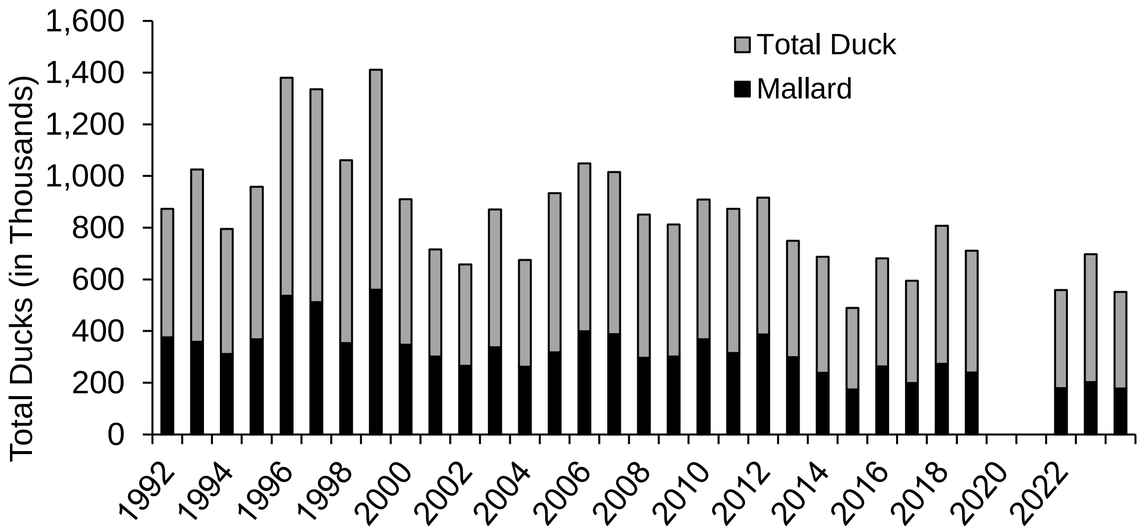
In Missouri, efforts to evaluate the use and attitudes regarding SWD were completed in 2000 and 2001. Hunters using SWDs shot and retrieved 1.28 more total ducks per hunting party (2-3 hunters) and 0.82 more male mallards than when not using a SWD. Missouri waterfowl hunters hunting on public areas were more successful in 2000 when using SWDs than hunters who did not use SWDs. The overall difference in success rate between users and non-users was 0.78 ducks per hunter trip; however, about half of this difference was attributed to factors other than SWDs, such as greater hunting skills. The remaining increase in hunting success, between 0.32 and 0.45 ducks/ hunter trip (13-19% increase in success rate), was attributed to SWDs (A. Raedecke, Missouri Department of Conservation, unpub. data).

These brief summaries of the additional results and other studies (Nebraska) were summarized in Ackerman et al (2006). Overall, 70.2% of all ducks were harvested when the SWDs were used, as compared to 29.8% when the decoy was not in use. Significant results indicated that the probability of being shot increased with latitude (study location) and annual survival rates of species. These results support that fact that ducks may be more naïve at the beginning of migration (i.e. Manitoba), as compared to late in migration (i.e. Arkansas). Ackerman et al. (2006) suggested that these studies “only measured the effect of SWDs on kill rates of ducks and these rates will not necessarily translate into overall changes in population harvest rates.”

California breeding populations

The Department annually estimates the breeding population of ducks in California (CDFW 2022). Results of the current year breeding population survey are not usually available until June of each year. Based on the mallard breeding population, a decline was observed following the 1999 waterfowl season, but this trend was not statistically significant because the annual estimates have large confidence intervals. More recent mallard breeding population levels are similar to the mid-1990s levels when SWDs were not being used for duck hunting. Furthermore, breeding populations of mallards and total ducks have remained relatively stable since 2008 (Figure I-4).

