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MIGRATORY GAME BIRD HUNTING
(WATERFOWL, COOTS, MOORHENS)



December 3, 2018

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE



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CHAPTER 1 - SUMMARY

PROPOSED PROJECT AND ALTERNATIVES

The project discussed in this document (the proposed project) involves modifications to the current waterfowl hunting regulations for the 2019-20 waterfowl hunting season. Specifically, the Department is proposing to:

- Add Small Canada geese to the Regular Season in the Northeastern California Zone
- Add Small Canada geese to Season in the Klamath Basin Special Management Area
- Open the Late Season for white geese two weeks after the close of the Regular Season in the Imperial County Special Management Area

The U.S. Fish and Wildlife Service (Service) established the frameworks in late October. 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. States must set waterfowl hunting regulations within the federal frameworks. The Department of Fish and Wildlife (Department) will recommend specific season dates and bag limits to the Fish and Game Commission (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 can only make recommendations within the Federal framework and the Commission's decision is whether to adopt the proposed changes or consider more restrictive regulations.

The Department is providing the Commission with a range of alternatives to the proposed project. Table 1 summarizes the Department findings that there are no significant long-term adverse impacts associated with the proposed project or any of the project alternatives considered for the 2019-20 waterfowl hunting regulations.

SUMMARY OF IMPACTS AND MITIGATION

| Table 1. Summary of Alternatives and Their Impacts | | | |
|---|---|--------------------|------------|
| Alternative | Description | Significant Impact | Mitigation |
| Proposed Project | <p>Add Small Canada geese to the Regular Season in the Northeastern California Zone</p> <p>Add Small Canada geese to Season in the Klamath Basin Special Management Area</p> <p>Open the Late Season for white geese two weeks after the close of the Regular Season in the Imperial County Special Management Area</p> | No | N/A |
| Alternative 1. No Project | No change from the 2018-19 hunting regulations. | No | N/A |
| Alternative 2. Reduced Season Lengths, Timing and Bag Limits | Reduce season lengths, timing, and/or bag limits by up to 50 percent. | No | N/A |
| Alternative 3. Elimination of 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 guidelines 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 1812 9th Street, Sacramento 95811). 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.

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 (40. Stat. 755:16 U.S.C. 703 et seq.), Federal regulations [50 CFR 20 (K)(L)], as well as California statutes (Fish and Game Code sections 355 and 356) and regulations selected by the Commission.

The regulations governing the take of migratory game birds in California are selected by the Commission and forwarded to the Service each year. The regulations selected by the Commission must be within frameworks established by the Service through the following generalized three-step process:

1. The Service, with assistance from the states, assesses the status of migratory game bird populations.
2. The Service establishes regulatory frameworks;
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. Proposals selected by the Commission cannot be more liberal than the frameworks established by the Service (Fish and Game Code, Section 355).

In selecting hunting regulations, the Commission is governed by the State's Conservation of Wildlife Resources Policy (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 (Section 1801 California Fish and Game Code).

In August, the Service provided notice to establish hunting regulations for the 2019-20 hunting season; see Federal Register 83 FR 27836. The notice also solicits public comments and establishes the annual schedule for meetings.

The Department is recommending 3 changes to the existing hunting regulations. The frameworks for the 2019-20 season have been approved by the Flyway Councils and adopted by the Service Regulation's Committee meeting October 16-17, 2018. The frameworks allow for a liberal duck season which includes a 107 day season, 7 daily duck limit including 7 mallards but only 2 hen mallards, 1 pintail, 2 canvasback, 2 redheads, and 3 scaup (during an 86 day season). The Department's proposals for the 2019-20 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 Winter Brant Survey is conducted in January 2019. The regulatory package is to be determined by the most current Winter 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 January survey

The 2019-20 Federal Frameworks Pertaining to California

Ducks, Mergansers, Coots, Common Moorhens, and Purple 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, 1 pintail, 3 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 24 (September 21) 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 24 (September 21) 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 2019 Winter Brant Survey (WBS). If the results of the 2019 WBS are not available, results of the most recent WBS 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 24 (September 21) 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 24 (September 21) 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 U.S. Fish and Wildlife Service approval and a 3-year evaluation by each participating State.

California: The daily bag limit for Canada geese is 10.

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 24 (September 21) and March 10. 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.

AREAS OF CONTROVERSY

A public scoping session regarding the preparation of environmental documents for hunting waterfowl was held on October 18, 2018, at the Wildlife Branch office located at 1812 9th Street, Sacramento. No areas of controversy regarding migratory bird hunting were identified at the meeting. However, members of the public have expressed concern regarding the following: 1) mechanical spinning wing decoys in the use of taking waterfowl during past hunting seasons. Specifically, since 2002 about 100 letters and or public testimony has been received by the Fish and Game Commission 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) the Commission has received numerous letters both supporting and opposing the continued hunting in Morro and Tomales bays; and 3) opposition to the continued restrictions on bag limit and season length for white-fronted geese in the Sacramento Valley Special Management Area.

Concerns about the effect of climate change since the 2006 Final Environmental Document for Migratory Game Bird Hunting of Waterfowl, Coots, and Moorhens (incorporated by reference, State Clearinghouse Number 2006042115, available at 1812 9th Street, Sacramento 95811) was published led to a discussion of this topic in Appendix F.

ISSUES TO BE RESOLVED

As provided by existing law, the Commission is the decision-making body (lead agency) considering the proposed project, while the Department has responsibility for conducting management activities such as 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 special 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 a potential to significantly affect the environment. CEQA review of the proposed project will be conducted in accordance with the Commission's certified regulatory program (CRP) approved by the Secretary for the California

Resources Agency pursuant to Public Resources Code section 21080.5 (See generally Cal. Code Regs., tit. 14, §§ 781.5, and 15251, subd. (b)). The Department has prepared this Environmental Document (ED) which is the functional equivalent of an Environmental Impact Report, on behalf of the Commission in compliance with this requirement. The ED provides the Commission, other agencies, and the general public with an objective assessment of the potential effects.

In addition, 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 regarding the environmental document to the Department of Fish and Wildlife, Wildlife Branch, 1812 9th Street, Sacramento, California 95811. Comments must be received by the Department by 5:00 p.m. on January 25, 2019.

CHAPTER 2 - THE PROPOSED ACTION

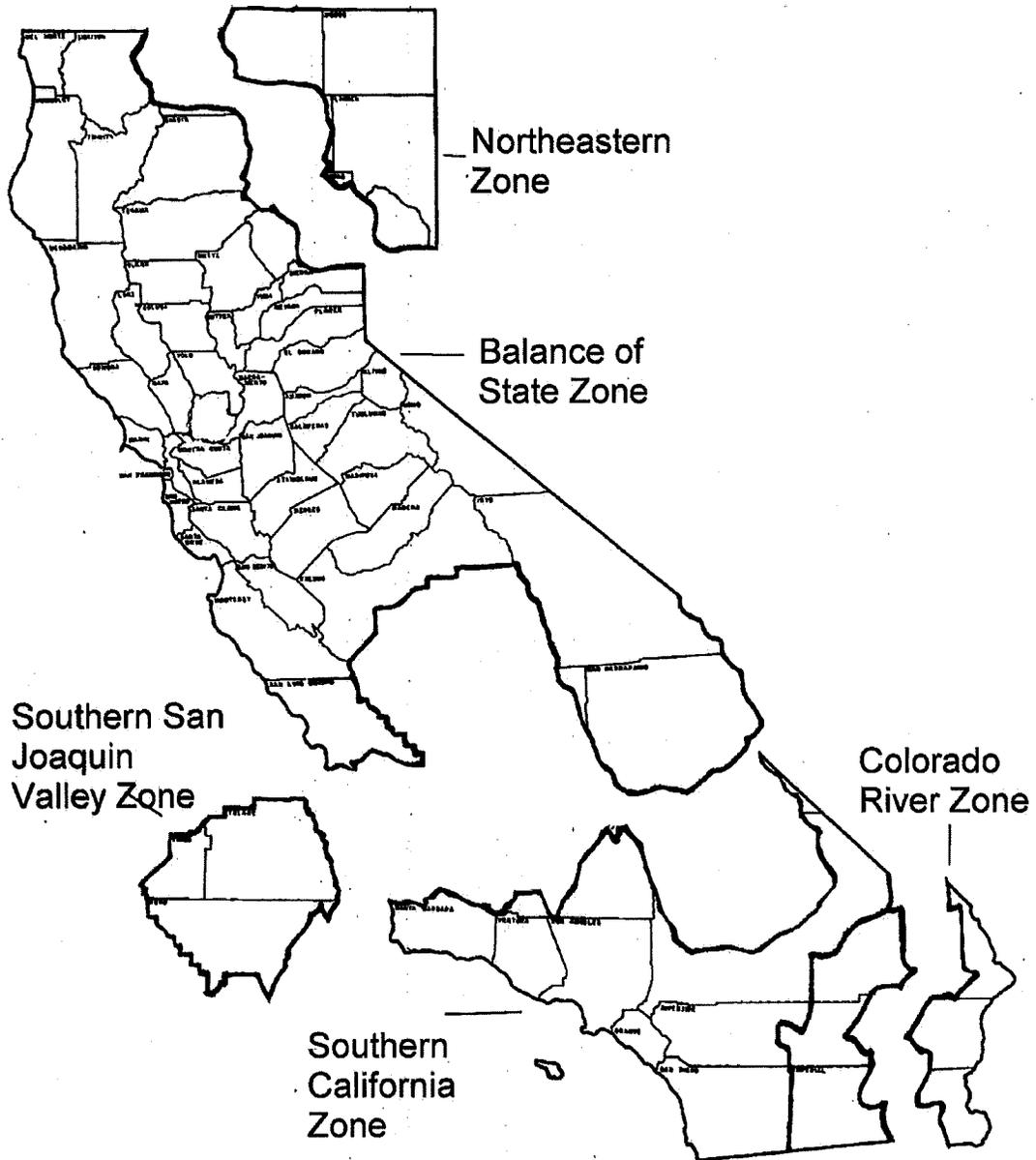
The proposed project being considered consists of the following modifications to existing migratory game bird hunting regulations:

1. Add Small Canada Geese to the Regular Season in the Northeastern California Zone.
2. Add Small Canada Geese to Season in the Klamath Basin Special Management Area.
3. Open the Late Season for white geese two weeks after the close of the Regular Season in the Imperial County Special Management Area.

Table 2. Proposed Changes to Season Dates and Bag Limits for 2019-20.

| 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.) | 1 | 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 | no change |
| Southern California | no change | no change | no change |
| Colorado River | no change | no change | no change |
| Balance of State | no change | no change | no change |
| 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 | no change |
| 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 | no change |
| 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 | no change |
| 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 | | | |
| 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 |
| North Coast 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

Background

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 the following taxonomic families (USDI 1988a:1):

Anatidae (ducks, geese, brant, and swans);
Columbidae (doves and pigeons);
Gruidae (cranes);
Rallidae (rails, coots, and gallinules);
Scolopacidae (woodcock and snipe);
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 do 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

Figure 2. Administrative Waterfowl Flyways



the proposed project in California must consider the status of the affected species at a flyway level.

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 2019 (83 FR 27836-27844). 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 2018a) 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 August 2006, incorporated by reference, State Clearinghouse Number 2006042115, available at 1812 9th Street, Sacramento 95811)

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. 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 2019 (83 FR 27836-27844).

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 mallard breeding population. 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.

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 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. The current strategy was developed in 2010 (75 FR 32873) and designed to maximize long-term cumulative harvest, which inherently requires perpetuation of a viable population. Hunting will be allowed when the observed breeding population is above 1.75 million birds (based on the lowest observed breeding population size since 1985 of 1.79 million birds in 2002).

The adaptive management protocol considers a range of regulatory alternatives for pintail harvest management that includes a closed season, 1-bird daily bag limit, or 2-bird daily bag limit. The maximum pintail season length depends on the general duck season framework (characterized as liberal, moderate, or restrictive and varying by Flyway) specified by mallard AHM.

An optimal pintail regulation is calculated under the assumption of a liberal mallard season length in all Flyways. However, if the season length of the general duck

season determined by mallard AHM is less than liberal in any of the Flyways, then an appropriate pintail daily bag limit would be substituted for that Flyway. Thus, a shorter season length dictated by mallard AHM would result in an equivalent season length for pintails, but with increased bag limit if the expected harvest remained within allowable limits.

Canvasback Harvest Strategy

Since 1994 the Service has followed a harvest strategy that if 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.

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 percent 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.

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 (SRC) 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.

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 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 105 days, 7/day which may include 7 mallards, 2 hen mallard, 2 pintail, 2 canvasback, 2 redheads, 3 scaup during the 86-day season. Possession limit triple the daily bag.