Figure I-4. California Duck Breeding Population Estimates, 1992–2024



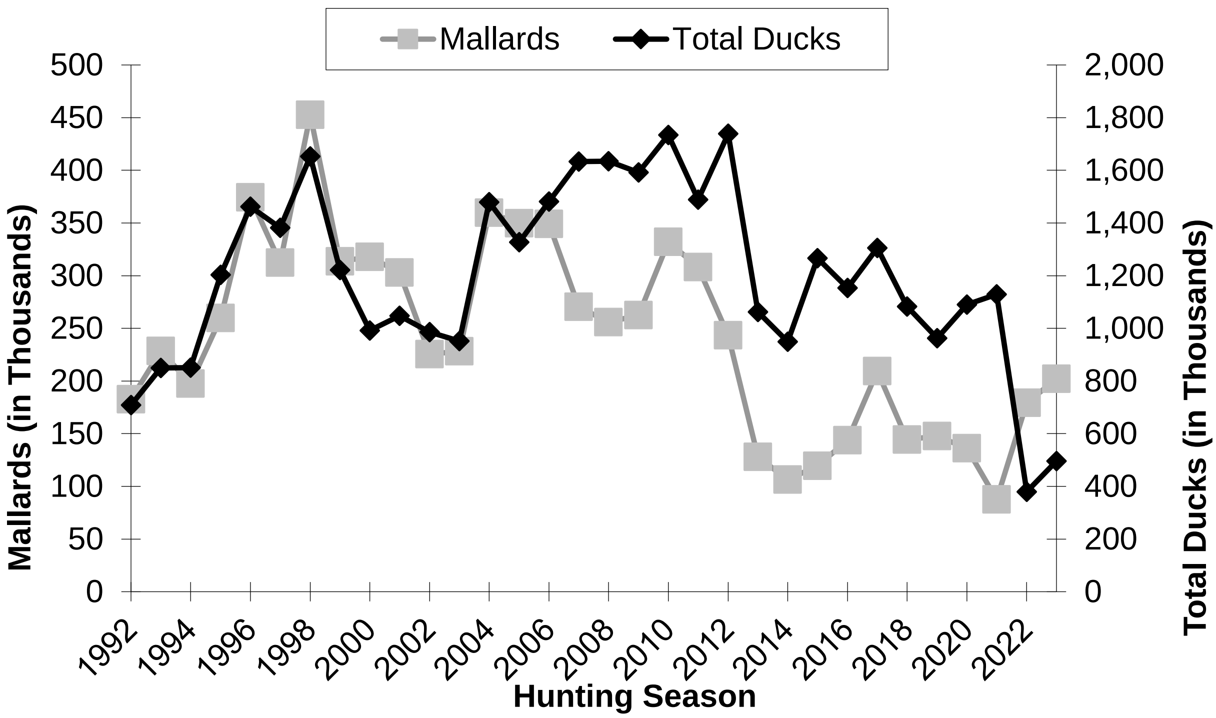
Total estimated duck harvest

The Service annually estimates the harvest of ducks in California and though out the United States. However, the most recent year of harvest is not available until July of the following year. For example, at this time, harvest information from the 2023-24 season is available but harvest estimates from 2024-25 will not be available until July 2025. There remain many factors (e.g., regulations, weather, hunter participation, age ratios in duck populations, etc.) besides the use SWDs that may impact hunter success on an individual hunt, which may transfer to decreased or increased total statewide duck harvest.

Relationships Among Survival & Harvest in Mallards: Issues in Findings

The studies cited above indicate that the use of SWDs increases harvest at the individual hunt level, however, despite the widespread use of SWDs (at least when last measured) overall estimates of harvest have not changed at the same magnitude as indicated in the individual hunt studies (Figure I-5). To have a biological effect at the population level, SWDs would have to be shown to lead to increased harvests and those increased harvests would have to be shown to lead to decreased annual survival rates. Other unmeasured variables act on populations during and after hunting seasons and it is not possible to unequivocally attribute potential population level effects due to SWDs through existing monitoring programs. However, banding data are the most likely of these monitoring programs that provide any inference on the role of SWDs on population parameters of ducks.

Figure I-5. Mallard and Total Duck (all species combined) Harvest in California.