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 the first Saturday in January extending for a period of 14 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 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: Open concurrently with duck season extending for 105 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 third Saturday in October extending for 100 days, 7/day which may include, 7 mallards, 2 hen mallards, 2 pintail, 2 canvasback, 2 redheads, 3 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From the third Saturday in October extending for 100 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 Saturday following the closing of waterfowl season 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: Ducks only, concurrent with duck season and January 28-30, 2019. 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 third Saturday in October extending for 100 days, 7/day which may include, 7 mallards, 2 hen mallards, 2 pintail, 2 canvasback, 2 redheads, 3 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From the third Saturday in October extending for 100 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 Saturday following the closing of waterfowl season 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: Concurrent with duck season and January 28 – February 1, 2019. 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 the third Friday in October extending for 101 days, 7/day which may include 7 mallards, 2 hen mallards or Mexican-like ducks, 2 pintail, 2 canvasback, 2 redheads, 3 scaup during the 86-day season. Possession limit triple the daily bag.

Geese: From the third Friday in October extending for 101 days, 24/day, up to 20 white geese, up to 4 dark geese. Possession limit triple the daily bag.

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

Youth Hunting Days: The Saturday following the closing for waterfowl season. 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: Ducks only. Concurrent with duck season and from January 28 – 31, 2019. 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 third Saturday in October extending for 100 days, 7/day which may include 7 mallards, 2 hen mallards, 2 pintail, 2 canvasback, 2 redheads, 3 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 5 days EXCEPT in the North Coast Management Area where Large Canada geese are closed during the early season. Regular Season: Dark and white geese from the third Saturday in October extending for 100 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season will close after December 21. Late Season: 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 Region. 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 Saturday following the closing of waterfowl season extending for 2 days. To participate in these youth hunts hunters must be 15 years of age or younger and must be accompanied by a non-hunting adult 18 years of age or older.

Falconry Take of Ducks: Open concurrently with duck season and February 2–3, 2019. 3/day. Possession limit triple the daily bag.

North Coast Special Management Area: All of Del Norte and Humboldt counties.

All Canada Geese: From the second Sunday in November extending for a period of 85 days (Regular Season) and from the third Saturday in February extending for a period of 20 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner 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: Geese only. Concurrent with Small 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. 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.

Large 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 (West) 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: Closed after Dec 21, 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

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 8 extending for 37 days. 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 9 extending for 37 days. 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 the first Saturday in November extending for a period of 86 days (Regular Season) and from the first Saturday in February extending for 16 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner under provisions of Section 2016. Up to 15 geese. Possession limit triple the daily bag.

Proposed Changes and Analysis

- Add Small Canada Geese to the Regular Season in the Northeastern California Zone.

The existing regulation only identifies Large Canada geese under the heading of "Regular Season". Small Canada geese were inadvertently omitted from that section when white-fronted goose seasons were modified in prior year rulemakings. Dark geese, by definition, include both Small and Large Canada geese, and white-fronted geese. Dark geese remained listed under the heading of "Daily Bag and Possession Limits" but were removed from the heading of "Regular Season" to accommodate the modified white-fronted goose seasons. This recommendation is to clarify the intent of the regulation and to maintain the hunting season for Small Canada geese in the zone.

- Add Small Canada Geese to Season in the Klamath Basin Special Management Area.

See analysis above for justification. This recommendation is to clarify the intent of the regulation and to maintain the hunting season for Small Canada geese in the special management area.

- Open the Late Season for white geese two weeks after the close of the Regular Season in the Imperial County Special Management Area.

The existing regulation opens the Late Season one week after the close of the Regular Season. The proposed change is intended to allow private land owners to use hunting as a tool to disperse geese and minimize depredation when the greatest concentration of white geese are present.

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 (Section 1801, Fish and Game Code). The policy includes several objectives, as follows:

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 Fish and Game Code provides that the Commission may adopt migratory game bird hunting regulations as long as they are 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 needed.

POTENTIAL FOR SIGNIFICANT EFFECTS

Previous reviews of other potential environmental effects were analyzed extensively in previous environmental documents. The analysis of these fifteen factors regarding migratory game bird hunting were examined in the prior year environmental document (incorporated by reference, August 2006, State Clearinghouse Number 2006042115, available at 1812 9th Street, Sacramento 95811) and certified by the Fish and Game Commission. The modifications proposed are to increase hunter opportunity and reduce depredation of 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 FED and summarized below.

EFFECTS OF HABITAT DEGRADATION

Breeding Areas

The 2006 analysis was presented on page 100 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 are able to 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 the majority of goose populations, because most goose nesting occurs in undeveloped areas of the arctic.

Wintering Areas

The 2006 analysis was presented on page 101 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 percent 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 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). Diseases, pesticides and other contaminants will likely cause the death of waterfowl, coots, moorhens, and common snipe 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 2019-20.

EFFECTS OF ILLEGAL HARVEST

The 2006 analysis was presented on pages 110 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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). In an attempt 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 percent and estimated hunting mortality is 18 percent (based on recoveries of banded birds), all other forms of mortality would thus equal 16 percent of the population. Since other mortality factors are known to exist (disease, predation, starvation, weather), it would seem that illegal harvest is considerably less than 16 percent 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 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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.

EFFECTS OF HARVEST OUTSIDE UNITED STATES

The 2006 analysis was presented on page 113 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 the majority 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 framework regulations by the Service addresses this issue by modifying hunting regulations in response to long-term population fluctuations. The

Department concludes that the combination of the increased 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 was presented on page 115 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 was presented on page 91 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 these 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 was presented on page 93 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 was presented on pages 93 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 was presented on page 96 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 by some degree by the knowledge or observation of hunters in the field. Because the proposed project and existing regulations occurs for no more than 107 days in largely unpopulated areas of the State, this will not result in significant adverse environmental impacts.

EFFECTS OF METHODS OF TAKE AND IMPACTS ON INDIVIDUAL ANIMALS

The 2006 analysis was presented on page 88 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 which creates poor breeding habitat conditions (McLandress *et al.* 1996), lower 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 expose 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 3-A) are the Sacramento Valley, San Joaquin Valley Grasslands, Suisun Marsh and high desert region of Northeastern California. Figures are for mallards because they make up the majority of the breeding duck population in California (see Figure D-4). 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 (Figure 3-B and C). Breeding mallard populations in northeastern California however, do not follow precipitation trends (Figure 3-D) 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 NWR 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 has 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 percent 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 inconsistencies 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 5-C). 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 and 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 percent of all ducks (excluding mergansers; based on long term average 1955 – 2014) in the Pacific Flyway, 40 percent 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 percent, the Sacramento Valley alone supports 43 percent (Olson 2014, Department unpublished data). California waterfowl distribution based on this survey indicates the Sacramento Valley harbors 60 percent of total waterfowl, the San Joaquin has 20 percent, and the Delta, Suisun Marsh, northeastern California combined hold 10 percent of total waterfowl.

Sensitive wintering populations

Sensitive waterfowl subspecies also occur in California during winter. Tule greater white-fronted 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. A special management area that has a reduced season length and bag limit has been maintained in the Sacramento Valley for this population compared to the rest of the state. Department staff monitor harvest by actively measuring all greater white-fronted geese at check stations on the Sacramento National Wildlife Refuge Complex.

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 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 a number of 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 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 (USFWS 2018b; 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).

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 2018 California midwinter survey indicate 1,486,970 Northern pintail, 602,930 Northern shoveler, 595,890 American wigeon, 508,490 American green-winged teal, compared to 211,400 mallards counted on the survey. Nonetheless, mallards are the most sought after species by hunters by proportion of population (USFWS 2018c).

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; $R^2=0.25$, respectively) with subsequent breeding population levels.

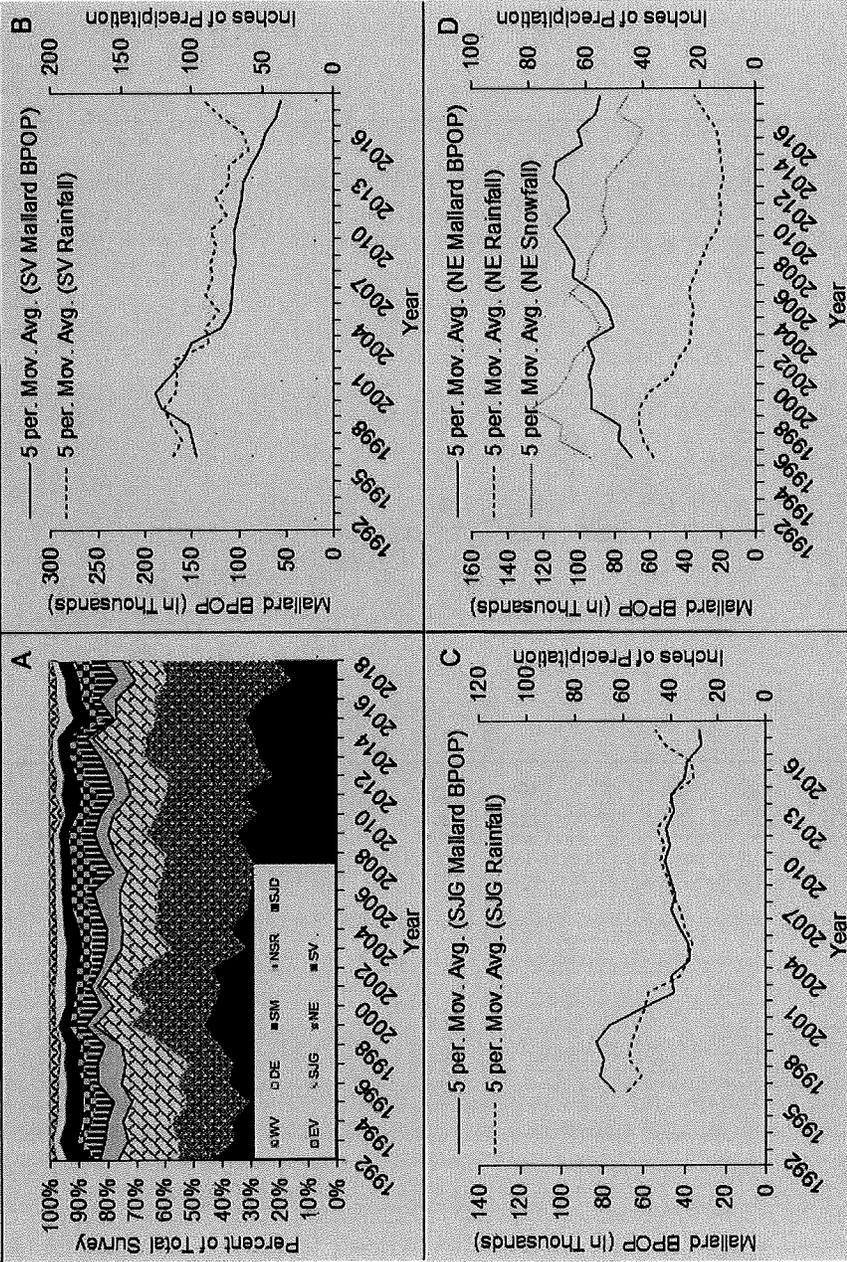
A number of goose populations have increased substantially in the Pacific Flyway in recent years, with continued hunting and more liberal season and bag limits. Examples are the Pacific greater white-fronted goose and the Ross's goose. Pacific greater white-fronted geese have increased from 75,000 in 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 700,000. 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 subsistence or sport 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 than 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 is currently working on revising the management plan for Tule white-fronted geese. The plan will incorporate population estimates derived from Department ground surveys, telemetry data and public hunt area harvest from

check station measurements. These management actions will ensure that population levels of waterfowl species in California are being monitored and hunter harvest is sustainable over the long term.

Figure 3. Proportion of California breeding population by area (Chart A) and area specific mallard BPS estimates with total rainfall (Charts B-D, mallard on left Y axis in thousands; precipitation on right Y axis in inches), 1992-2018



Total precipitation values derived January to April prior to breeding season using Lincoln, Nicolaus, Stonyford, Bango, 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 May prior to breeding season using Cedarville, Doyle, Juniper Creek and Tulelake weather stations.
 4 Total precipitation values derived January to May 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.

CAGO traditional survey - pairs

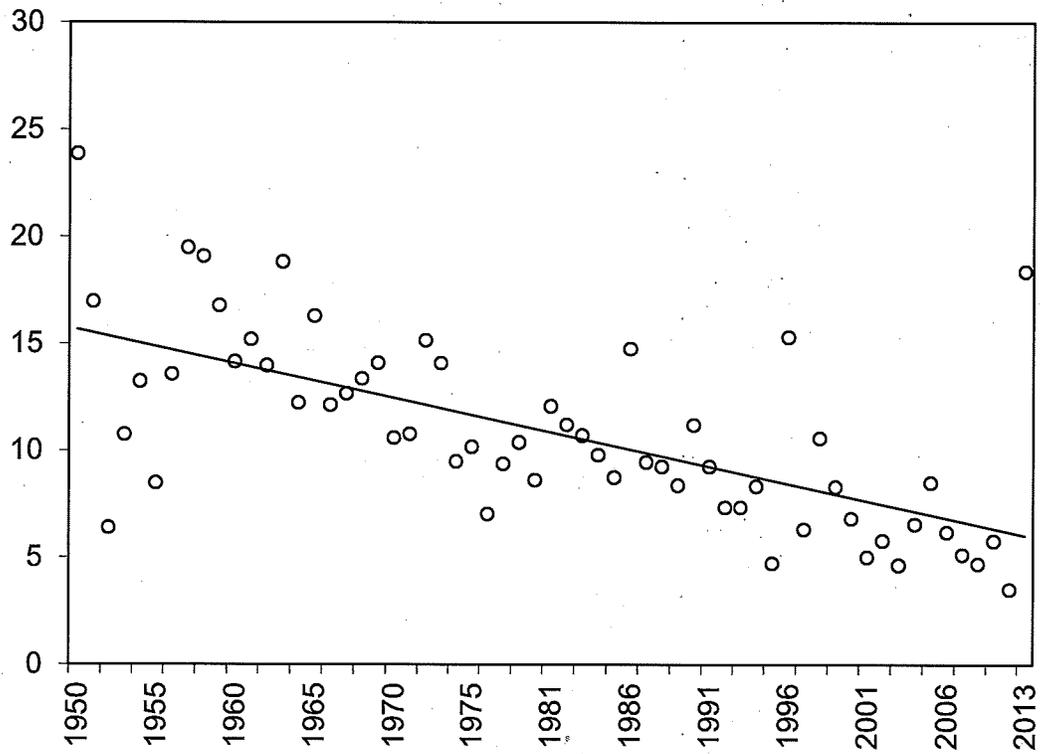


Figure 5. Waterfowl mortality from botulism by area, California 1970-2017.

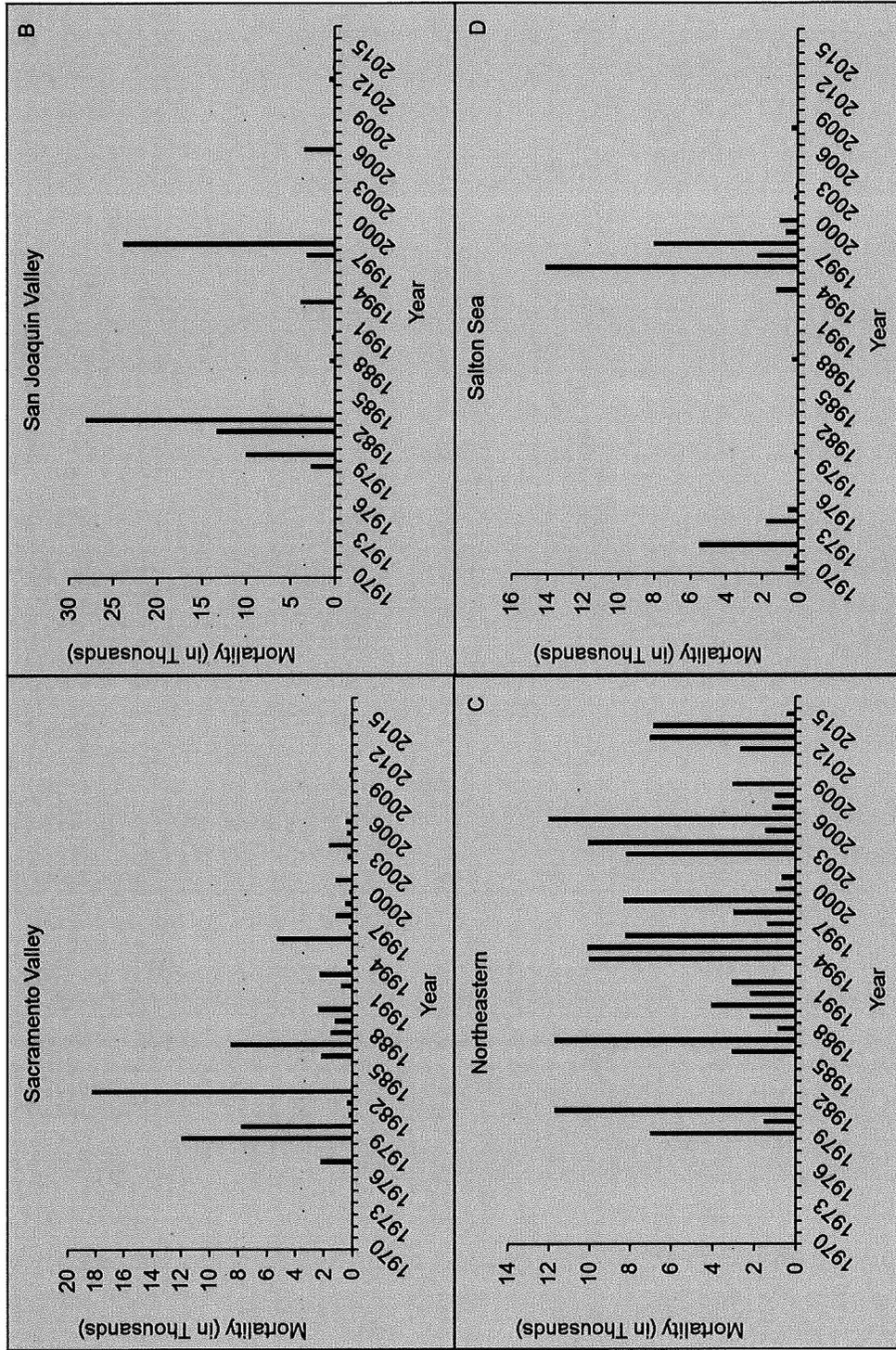


Figure 6. Waterfowl mortality from avian cholera by area, California 1970-2017.

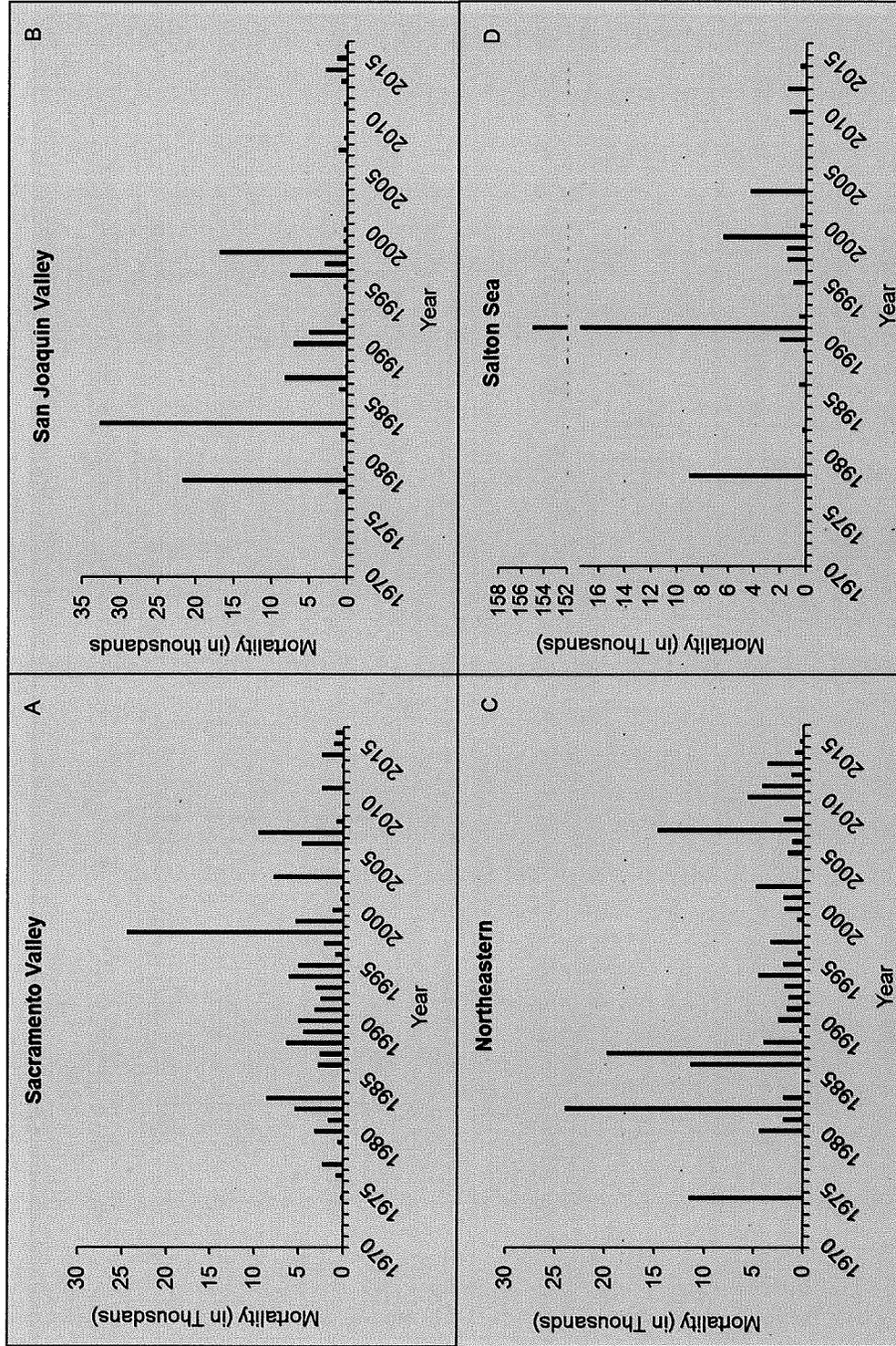
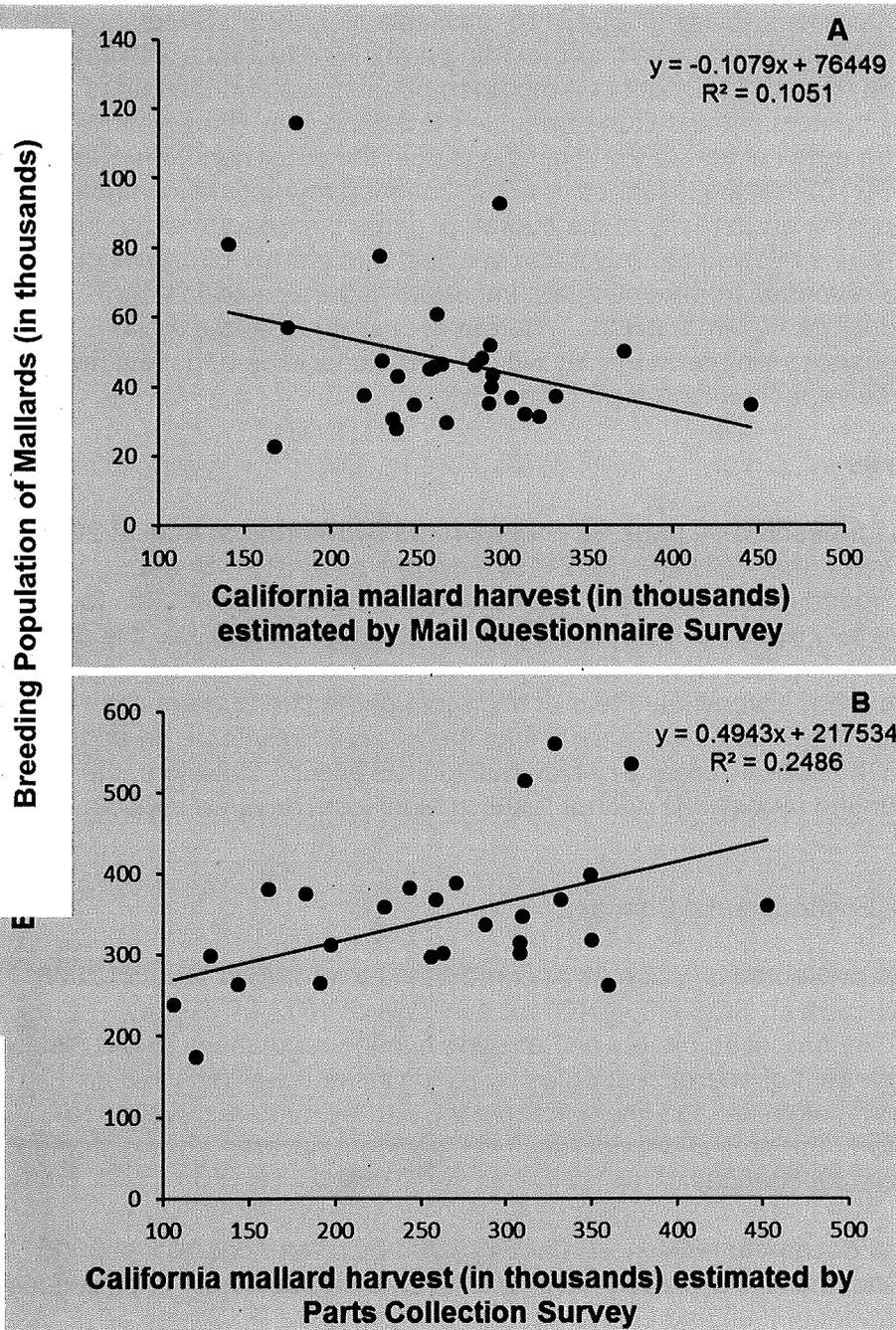


Figure 7. California breeding mallard populations estimates vs hunter harvest: 1960-1990 (Chart A), 1991-2017 (Chart B)



CUMMULATIVE IMPACTS

Short-term uses and Long-term Productivity

The 2006 analysis was presented on page 97 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 actually enhances 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 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 particular 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 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115, available at 1812 9th Street, Sacramento 95811). 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 (incorporated by reference, August 2006 Final Environmental Document, SCH#2006042115) is located and available upon request from California Department of Fish and Game, Wildlife Branch, 1812 9th Street, Sacramento, CA 95811.