Numerous scientific studies have attempted to improve the understanding of the relationship among harvest rates and annual survival rates of waterfowl (Anderson and Burnham 1976, Nichols et al. 1984, Nichols and Hines 1982, Burnham and Anderson 1984, Johnson et al. 1986, Trost 1987, Raveling and Heitmeyer 1989, Nichols 1991, Smith and Reynolds 1992, Conn and Kendall 2004). Most of these studies have relied on banding data. As an example, Smith and Reynolds (1992) concluded that survival rates increased in response to restrictive regulations, and they rejected the completely compensatory model of population dynamics. Conversely, Sedinger and Rextad (1994) contested those conclusions because Smith and Reynolds pooled data and their analyses had low statistical power. Thus, there is still debate whether existing harvest levels affect survival rates in mallard populations. Partially due to this debate and uncertainty, the Service implemented Adaptive Harvest Management in 1995 to help reduce the uncertainty about the role of harvest and survival rates in population dynamics of mid-continent mallards.

The ability to detect significant changes in estimates of mallard recovery and survival rates in California and relate these changes solely to the use of SWDs, is difficult if not impossible for several reasons.

First, survival and recovery rates are calculated through modeling using data from banded ducks. The data from these banded ducks consists of the number of birds banded (categorized by age, sex, date and location of banding) and reports of encountered bands (usually through hunting for game birds). The number of birds encountered divided by the number of birds banded is the recovery rate. However, not all bands encountered are reported, and an estimate of reporting rate is needed. The product of the recovery rate and the reporting rate is the harvest rate.

Reporting rates have been estimated because this rate is necessary to estimate the harvest rate and harvest rate is necessary to understand the relationship between harvest and population dynamics. Reporting rates vary widely due to band type and even geography (Nichols et al. 1991, 1995, Royle and Garretson 2004). Band types (i.e. their inscriptions) have changed over time. Before the 1990s, "avise" bands were used. These bands were inscribed with "AVISE BIRD BAND, WRITE WASHINGTON DC USA". Later, "address" bands were introduced with the inscription "WRITE BIRD BAND LAUREL MD 20708". These bands were replaced beginning in 1995, but not entirely until about 1999, with "toll-free" bands that were inscribed with "CALL 1 800 327 BAND and WRITE BIRD BAND LAUREL MD 20708 USA". The adoption and widespread advertising of this new reporting method greatly increased reporting rate and apparent recovery rates. Due to the overlap of band types and the timing and duration of research into reporting rates, harvest rates cannot be calculated for all areas in all years.

Secondly, changes in basic hunting regulations (e.g. season length and bag limits) occurred before and after the use of SWDs began. For instance, in 2001 (the first year of the December 1 regulation), the season was 100 days long with a 7 mallard (2 hen) daily bag limit whereas in 2002, the season was 74 days long with a 5 mallard (1 hen) daily bag limit. Thus, changes in harvest and survival rates due to basic regulations could be confounded with any changes to these parameters due to the use of SWDs. More inferences could be made from the standard monitoring programs with stabilized regulations over a period of time.

Third, duck (and presumably mallard) harvest varies annually due to non-regulatory effects (weather, hunter participation, etc.) and survival rates vary due to variation in natural mortality (disease, etc.) (Miller et al. 1988).

With these caveats in mind, the Department calculated recovery rates and survival rates for mallards banded in California between 1988 and 2005. These ducks were banded by the Department, the California Waterfowl Association, and the U.S. Fish and Wildlife Service. Only normal, wild mallards banded from June to September with standard USFWS bands were used in this analysis. The Department examined the data by age class (adult and hatch-year or immature) and sex. Survival and recovery rates were calculated using Brownie models (Brownie et al. 1985) in Program MARK (White and Burnham 1999). Harvest rates were calculated from recovery rates by incorporating reporting rates (Nichols et al. 1995, Royle and Garretson 2004). For comparison purposes, the Department summarized harvest rates for mid-continent mallards during liberal seasons (1979–1984) (Smith and Reynolds 1992) and for mallards from eastern Washington (1981–1998) (Giudice 2003).