CULTURAL RESOURCES

The proposed Project would modify current waterfowl hunting regulations for the 2019-2020 waterfowl hunting season. 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 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 Project is not expected to impact Tribal Cultural Resources. As a result, 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 2018-19 hunting regulations; (2) reduced season lengths and bag limits; and (3) elimination of all mechanical decoys.

Alternative 1. No project – no change from the 2018-19 hunting regulations

This alternative provides identical season and bag limit regulations as the 2018-19 seasons. Under this alternative, the addition of Small Canada geese to the “Regular Season” in the Northeastern California Zone, the addition of Small Canada geese to “Season” in the Klamath Basin Special Management Area and opening the late goose season two weeks after the close of the regular season in the Imperial County Special Management Area would not occur.

Advantages of This Alternative

Waterfowl regulations are inherently complicated and any changes may result in confusion for some members of the public. Maintaining the 2018-19 regulations for the 2019-20 season may result in less confusion to some members of the public.

Disadvantages of This Alternative

The no change alternative is not consistent with federal frameworks, including a reduction in the daily pintail daily bag limit from 2 to 1. In addition, less hunting opportunity and use of hunting as a tool to alleviate goose depredation in the Imperial County Special Management Area would be reduced.

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 it conflicts with Federal frameworks.

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 percent. For ducks, more conservative Adaptive Harvest Management regulatory alternatives (86 or 60 days) could be used. For brant, the 37-day season would be reduced to 19 days and for most other geese the season would be reduced from either 107 or 100 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 1 geese depending on zone; a reduction in brant from two to one; and a reduction in the coot limit from 25 to 12 birds per day. Additionally, species-specific regulations, for pintail, redheads, canvasback or scaup could be further reduced under this alternative.

Advantages of This Alternative

Selection of Alternative 2, reduced season lengths, 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 2017-18, the estimated retrieved harvest in California was 1,305,600 ducks, 239,000 geese and 10,300 coots. If harvest regulation restrictions cause a larger than expected decline in hunter participation, harvests might be reduced by more than 50 percent. If, as experienced in the 1989-90 season, there is a drop in hunter participation but fall flights are larger or contain higher percentages of juveniles than are expected, harvests would probably not decline by 50 percent. If harvests declined by exactly 50 percent; approximately 652,800 ducks, 119,500 geese, and 5,150 coots would not be harvested in California. If waterfowl, coots and moorhens have access to habitat of sufficient quality and quantity and these populations are being suppressed due to the levels of harvest previously experienced, populations might increase in following years as a result of 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 (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 while this would increase viewing days on hunting areas,

these areas are a small percent of total waterfowl habitat. Reduction in possible conflicts between non-hunters and hunters would be a likely result of this alternative.

Disadvantages of This Alternative

Harvest restrictions for waterfowl, coots and moorhens would probably be a disincentive for many of those private landowners who 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 judged to be not worth the high costs associated with providing water and managing this habitat. This would reduce the amount of habitat available for waterfowl and other wetland dependent wildlife. Overcrowding, and as a result, reduced food resources and increased losses to diseases, would be expected.

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. Elimination of 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 D.

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 E). 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. Resources would continually be re-directed to assess each new technological advance.

Disadvantages of This Alternative

As detailed in Appendix D, existing analyses do not clearly establish an effect of harvest on duck population dynamics. To some unmeasured extent, the use of SWD 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 D, 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 SWDs. 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 their regulation.

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Appendix A. 2018-19 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 ("lessers").

(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.

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| (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 |

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| <p>Ducks (including Mergansers)</p> | <p>From the first Saturday in October extending for 105 days. Scaup: from the first Saturday in October extending for a period of 58 days and from the fourth Saturday in December extending for a period of 28 days.</p> | <p>Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 2 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex).</p> <p>Possession limit: triple the daily bag limit.</p> |
| <p>Geese</p> | <p>Regular Season: Dark geese from the first Saturday in October extending for 100 days. White geese from the first Saturday in October extending for a period of 58 days and from the first Saturday in January extending for a period of 14 days.</p> <p>Late Season: White-fronted and white geese from February 6 extending for 33 days.</p> <p>During the Late Season, hunting is only permitted on Type C wildlife areas listed in Section 550-552, navigable waters, and private lands with the permission of the land owner 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</p> | <p>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)).</p> <p>Possession limit: triple the daily bag limit.</p> |

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| | and Type B wildlife areas, the Klamath Basin National Wildlife Refuge Complex, or the Modoc National Wildlife Refuge. | |
| (2) Southern San Joaquin Valley Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.) | | |
| <i>(A) Species</i> | <i>(B) Season</i> | <i>(C) Daily Bag and Possession Limits</i> |
| Ducks (including Mergansers) | From the third Saturday in October extending for 100 days. Scaup: from the first Saturday in November extending for 86 days. | Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 2 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit. |
| Geese | From the third Saturday in October extending for 100 days. | Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 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.) | | |
| <i>(A) Species</i> | <i>(B) Season</i> | <i>(C) Daily Bag and Possession Limits</i> |
| Ducks (including Mergansers) | From the third Saturday in October extending for 100 days. Scaup: from the first Saturday in November extending for 86 days. | Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 2 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). |

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| | | <ul style="list-style-type: none"> • 3 scaup (either sex). <p>Possession limit: triple the daily bag limit.</p> |
| Geese | From the third Saturday in October extending for 100 days. | <p>Daily bag limit: 23 Daily bag limit may include:</p> <ul style="list-style-type: none"> • 20 white geese. • 3 dark geese <p>(see definitions: 502(a)).</p> <p>Possession limit: triple the daily bag limit.</p> |
| (4) Colorado River Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.) | | |
| <i>(A) Species</i> | <i>(B) Season</i> | <i>(C) Daily Bag and Possession Limits</i> |
| Ducks (including Mergansers). | <p>From the third Friday in October extending for 101 days.</p> <p>Scaup: from the first Saturday in November extending for 86 days.</p> | <p>Daily bag limit: 7 Daily bag limit may include:</p> <ul style="list-style-type: none"> • 7 mallards, but not more than 2 females or Mexican-like ducks. • 2 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). <p>Possession limit: triple the daily bag limit.</p> |
| Geese | From the third Friday in October extending for 101 days. | <p>Daily bag limit: 24 Daily bag limit may include:</p> <ul style="list-style-type: none"> • 20 white geese. • 4 dark geese <p>(see definitions: 502(a)).</p> <p>Possession limit: triple the daily bag limit.</p> |
| (5) Balance of State Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.) | | |
| <i>(A) Species</i> | <i>(B) Season</i> | <i>(C) Daily Bag and Possession Limits</i> |
| Ducks (including Mergansers). | <p>From the third Saturday in October extending for 100 days.</p> <p>Scaup: from the first Saturday in</p> | <p>Daily bag limit: 7 Daily bag limit may include:</p> <ul style="list-style-type: none"> • 7 mallards, but not more than 2 females. |

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| | November extending for 86 days. | <ul style="list-style-type: none"> • 2 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit. |
| Geese | <p>Early Season: Large Canada geese only from the Saturday closest to October 1 for a period of 5 days EXCEPT in the North Coast Special Management Area where Large Canada geese are closed during the early season.</p> <p>Regular Season: Dark and white geese from the third Saturday in October extending for 100 days EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season will close after December 21.</p> <p>Late Season: 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 goose season 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.</p> | <p>Daily bag limit: 30 Daily bag limit may include:</p> <ul style="list-style-type: none"> • 20 white geese. • 10 dark geese <p>EXCEPT in the Sacramento Valley Special Management Area where only 3 may be white-fronted geese (see definitions: 502(a)).</p> <p>Possession limit: triple the daily bag limit.</p> |

| (6) Special Management Areas (see descriptions in 502(b)(6)) | | | |
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| | (A) Species | (B) Season | (C) Daily Bag and Possession Limits |
| 1. North Coast | All Canada Geese | From October 31 extending for a period of 89 days (Regular Season) and from February 23 extending for a period of 16 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner 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 | Large 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. |
| 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 | All species | Closed until November | |

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| Creek Lake | | 16. | | |
| 7. Northern Brant | Black Brant | From November 8 extending for 37 days. | Daily bag limit: 2 Possession limit: triple the daily bag limit. | |
| 8. Balance of State Brant | Black Brant | From November 9 extending for 37 days. | Daily bag limit: 2 Possession limit: triple the daily bag limit. | |
| 9. Imperial County | White Geese | From the first Saturday in November extending for a period of 86 days (Regular Season) and from the first Saturday in February extending for a period of 16 days (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner 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, federal regulations require that hunters must be 17 years of age or younger and must be accompanied by a non-hunting adult 18 years of age or older.)

(1) Statewide Provisions.

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

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| | 4. Colorado River Zone: The Saturday following the closing of waterfowl season extending for 2 days. | |
| | 5. Balance of State Zone: The Saturday following the closing of waterfowl season extending for 2 days. | |
| (f) 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 | <p>1. Northeastern California Zone. Open concurrently with duck season through January 13, 2019.</p> <p>2. Balance of State Zone. Open concurrently with duck season and February 2-3, 2019 EXCEPT in the North Coast Special Management Area where the falconry season for geese runs concurrently with the season for Small Canada geese (see 502(d)(6))</p> <p>3. Southern San Joaquin Valley Zone. Open concurrently with duck season and January 28-30, 2019. Goose hunting in this zone by means of falconry is not permitted.</p> <p>4. Southern California Zone. Open concurrently with duck season and January 28-February 1, 2019. EXCEPT in the Imperial County Special Management Area where the falconry season for geese runs concurrently with the</p> | <p>Daily bag limit: 3 Daily bag limit makeup: • Either all of 1 species or a mixture of species allowed for take.</p> <p>Possession limit: 9</p> |

season for white geese.

5. Colorado River Zone. Open concurrently with duck season and January 28-31, 2019.

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. Estimated Retrieved Harvest of Geese in California, 1962-2017.

| Year | White- | | | | | TOTAL |
|---------------------------------------|---------|---------|---------|-------------------|--------|---------|
| | Canada | Front | Snow | Ross ¹ | Brant | |
| 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 |
| 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 | 169,100 |
| 2016 | 41,280 | 34,885 | 56,979 | 6,977 | 4,786 | 145,200 |
| 2017* | 52,876 | 64,098 | 91,487 | 25,107 | 3,176 | 239,000 |
| Averages: | | | | | | |
| 1962-2017 | 46,339 | 36,736 | 50,236 | 7,283 | 2,919 | 143,558 |
| 1962-65 | 70,256 | 50,182 | 46,140 | 0 | 7,981 | 174,559 |
| 1966-70 | 64,366 | 62,913 | 93,285 | 1,837 | 6,566 | 228,967 |
| 1971-75 | 85,353 | 40,304 | 75,120 | 4,695 | 4,015 | 209,487 |
| 1976-80 | 41,181 | 30,485 | 57,733 | 4,139 | 2,178 | 135,717 |
| 1981-85 | 46,642 | 14,957 | 42,554 | 7,538 | 715 | 112,405 |
| 1986-90 | 21,364 | 7,681 | 25,876 | 2,856 | 208 | 57,985 |
| 1991-95 | 21,735 | 11,583 | 30,247 | 5,214 | 1,498 | 70,277 |
| 1996-00 | 22,468 | 21,214 | 36,026 | 11,361 | 4,641 | 95,710 |
| 2001-05 | 40,722 | 33,068 | 35,661 | 12,614 | 1,840 | 123,905 |
| 2005-12 | 52,100 | 63,465 | 48,842 | 10,528 | 1,256 | 176,191 |
| 2010-14 | 53,044 | 61,092 | 49,753 | 15,230 | 1,283 | 180,402 |
| % Change from: | | | | | | |
| 2016 | 28.1% | 83.7% | 60.6% | 259.9% | -33.6% | 64.6% |
| 1962-2016 | 14.1% | 74.5% | 82.1% | 244.7% | 8.8% | 66.5% |
| % State's Total Goose Harvest: | | | | | | |
| 2017 | 23.4% | 28.3% | 40.5% | 11.1% | 1.4% | |
| 1962-2016 | 32.3% | 25.6% | 35.0% | 5.1% | 2.0% | |

*Preliminary Data

Appendix C. Pacific Flyway Fall and Winter Goose Surveys

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 | Yukon-Kuskokwim | | | Projected fall | | Fall Survey ^a |
|-----------------------|-----------------|----------|-------------|----------------|-------------------------|--------------------------|
| | Delta | Interior | Bristol Bay | Total | population ^b | |
| 1979 | | | | | | 73,100 |
| 1980 | | | | | | 93,500 |
| 1981 | | | | | | 116,500 |
| 1982 | | | | | | 91,700 |
| 1983 | | | | | | 112,900 |
| 1984 | | | | | | 106,200 |
| 1985 | 18,914 | 12,082 | 5,050 | 36,046 | 163,249 | 93,900 |
| 1986 | 13,400 | 10,019 | 4,266 | 27,685 | 141,930 | 107,100 |
| 1987 | 15,717 | 7,564 | 3,657 | 26,938 | 140,026 | 130,600 |
| 1988 | 27,191 | 14,145 | 3,918 | 45,254 | 186,728 | 124,690 |
| 1989 | 28,004 | 16,307 | 5,358 | 49,709 | 198,097 | 263,350 |
| 1990 | 37,836 | 16,468 | 2,003 | 56,307 | 220,010 | 237,050 |
| 1991 | 31,286 | 13,262 | 4,527 | 49,075 | 196,470 | 215,655 |
| 1992 | 34,671 | 16,110 | 7,052 | 57,833 | 218,802 | 230,675 |
| 1993 | 39,746 | 22,790 | 1,306 | 63,844 | 234,128 | 253,820 |
| 1994 | 66,513 | 12,966 | 4,052 | 73,521 | 258,930 | 295,930 |
| 1995 | 77,710 | 10,215 | 2,612 | 90,537 | 302,190 | 251,970 |
| 1996 | 78,032 | 36,543 | 4,353 | 118,928 | 374,582 | 350,850 |
| 1997 | 83,215 | 30,452 | 3,657 | 117,324 | 370,492 | 316,954 |
| 1998 | 67,881 | 34,381 | 1,915 | 104,177 | 387,966 | 413,100 |
| 1999 | 95,040 | 27,800 | 3,453 | 126,293 | 393,437 | 285,514 |
| 2000 | 91,911 | 16,798 | 1,654 | 110,363 | 352,743 | 284,044 |
| 2001 | 113,603 | 24,460 | 6,055 | 144,118 | 438,913 | 337,648 |
| 2002 | 50,407 | 17,387 | 5,311 | 113,105 | 359,734 | 402,565 |
| 2003 | 117,951 | 17,387 | 2,177 | 137,515 | 421,975 | 424,900 |
| 2004 | 100,622 | 16,601 | 1,828 | 119,051 | 374,895 | 337,971 |
| 2005 | 121,017 | 16,566 | 6,530 | 144,113 | 443,898 | 506,690 |
| 2006 | 138,067 | 26,979 | 4,702 | 171,748 | 509,262 | 426,300 |
| 2007 | 178,515 | 26,488 | 2,177 | 207,180 | 604,706 | 476,009 |
| 2008 | 161,979 | 54,913 | 1,045 | 217,937 | 627,035 | 602,699 |
| 2009 | 144,676 | 32,712 | 5,137 | 182,525 | 536,746 | 457,802 |
| 2010 | 174,556 | 44,402 | 7,923 | 226,881 | 649,840 | 783,648 |
| 2011 | 168,925 | 33,989 | 6,055 | 209,009 | 604,270 | 546,501 |
| 2012 | 181,519 | 47,250 | 3,744 | 232,513 | 664,201 | 831,955 |
| 2013 | 164,399 | 29,568 | 5,485 | 199,452 | 579,902 | No Survey |
| 2014 | 205,081 | 16,503 | 346 | 221,930 | 637,221 | 663,257 |
| 2015 | 140,313 | 16,468 | 1,132 | 157,913 | 479,085 | 634,478 |
| 2016 | 206,503 | 31,042 | 3,309 | 240,854 | 565,489 | 727,419 |
| 2017 | 216,219 | 43,616 | 697 | 260,532 | 735,643 | 743,488 |
| 2018 | 150,586 | 11,788 | 1,045 | 203,419 | 590,017 | |
| Averages: | | | | | | |
| Long Term | 106,824 | 24,001 | 3,639 | 134,463 | 414,194 | 402,060 |
| 3-yr | 204,436 | 28,615 | 1,684 | 234,735 | 670,376 | 735,454 |
| % Change from: | | | | | | |
| Long Term | 78.4 | -50.9 | -71.3 | 51.3 | 42.4 | -100.0 |
| 3-yr | -5.8 | -69.1 | -37.9 | -13.4 | -12.0 | -100.0 |
| 2017 | -11.9 | -73.0 | -49.9 | -21.9 | -19.8 | -100.0 |

^aFall 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).

^bProjected fall population = (Alaska total * 2.6458) + 71,339.

White Goose (Snow Goose and Ross's Goose) abundance indices from the California Special white goose survey and Skagit-Fraser photo inventory conducted in December, 1979-current, and the Oregon Winter light goose and tundra swan survey, conducted in January, 2016-current.

| Year | Skagit-Fraser | 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 | | 481,600 | 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 | 45,600 | | 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 | 62,000 | | 396,200 | 448,200 |
| 2002 | 73,100 | | 523,700 | 596,800 |
| 2003 | 66,600 | | 521,000 | 587,600 |
| 2004 | 68,141 | | 682,128 | 750,269 |
| 2005 | 80,040 | | 630,686 | 710,726 |
| 2006 | 79,851 | | 719,610 | 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 ¹ | 66,501 | 19,666 | | |
| 2016 | 103,617 | 29,678 | 1,773,493 | 1,906,788 |
| Averages: | | | | |
| Long Term | 52,421 | 24,772 | 634,925 | 687,768 |
| 3-yr | 76,042 | 24,772 | 1,396,987 | 1,435,859 |
| % Change from: | | | | |
| Long Term | 103.0 | 49.4 | 154.0 | 151.5 |
| 3-yr | 36.3 | 19.8 | 27.0 | 28.3 |
| 2015 | 55.8 | 49.4 | 55.4 | 59.0 |

¹The California Special White Goose Survey was not conducted.

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

| Year | Estimate | SE | LS95% C.I. | US95% 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 | 3,600 | | | | 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* | 21,420 | | | | Direct count |
| 1997* | 22,800 | | | | Direct count |
| 1998* | 27,600 | | | | Direct count |
| 1999* | 15,451 | 558 | 14,357 | 16,544 | Mark-resight |
| 2000* | 20,392 | 763 | 18,698 | 21,887 | Mark-resight |
| 2001* | 32,440 | 1,070 | 30,343 | 34,536 | Mark-resight |
| 1999 | 35,336 | 3,120 | 29,220 | 41,452 | Mark-resight |
| 2000 | 34,182 | 1,339 | 31,537 | 36,806 | Mark-resight |
| 2001 | 88,292 | 18,736 | 51,570 | 125,014 | Mark-resight |
| 2002 | 65,211 | 12,822 | 39,953 | 90,459 | Mark-resight |
| 2003 | 73,030 | 2,761 | 67,616 | 78,441 | Mark-resight |
| 2004 | 111,091 | 4,375 | 102,517 | 119,666 | Mark-resight |
| 2005 | 87,641 | 4,641 | 78,353 | 97,329 | Mark-resight |
| 2006 | 97,224 | 4,524 | 88,358 | 105,091 | Mark-resight |
| 2007 | 117,347 | 9,797 | 98,144 | 136,550 | Mark-resight |
| 2008 | 116,119 | 7,438 | 101,539 | 130,698 | Mark-resight |
| 2009 | 81,766 | 13,347 | 55,605 | 107,925 | Mark-resight |
| 2010 | 106,691 | 8,966 | 89,078 | 124,305 | Mark-resight |
| 2011 | 105,271 | 8,405 | 88,797 | 121,745 | Mark-resight |
| 2012 | 135,915 | 10,925 | 114,501 | 157,328 | Mark-resight |
| 2013 | 166,292 | 15,657 | 135,213 | 197,371 | Mark-resight |
| 2014 | 149,968 | 13,087 | 124,318 | 175,618 | Mark-resight |
| 2015 | 197,725 | 17,822 | 162,794 | 232,656 | Mark-resight |
| 2016 | 154,659 | 13,368 | 128,459 | 180,860 | Mark-resight |
| 2017 | 168,548 | 20,345 | 128,671 | 208,424 | Mark-resight |
| 2018 | 171,334 | 16,229 | 139,526 | 203,142 | Mark-resight |
| Averages: | | | | | |
| Long Term | 53,531 | 9,153 | 63,452 | 119,341 | |
| 3-yr | 164,847 | 16,647 | 132,219 | 197,475 | |
| % Change from: | | | | | |
| Long Term | 236.1 | 83.8 | 72.5 | 75.8 | |
| 3-yr | 3.9 | -2.5 | 5.5 | 2.9 | |
| 2017 | 1.7 | -20.2 | 8.4 | -2.5 | |

*Methods overlapped by three years.

Pacific Brant population indices from the Mid-winter Waterfowl Survey, 1936–current. The table continues on the next page and includes long-term summary statistics.