For data from mallards banded in California, the data were portioned into 4 time periods (Table I-3): Period 1 (Restrictive season lengths and bag limits, no SWD); Period 2 (Liberal season lengths and bag limits, no SWD); Period 3 (Liberal regulations with SWD, but no December 1 regulation) and, Period 4 (Liberal regulations with December 1 regulation). If SWD affected harvest and survival rates, harvest rates should be highest and survival rates lowest during Period 3. If regulations by themselves change these parameters, harvest rates should be higher and survival rates lower in Period 2 compared to Period 1. If SWD had an effect, survival rates should be lower and harvest rates higher in Period 3 compared to Period 2. If the December 1 regulation had an effect, harvest rates should be lower and survival rates higher during Period 4 compared to Period 3.

Table I-3. Time periods used to summarize basic regulations, SWD use, and the December 1 regulation.

Time Period	Starting Season	Ending Season	Regulations	Pre or Post-SWD	Dec 1st Restrictions
1st	1988	1994	Conservative	Pre-SWD	No
2nd	1995	1997	Liberal	Pre-SWD	No
3rd	1998	2000	Liberal	Post-SWD	No
4th	2001	2004	Liberal	Post-SWD	Yes

Unfortunately, due to the introduction of "toll-free" bands and the increasing and changing reporting rates, harvest rate estimates are only available for Periods 1 and 4. Harvest rates for adults between Period 1 and Period 4 were unchanged and lower than those rates for eastern Washington and mallards from the mid-continent region (Table I-4). However, harvest rates of immature mallards banded in California have increased between periods 1 and 4 by 62 and 30 % for males and females, respectively. Thus, the combination of regulation changes and use of SWD did not change harvest rates of adults, but the combination of more liberal regulations and the use of SWD did change harvest rates of immature mallards. The combination of liberalized regulations and SWD appears to have increased the harvest rate of mallards banded in California to higher levels than occurred in the mid-continent region or eastern Washington (Table I4).

Table I-4. Harvest rates for mallards banded in California (restrictive and liberal periods), eastern Washington (liberal period) and the mid-continent region (liberal period).

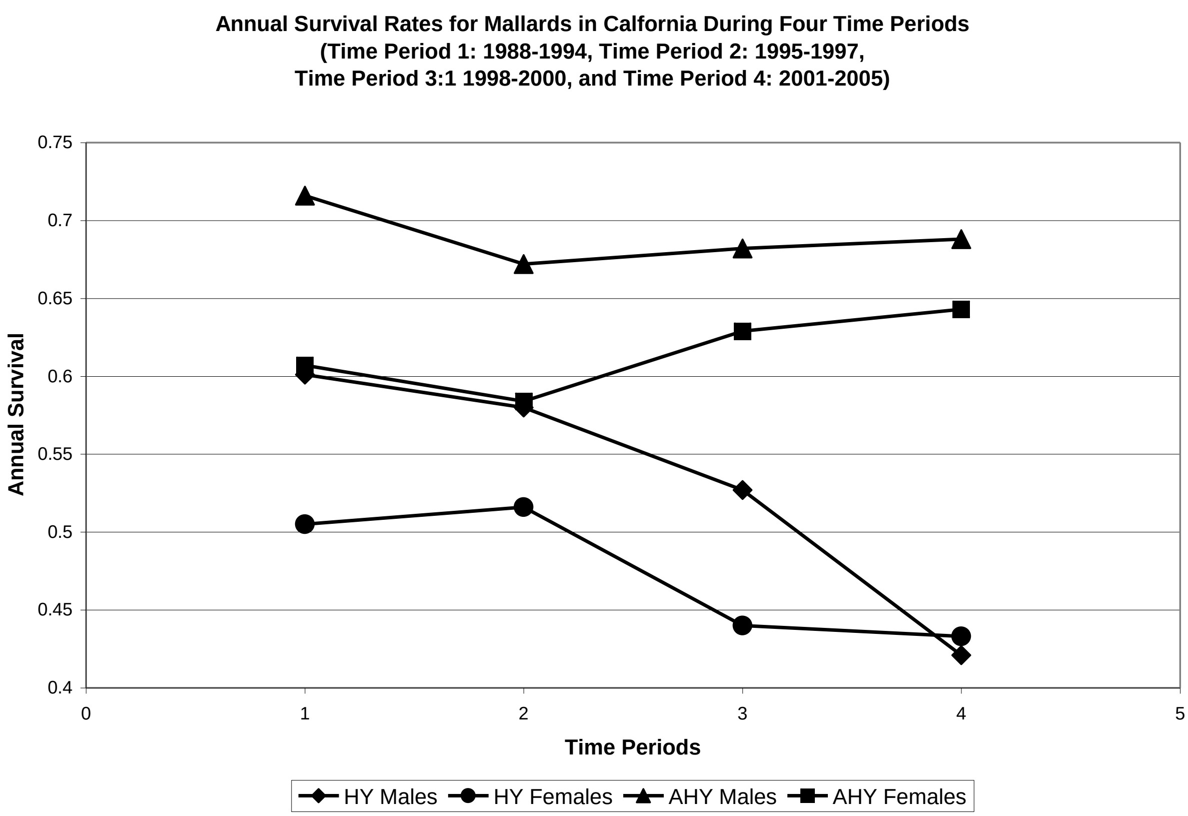
Cohort	California (restrictive)	California (liberal)	Eastern Washington	Mid-Continent (liberal)
Adult Males	0.138	0.138	0.172	0.150
Hatch-Year Males	0.202	0.327	0.286	0.228
Adult Females	0.058	0.058	0.100	0.097
Hatch-Year Females	0.143	0.186	0.172	0.157