| Year | U.S. and Canada | | | | | | Mexico ^b | | | MWS Index | | Izembek Index | |
|------|-----------------|-----------------|--------|--------|--------|-----------------------|---------------------|----------|----------|---------------------|-----------------------|---------------------|--------------------|
| | AK ^a | BC ^a | WA | OR | CA | Subtotal ^a | Baja | Mainland | Subtotal | Annual ^c | 3-yr Avg ^c | Annual ^d | % Juv ^d |
| 1936 | | | 8,202 | 3,085 | 19,910 | 31,197 | | | | | | | |
| 1937 | | | 13,450 | 5,935 | 13,480 | 32,865 | | | | | | | |
| 1938 | | | 24,560 | 10,475 | 38,200 | 73,235 | | | | | | | |
| 1939 | | | 26,595 | 9,502 | 18,590 | 51,987 | | | | | | | |
| 1940 | | | 36,520 | 5,350 | 35,050 | 75,920 | | | | | | | |
| 1941 | | | 24,100 | 5,000 | 31,785 | 60,885 | | | | | | | |
| 1942 | | | 53,950 | 8,850 | 28,983 | 89,783 | | | | | | | |
| 1943 | | | 37,000 | 575 | 18,000 | 55,575 | | | | | | | |
| 1944 | | | 33,950 | 7,250 | 20,250 | 61,450 | | | | | | | |
| 1945 | | | 32,650 | 3,000 | 30,100 | 65,750 | | | | | | | |
| 1946 | | | 28,462 | 55 | 60,452 | 85,969 | | | | | | | |
| 1947 | | | 20,250 | 8,200 | 39,640 | 68,090 | | | | | | | |
| 1948 | | | 20,860 | 2,850 | 32,750 | 56,260 | | | | | | | |
| 1949 | | | 20,650 | 803 | 68,515 | 87,968 | | | | | | | |
| 1950 | | | 15,574 | 3,600 | 57,792 | 76,966 | | | | | | | |
| 1951 | | | 21,839 | 2,110 | 48,131 | 71,880 | 93,200 | 0 | 93,200 | | | | |
| 1952 | | | 16,578 | 3,200 | 43,840 | 63,618 | 102,945 | 0 | 102,945 | | | | |
| 1953 | | | 27,473 | 1,509 | 37,557 | 66,539 | 87,905 | 0 | 87,905 | | | | |
| 1954 | | | 15,376 | 1,560 | 28,750 | 45,686 | 86,316 | 0 | 86,316 | | | | |
| 1955 | | | 21,915 | 1,666 | 34,070 | 57,671 | 76,679 | 0 | 76,679 | | | | |
| 1956 | | | 15,914 | 2,073 | 39,510 | 56,497 | 52,743 | 0 | 52,743 | | | | |
| 1957 | | | 20,701 | 1,493 | 35,845 | 58,042 | 73,380 | 0 | 73,380 | | | | |
| 1958 | | | 25,219 | 2,778 | 26,560 | 54,557 | 71,305 | 4 | 71,309 | | | | |
| 1959 | | | 10,815 | 1,121 | 10,750 | 22,686 | 71,305 | 1,400 | 72,705 | | | | |
| 1960 | | | 17,614 | 652 | 3,771 | 22,037 | 113,087 | 1,115 | 114,202 | 136,239 | -- | | |
| 1961 | | | 16,675 | 1,330 | 6,853 | 24,858 | 138,625 | 4,355 | 142,980 | 187,835 | -- | | |
| 1962 | | | 25,815 | 2,286 | 23,510 | 51,601 | 115,245 | 2,400 | 118,645 | 170,236 | 158,104 | | |
| 1963 | | | 20,400 | 2,639 | 2,388 | 25,427 | 101,575 | 13,240 | 114,815 | 140,242 | 159,439 | | |
| 1964 | | | 34,189 | 2,000 | 8,353 | 44,522 | 117,470 | 23,290 | 140,760 | 185,282 | 185,253 | | 24.0 |
| 1965 | | | 19,938 | 1,325 | 3,372 | 24,635 | 117,350 | 24,916 | 142,265 | 166,900 | 164,141 | | 27.7 |
| 1966 | | | 22,175 | 798 | 3,284 | 26,257 | 115,601 | 19,505 | 135,106 | 161,363 | 171,182 | | 22.5 |
| 1967 | | | 21,235 | 1,523 | 3,824 | 26,582 | 111,755 | 41,316 | 153,070 | 179,652 | 169,305 | | 45.4 |
| 1968 | | | 15,746 | 665 | 1,729 | 18,340 | 111,600 | 24,400 | 136,000 | 154,340 | 165,118 | | 18.8 |
| 1969 | | | 10,063 | 382 | 166 | 10,611 | 97,400 | 35,076 | 132,476 | 143,058 | 159,026 | | 18.9 |
| 1970 | | | 8,916 | 963 | 207 | 10,086 | 98,200 | 33,400 | 131,600 | 141,658 | 146,371 | | 30.5 |
| 1971 | | | 10,915 | 1,374 | 130 | 12,419 | 105,800 | 31,000 | 136,800 | 149,219 | 144,664 | | 40.0 |
| 1972 | | | 4,328 | 1,047 | 0 | 5,375 | 91,200 | 28,200 | 119,400 | 124,775 | 138,660 | | 37.6 |
| 1973 | | | 5,911 | 2,544 | 950 | 9,405 | 85,500 | 30,100 | 115,600 | 125,035 | 133,000 | | 39.8 |
| 1974 | | | 4,977 | 1,904 | 470 | 7,351 | 86,900 | 26,400 | 113,300 | 130,651 | 126,810 | | 34.9 |
| 1975 | | | 6,163 | 1,507 | 480 | 8,150 | 80,825 | 34,455 | 115,280 | 123,430 | 126,382 | | 5.0 |
| 1976 | | | 7,540 | 1,769 | 680 | 9,989 | 52,783 | 29,273 | 82,056 | 122,045 | 125,375 | | 40.1 |
| 1977 | | | 14,111 | 2,100 | 0 | 16,211 | 85,534 | 44,222 | 130,756 | 146,667 | 130,814 | 107,784 | 38.9 |
| 1978 | | | 18,109 | 1,110 | 560 | 19,779 | 106,469 | 36,848 | 143,317 | 162,557 | 143,966 | 110,298 | 34.1 |
| 1979 | | | 8,078 | 1,255 | 10 | 9,343 | 87,860 | 32,210 | 120,070 | 129,413 | 146,422 | | 16.5 |
| 1980 | | | 7,665 | 1,015 | 135 | 8,815 | 89,660 | 47,860 | 137,520 | 146,365 | 146,222 | 128,204 | 18.1 |
| 1981 | 3,271 | | 10,107 | 1,780 | 540 | 15,708 | 160,660 | 21,200 | 181,760 | 197,468 | 157,749 | 127,667 | 31.8 |
| 1982 | | | 6,451 | 708 | 485 | 7,642 | 85,105 | 29,297 | 113,402 | 121,044 | 154,959 | 180,734 | 31.0 |
| 1983 | | | 3,113 | 718 | 565 | 4,396 | 81,761 | 23,157 | 104,918 | 109,314 | 142,609 | 146,945 | 14.2 |
| 1984 | 1,611 | | 7,097 | 930 | 700 | 10,338 | 95,170 | 29,533 | 124,703 | 135,041 | 121,800 | 147,933 | 32.9 |
| 1985 | | 283 | 11,793 | 641 | 800 | 13,517 | 101,405 | 30,163 | 131,568 | 145,055 | 129,813 | 120,122 | 18.3 |

^aIn British Columbia, totals for 1984-1991 are Christmas Bird Counts, and from 1992-on are from Canadian Wildlife Service counts.

^bIncomplete survey in Mexico during 1951-1959.

^cIncludes Western High Arctic brant. 3-year average considers most recent 3 years of annual counts.

^dIzembek index from fall before Mid-winter Waterfowl Survey, includes Western High Arctic brant, and was updated Fall 2016 after extensive review. Percent Juvenile from NWR ground surveys.

^eThe historical Alaska MWS Index was recalculated in 2015, following the recommendation by Wilson and Dau 2015.

Pacific Brant population index, continued.

| Year | U.S. and Canada | | | | | | Mexico ^b | | | MWS Index | | Izembek Index | |
|----------------|-----------------|-----------------|--------|-----------|--------|-----------------------|----------------------|----------|----------|---------------------|-----------------------|---------------------|--------------------|
| | AK ^c | BC ^d | WA | OR | CA | Subtotal ^e | Baja | Mainland | Subtotal | Annual ^f | 3-yr Avg ^g | Annual ^h | % Juv ⁱ |
| 1986 | 5,338 | 319 | 12,026 | 1,113 | 706 | 19,502 | 92,526 | 22,200 | 114,726 | 134,227 | 134,227 | 122,673 | 21.4 |
| 1987 | 7,550 | 205 | 14,371 | 1,133 | 736 | 23,995 | 73,826 | 13,068 | 86,913 | 110,905 | 122,568 | 116,131 | 23.2 |
| 1988 | 6,180 | 263 | 19,831 | 1,104 | 947 | 28,325 | 99,066 | 17,630 | 116,696 | 145,021 | 130,052 | 136,785 | 47.4 |
| 1989 | 6,918 | 484 | 18,538 | 871 | 1,033 | 27,544 | 89,600 | 18,121 | 107,721 | 135,565 | 130,498 | 123,822 | 24.4 |
| 1990 | 5,303 | 406 | 13,756 | 1,399 | 922 | 21,856 | 107,545 | 22,320 | 129,865 | 151,721 | 144,102 | 135,041 | 27.4 |
| 1991 | 4,742 | 591 | 16,221 | 1,262 | 1,340 | 24,156 | 88,650 | 19,905 | 108,555 | 132,711 | 139,999 | 123,551 | 22.3 |
| 1992 | 7,043 | 283 | 13,505 | 1,397 | 2,424 | 24,652 | 78,280 | 14,905 | 93,185 | 117,837 | 134,090 | 128,784 | 29.9 |
| 1993 | 8,359 | 180 | 13,058 | 1,254 | 9,415 | 32,276 | 68,280 | 24,444 | 92,724 | 125,000 | 125,183 | 119,531 | 19.6 |
| 1994 | 12,125 | 382 | 13,595 | 666 | 2,299 | 29,077 | 63,130 | 17,135 | 80,265 | 129,332 | 124,056 | 143,769 | 28.2 |
| 1995 | 11,351 | 363 | 20,231 | 705 | 3,957 | 36,670 | 74,060 | 22,755 | 96,815 | 133,485 | 126,414 | 142,701 | 17.0 |
| 1996 | 10,278 | 634 | 6,941 | 644 | 2,005 | 20,505 | 87,280 | 20,205 | 107,485 | 127,990 | 128,952 | 150,946 | 39.7 |
| 1997 | 10,049 | 500 | 9,753 | 689 | 3,598 | 24,569 | 108,018 | 22,720 | 130,738 | 155,307 | 139,927 | 118,188 | 28.8 |
| 1998 | 6,562 | 619 | 10,881 | 580 | 6,091 | 28,733 | 97,805 | 14,300 | 112,105 | 138,835 | 140,712 | 130,252 | 20.9 |
| 1999 | 10,354 | 955 | 15,252 | 645 | 4,295 | 31,532 | 84,965 | 15,795 | 100,760 | 132,292 | 142,145 | 116,512 | 30.7 |
| 2000 | 8,120 | 1,238 | 13,859 | 523 | 3,389 | 27,129 | 92,020 | 16,420 | 108,440 | 135,669 | 135,568 | 131,134 | 23.4 |
| 2001 | 17,790 | 1,254 | 10,197 | 695 | 4,197 | 34,133 | 78,850 | 13,010 | 91,860 | 125,993 | 131,285 | 151,216 | 31.8 |
| 2002 | 13,576 | 1,453 | 13,478 | 552 | 4,022 | 33,181 | 93,905 | 11,055 | 105,050 | 138,231 | 133,264 | 112,554 | 10.0 |
| 2003 | 7,677 | 1,103 | 11,455 | 557 | 3,124 | 23,918 | 74,132 | 8,094 | 82,226 | 109,142 | 123,455 | 115,839 | 23.6 |
| 2004 | 12,755 | 2,117 | 14,544 | 528 | 6,372 | 36,317 | 71,585 | 13,270 | 84,855 | 121,272 | 121,582 | 135,944 | 13.2 |
| 2005 | 12,041 | 1,020 | 14,286 | 609 | 5,224 | 33,180 | 59,960 | 14,068 | 74,028 | 107,209 | 111,541 | 134,474 | 19.5 |
| 2006 | 15,404 | 1,792 | 16,305 | 649 | 5,069 | 39,219 | 87,483 | 14,254 | 101,737 | 140,956 | 123,145 | 152,712 | 37.0 |
| 2007 | 28,533 | 2,078 | 12,712 | 702 | 7,387 | 51,412 | 65,250 | 13,932 | 79,182 | 130,594 | 126,253 | 124,169 | 24.3 |
| 2008 | 27,422 | 1,264 | 19,775 | 370 | 4,827 | 53,658 | 83,556 | 19,443 | 103,009 | 156,957 | 142,836 | 140,597 | 27.6 |
| 2009 | 21,482 | 2,574 | 29,243 | 823 | 6,392 | 60,514 | no survey conducted* | | | - | 142,836 | 130,294 | 18.5 |
| 2010 | 28,234 | 2,699 | 23,908 | no survey | 13,553 | 68,394 | 71,688 | 23,389 | 95,077 | 163,471 | 150,341 | 144,594 | 30.5 |
| 2011 | 42,937 | 2,414 | 21,457 | no survey | 15,610 | 82,419 | 61,153 | 18,897 | 80,050 | 162,468 | 160,955 | 130,091 | 20.7 |
| 2012 | 44,252 | 1,229 | 17,502 | 687 | 2,227 | 65,897 | 101,571 | 9,873 | 111,444 | 177,341 | 167,760 | 126,029 | 24.5 |
| 2013 | 41,821 | 2,204 | 16,454 | 200 | 7,448 | 68,127 | 71,507 | 23,566 | 95,173 | 163,300 | 167,703 | 154,481 | 14.2 |
| 2014 | 48,140 | 2,104 | 17,485 | 511 | 7,916 | 76,156 | 68,280 | 28,899 | 97,179 | 173,315 | 171,319 | 157,781 | 16.8 |
| 2015 | 50,316 | 1,636 | 10,708 | 486 | 4,908 | 68,050 | 44,533 | 23,899 | 68,432 | 135,482 | 157,869 | 171,635 | 16.6 |
| 2016 | 46,772 | 3,364 | 11,811 | 583 | 5,105 | 67,635 | 55,066 | 17,324 | 72,390 | 140,025 | 149,241 | 160,984 | 17.2 |
| 2017 | 44,899 | 3,677 | 15,878 | 405 | 5,765 | 73,624 | 67,386 | 14,710 | 82,096 | 155,720 | 151,388 | 203,735 | 19.1 |
| 2018 | 46,067 | 2,796 | 10,905 | 355 | 2,466 | 62,589 | 46,924 | 14,038 | 60,962 | 123,551 | 139,765 | | |
| Averages: | | | | | | | | | | | | | |
| Long Term | 19,352 | 1,310 | 16,942 | 1,826 | 12,475 | 39,600 | 88,369 | 18,817 | 107,186 | 142,145 | 142,059 | 136,573 | 26 |
| 3-yr | 45,913 | 3,279 | 12,865 | 448 | 5,445 | 67,949 | 66,459 | 16,357 | 71,816 | 139,765 | 147,031 | 178,785 | 18 |
| % Change from: | | | | | | | | | | | | | |
| Long Term | 148.1 | 121.0 | -35.9 | -80.8 | -80.4 | 59.0 | -47.3 | -25.7 | -43.5 | -13.3 | -1.6 | 51.1 | -28.1 |
| 3-yr | 0.3 | -14.7 | -15.2 | -20.7 | -54.7 | -7.9 | -16.9 | -5.6 | -15.1 | -11.6 | -4.9 | 14.0 | 5.3 |
| 2016 | 2.6 | -24.0 | -31.3 | -12.3 | -71.9 | -15.0 | -30.4 | -4.6 | -25.7 | -20.7 | -7.7 | 26.6 | 11.0 |
| Objectives: | 9,000 | 8,000 | 25,000 | 3,000 | 10,000 | 55,000 | | | 107,000 | | 162,000 | | |

^aIn British Columbia, totals for 1984-1991 are Christmas Bird Counts, and from 1992-on are from Canadian Wildlife Service counts.
^bAerial surveys were not flown (2009, 2011-2012, 2014-2015) in Mexico due to pilot safety concerns. Instead, ground-counts conducted by Palacios and Avila (including 2013).
^cIncludes Western High Arctic brant. 3-year average considers most recent 3 years of annual counts.
^dIzembek Index from fall before Mid-winter Waterfowl Survey, includes Western High Arctic brant, and was updated Fall 2016 after extensive review. Percent Juvenile from NWR ground surveys.
^eNo survey conducted due to pilot survey concerns.
^fThe historical Alaska MWS Index was recalculated in 2015, following the recommendation by Wilson and Dau 2015.

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

| Year | Population | | | Nesting | | | Brood Size | | Colony Size (ha) | |
|-------------------|------------|-----------------|------------|--------------|---------|--------------|-------------|-------------------|------------------|-----------------------|
| | Adults | Breeding adults | % Juvenile | Total spring | Nests | % Successful | Clutch Size | At Nesting colony | | At brood rearing area |
| 1966 | | | | | | | 3.6 | | | |
| 1967 | | | | | | | 4.9 | | | |
| 1968 | | | | | | | | | | |
| 1969 | | 114,000 | | | 58,200 | | 3.7 | | | 1,962 |
| 1970 | 120,000 | 120,000 | 20.0 | 150,000 | 60,000 | 96.0 | 3.7 | 3.5 | 2.5 | 2,600 |
| 1971 | 120,000 | 24,000 | 9.1 | 132,000 | 12,000 | 55.0 | 4.7 | 3.4 | 2.3 | 825 |
| 1972 | 106,000 | 36,000 | 0.6 | 107,000 | 18,000 | 45.0 | 4.2 | 3.5 | 2.3 | 950 |
| 1973 | 85,900 | 12,000 | 0.0 | 86,000 | 6,000 | 67.0 | 6.0 | 3.9 | | 200 |
| 1974 | 69,500 | 32,000 | 0.7 | 70,000 | 15,000 | 0.0 | 4.7 | | | 800 |
| 1975 | 56,000 | 56,000 | 0.0 | 56,000 | 28,000 | 74.4 | 3.8 | 3.4 | 2.4 | |
| 1976 | 46,000 | 46,000 | 20.7 | 58,000 | 23,000 | 79.0 | 3.7 | 3.2 | 2.8 | 1,840 |
| 1977 | 57,200 | 10,000 | 16.1 | 68,200 | 5,000 | 76.8 | 5.0 | 3.7 | | 400 |
| 1978 | 64,900 | 42,000 | 0.8 | 65,400 | 21,000 | 80.0 | 4.2 | 3.7 | 2.4 | 2,200 |
| 1979 | 62,100 | 60,000 | 26.5 | 84,500 | 30,000 | 90.0 | 3.8 | 3.6 | | 1,860 |
| 1980 | 80,300 | 20,000 | 11.5 | 90,700 | 10,000 | 70.0 | 5.4 | 3.3 | | 315 |
| 1981 | 86,200 | 78,000 | 3.2 | 89,000 | 39,000 | 95.0 | 4.0 | 3.7 | 3.1 | 2,118 |
| 1982 | 81,000 | 28,000 | 18.5 | 100,000 | 14,000 | 65.0 | 4.1 | 3.2 | 2.8 | 688 |
| 1983 | 92,800 | 3,400 | 2.4 | 95,000 | 1,700 | 5.9 | 4.8 | | | 125 |
| 1984 | 85,000 | 42,000 | 0.0 | 85,000 | 21,000 | 83.3 | 3.7 | 3.2 | 2.1 | 1,500 |
| 1985 | 80,000 | 50,000 | 5.4 | 85,000 | 25,000 | 87.7 | 3.7 | 3.2 | 2.4 | 1,457 |
| 1986 | 70,000 | 58,000 | 20.4 | 90,000 | 29,000 | 90.0 | 3.9 | 3.6 | 3.2 | 2,100 |
| 1987 | 85,000 | 47,000 | 15.0 | 100,000 | 23,500 | 80.0 | 3.7 | 3.4 | 2.8 | 1,900 |
| 1988 | 80,000 | 13,000 | 17.7 | 80,000 | 6,500 | 51.0 | 5.2 | 3.4 | 2.7 | 675 |
| 1989 | 70,000 | 60,000 | 1.4 | 70,000 | 30,000 | 60.0 | 3.8 | 3.3 | | 1,025 |
| 1990 | 60,000 | 53,000 | 0.0 | 60,000 | 26,500 | 49.2 | 3.8 | 3.2 | 2.2 | 940 |
| 1991 | 56,000 | 41,600 | 6.6 | 60,000 | 20,800 | 82.0 | 4.1 | 3.4 | 2.7 | 888 |
| 1992 | 56,000 | 46,200 | 20.0 | 70,000 | 23,100 | 70.1 | 4.0 | 3.5 | 3.5 | 742 |
| 1993 | 64,500 | 52,200 | 0.8 | 65,000 | 26,100 | 85.1 | 3.9 | 3.2 | | 910 |
| 1994 | 52,500 | 30,000 | 25.0 | 70,000 | 15,000 | 13.0 | 2.8 | 2.1 | | 1,000 |
| 1995 | 64,000 | 8,800 | 0.8 | 65,000 | 4,400 | 50.0 | 4.7 | 2.8 | | 430 |
| 1996 | 75,000 | 75,400 | 0.0 | 75,000 | 37,700 | 75.4 | 3.7 | 3.7 | 2.4 | 740 |
| 1997 | 70,000 | 55,200 | 15.0 | 85,000 | 22,600 | 71.2 | 4.0 | 3.5 | | 628 |
| 1998 | 80,000 | 31,800 | 10.0 | 90,000 | 15,900 | 66.0 | 4.6 | 3.5 | | 750 |
| 1999 | 85,000 | 20,800 | 5.6 | 90,000 | 10,400 | 75.0 | 4.7 | 3.3 | | 278 |
| 2000 | 87,400 | 49,600 | 8.0 | 95,000 | 24,800 | 87.8 | 3.5 | 3.2 | 2.8 | 738 |
| 2001 | 92,400 | 48,000 | 12.0 | 105,000 | 24,000 | 87.0 | 3.6 | 3.2 | 2.3 | 900 |
| 2002 | | 60,600 | | 110,000 | 30,300 | 81.5 | 4.0 | 3.5 | 3.0 | 855 |
| 2003 | | 55,000 | | 115,000 | 27,500 | 77.5 | | | 2.2 | 900 |
| 2004 | 111,700 | 56,800 | 4.9 | 117,500 | 28,400 | 75.0 | 3.6 | 3.2 | | 838 |
| 2005 | | 95,800 | | 117,500 | 47,900 | 82.3 | 4.2 | 3.7 | 3.3 | 900 |
| 2006 | 100,800 | 93,200 | 23.9 | 132,500 | 46,600 | 87.7 | 4.0 | 3.7 | 3.2 | 875 |
| 2007 | | 79,000 | | 140,000 | 39,500 | 84.4 | 4.0 | 3.5 | 3.1 | 1,100 |
| 2008 | | 20,000 | | 140,000 | 10,000 | 35.0 | | | | |
| 2009 | | 108,800 | | 132,500 | 54,400 | 79.5 | 4.1 | 3.6 | | |
| 2010 | | 10,000 | | 150,000 | 5,000 | | | | | |
| 2011 | | 144,000 | 5.0 | 155,000 | 72,000 | 81.0 | 4.2 | 3.7 | | |
| 2012 ^a | | | | | | | | | | |
| 2013 | | | | 160,000 | 78,300 | 75.8 | 3.7 | 3.2 | 2.7 | 1,063 |
| 2014 ^a | | | | | | | | | | |
| 2015 | 228,500 | 215,600 | 4.8 | 240,000 | 107,800 | 89.1 | 4.0 | 3.7 | | 2,680 |
| 2016 | 251,000 | 236,000 | 20.0 | 300,000 | 118,000 | 89.5 | 3.9 | 3.7 | | 3,240 |
| Averages: | | | | | | | | | | |
| Long Term | 87,019 | 58,640 | 9.5 | 104,484 | 30,280 | 70.5 | 4.1 | 3.4 | 2.7 | 1,145 |
| 3-yr | 193,433 | 198,533 | 9.9 | 233,333 | 101,367 | 84.8 | 3.9 | 3.5 | 3.0 | 2,328 |
| % Change from: | | | | | | | | | | |
| Long Term | 204.9 | 332.2 | 116.6 | 199.9 | 316.5 | 27.8 | -5.7 | 8.8 | - | 196.6 |
| 3-yr | 70.7 | 91.6 | 78.0 | 62.2 | 37.2 | 9.2 | -1.5 | 4.3 | - | 73.1 |
| 2015 | 9.8 | 9.5 | 316.7 | 25.0 | 9.5 | 0.4 | -2.5 | 0.0 | - | 20.9 |

^aData were not gathered in 2012 or 2014.

Appendix D. Possible Effects of Spinning Wing Decoys in California

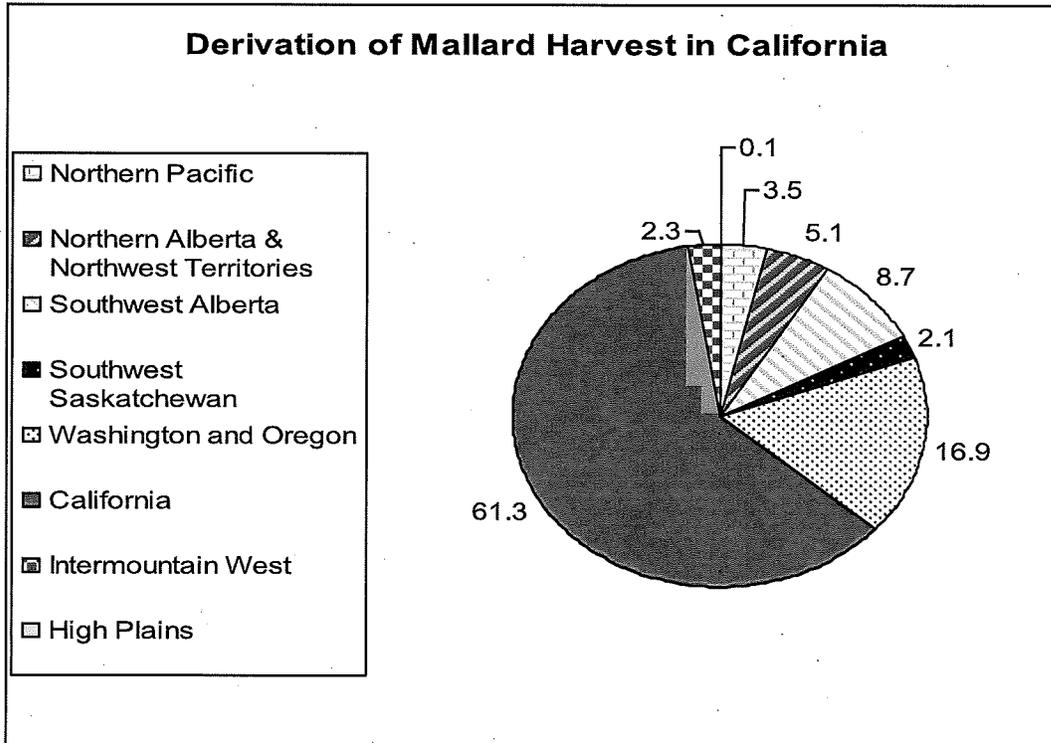
Introduction

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 E) and, unlike other species of ducks, are mostly derived from within California (62%; J. Dubovsky, USFWS, unpub data, Figure D-1).