Survival rates could be calculated for each cohort (age and sex) for each period (Figure I-6) since recovery and survival rate are not conditional on each other. Covariance among recovery and survival rates must be addressed to understand the impact of harvest on survival rates. Although recovery rates may have increased during these periods, it would not have as large an impact on survival rates, as compared to computed harvest rates. Furthermore, the grouping into time periods also correlates with the introduction of different band types.

Survival rates were constant for adult birds of sexes irrespective of harvest regulations, the use of SWD or the December 1 regulation (Figure I-6). However, survival rates for immature birds declined but only for males was the decline statistically significant (P=0.048).

From these analyses, it appears that adult mallard recovery, harvest and survival rates have not changed despite changes in regulations, the use of SWDs, or the imposition of the December 1 regulation. In contrast, immature mallard harvest rates have increased and survival rates have declined, but these changes may have been due to changing basic regulations, the use of SWDs, both, or other unmeasured variables.

Figure I-6. Annual survival rates of Mallards banded in California.



Public Perception of SWDs

The findings of this section have concentrated on biological information as related to the SWD in California. However, since past public views to the Commission has demonstrated different views on “fair chase”, public opinion information has been added to this review of this topic. In 2005, D. J. Case & Associates, as commissioned by the Association of Fish and Wildlife Agencies, released the findings of the National Duck Hunter Survey. According to this study, 55% of California duck hunters stated that SWDs should be allowed, whereas 26% opposed their use and 19% had no opinion on the subject. Other surveys have shown a wide variety of responses to their opinions on SWDs. For instance, California Waterfowl Association’s 2006 survey indicated that a majority of hunters opposed electronic decoys, but accepted wind driven decoys (California Waterfowl Association, pers. comm.).

Summary of Findings

There is substantial evidence that SWDs can/have increased harvest and harvest potential on an individual hunt basis. Although SWDs have been shown to increase potential harvest, total harvest estimates have not increased at the same magnitude. Furthermore, SWDs have not increased harvest rates nor decreased survival rates on adult mallards. In hatch-year mallards, harvest rates have increased over 60% on males, and survival rates have significantly declined. However, this is not a cause-and-effect relationship because other unmeasured variables were likely occurring simultaneously. The implementation of the December 1 regulation appears to have reduced daily harvest rates of mallards on public hunt areas when compared to unrestricted use of SWDs (1998–2000).

There is no clearly explicit link detectable through existing monitoring programs (or population level measures) between the introduction of SWDs and changes in measured population parameters. There remains no substantial evidence either for or against their large-scale effect on waterfowl populations. There are strongly held opposing positions on the “fair-chase” and other aspects of SWDs. For this reason, the Department has provided an alternative in Chapter 3.