Figure D-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 D-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 percent 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

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

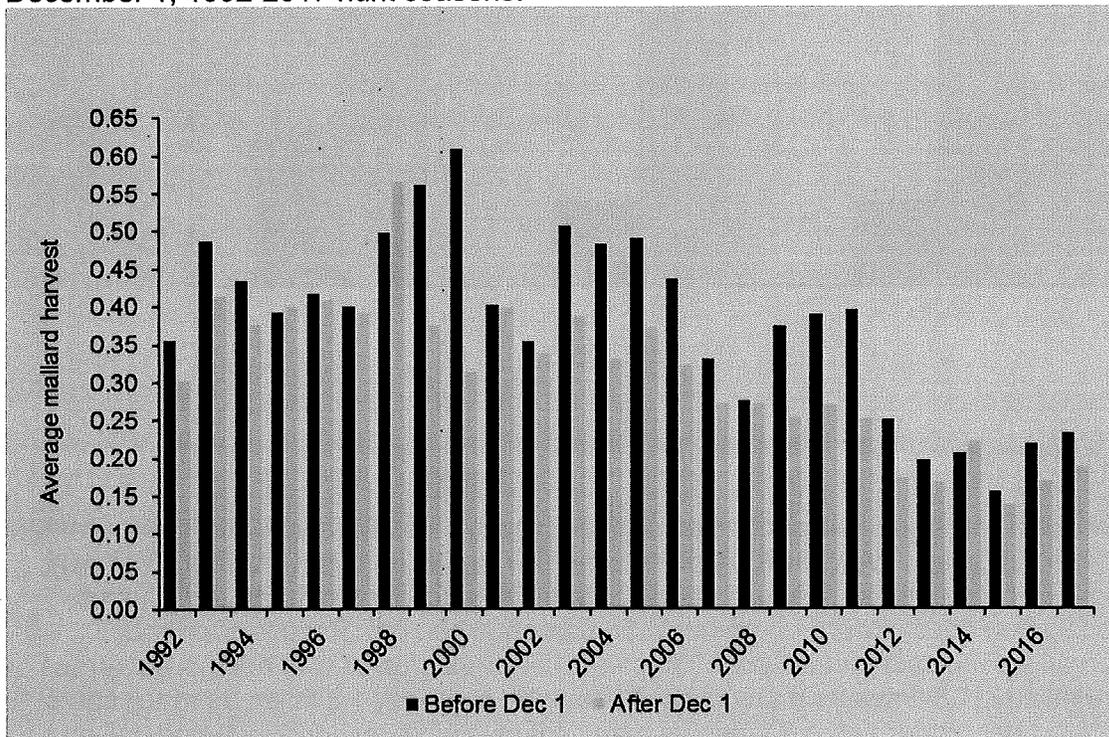
| Area | Year | % Who Used Decoy | Total Duck Harvest | Percent Mallard | Avg Mallards per Hunter | Avg Ducks per Hunter | Sample Size | Total Annual Hunter Visits | |
|------------------|------------|------------------|--------------------|-----------------|-------------------------|----------------------|-------------|----------------------------|------|
| Little Dry Creek | 1999-00 | 52 - YES | 2431 | 36 | 1.4 | 3.9 | 1197 | 5030 | |
| | | 48 - NO | 1610 | 34 | 1 | 2.8 | | | |
| | 2000-01 | 59 - YES | 2707 | 47 | 1.4 | 2.9 | 1550 | 4650 | |
| | | 41 - NO | 1006 | 51 | 0.8 | 1.6 | | | |
| | 2001-02 | 52 - YES | 2697 | 42 | 1.86 | 4.42 | 1165 | 4188 | |
| | | 47 - NO | 1553 | 47 | 1.32 | 2.79 | | | |
| Delevan | 1999-00 | 52 - YES | 1643 | 17 | 0.5 | 2.6 | 1210 | 7061 | |
| | | 48 - NO | 1177 | 18 | 0.4 | 2 | | | |
| | 2000-01 | not sampled | | | | | | | |
| | 2001-02 | 45 - YES | 1831 | 30 | 1.09 | 3.55 | 1132 | 5941 | |
| | | 54 - NO | 1251 | 30 | 0.6 | 2.02 | | | |
| | Sacramento | 1999-00 | not sampled | | | | | | |
| 2000-01 | | 57 - YES | 1271 | 24 | 0.5 | 1.8 | 1212 | 8656 | |
| | | 43 - NO | 904 | 32 | 0.6 | 1.7 | | | |
| 2001-02 | | not sampled | | | | | | | |
| Grizzly Island | | 1999-00 | 29 - YES | 1129 | 14 | 0.3 | 2 | 1978 | 8658 |
| | | | 71 - NO | 1998 | 18 | 0.3 | 1.4 | | |
| | 2000-01 | 36 - YES | 1508 | 28 | 0.5 | 1.8 | 2305 | 7176 | |
| | | 64 - NO | 1852 | 26 | 0.3 | 1.2 | | | |
| | 2001-02 | 39 - YES | 699 | 17 | 0.24 | 1.42 | 1250 | 5880 | |
| | | 60 - NO | 652 | 17 | 0.14 | 0.85 | | | |
| Los Banos | 1999-00 | 24 - YES | 416 | 31 | 0.6 | 1.8 | 981 | 4314 | |
| | | 76 - NO | 786 | 28 | 0.3 | 1.1 | | | |
| | 2000-01 | 41 - YES | 802 | 31 | 0.7 | 2.1 | 914 | 4698 | |
| | | 59 - NO | 448 | 35 | 0.3 | 0.9 | | | |
| | 2001-02 | 34 - YES | 454 | 16 | 0.32 | 2 | 654 | 4427 | |
| | | 65 - NO | 502 | 23 | 0.26 | 1.17 | | | |
| Mendota | 1999-00 | 16 - YES | 790 | 16 | 0.4 | 2.4 | 2133 | 9886 | |
| | | 84 - NO | 3179 | 13 | 0.2 | 1.8 | | | |
| | 2000-01 | 24 - YES | 1224 | 29 | 0.6 | 2 | 2638 | 10196 | |
| | | 76 - NO | 2716 | 20 | 0.3 | 1.3 | | | |
| | 2001-02 | 28 - YES | 1842 | 12 | 0.33 | 2.59 | 2497 | 11132 | |
| | | 71 - NO | 3056 | 12 | 0.22 | 1.71 | | | |

breeding population of mallards in California was declining. Beginning in December, a larger percentage of migrant mallards start appearing in the harvest.

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 1st (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 restriction 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 D-2). Also Included are past years (2007-2016) 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 1st ($P = 0.617$). However, there were significant differences in hunter harvest per day among the three time periods before December 1st ($P = .005$). On average, the mallard harvest per hunter-day was 33% larger from 1998-2000 than 1992-1997 before December 1st. 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 restriction has significantly decreased the before December 1st harvest on mallards on public hunt areas (on a hunter-day basis).

Figure D-2. Average mallard harvest on the public hunting areas relative to December 1, 1992-2017 hunt seasons.

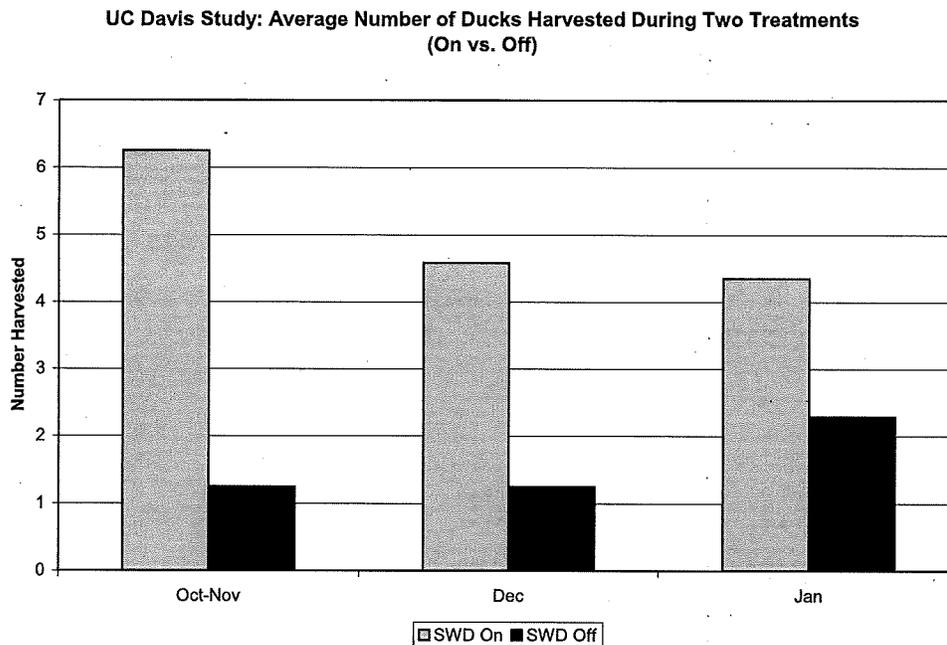


Studies and Scientific Literature on Spinning Wing Decoys (SWDs)

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 D-3.

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



Arkansas Study

In Arkansas, as study was conducted during 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 percent were harvested during periods when decoys were on and only 36 percent 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 juveniles 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

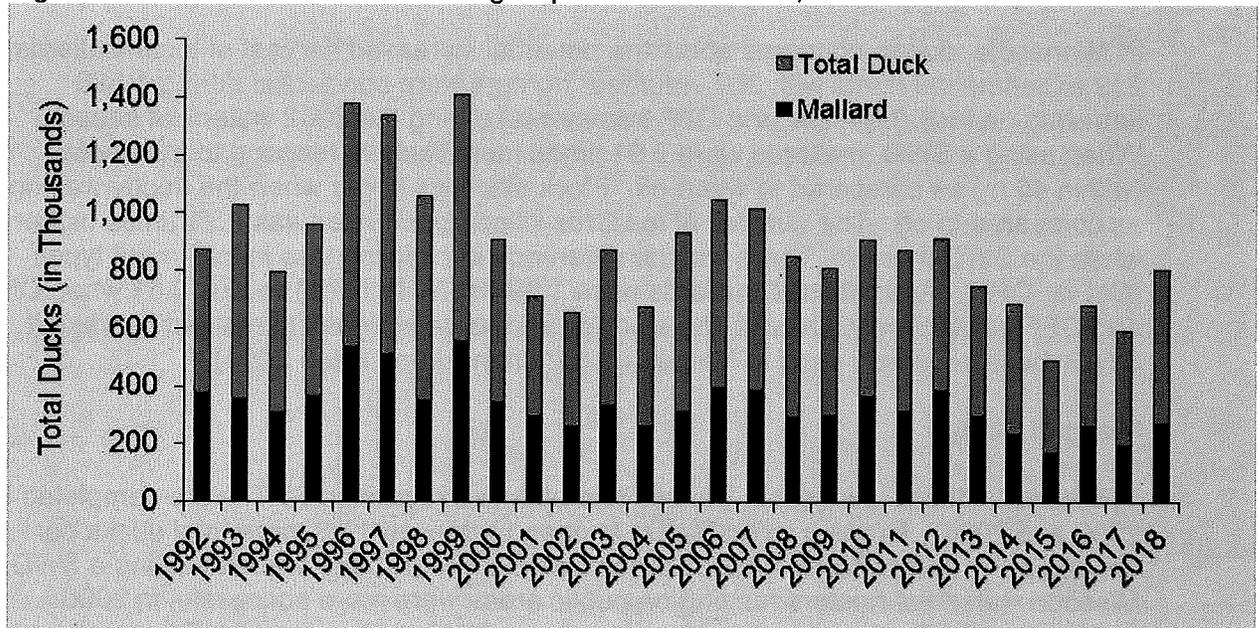
ducks/ hunter trip (13%-19% increase in success rate), was attributed to SWDs (A. Raedecke, Missouri Department of Conservation, unpub. data).

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. 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 D-4).

Figure D-4. California Duck Breeding Population Estimates, 1992- 2018



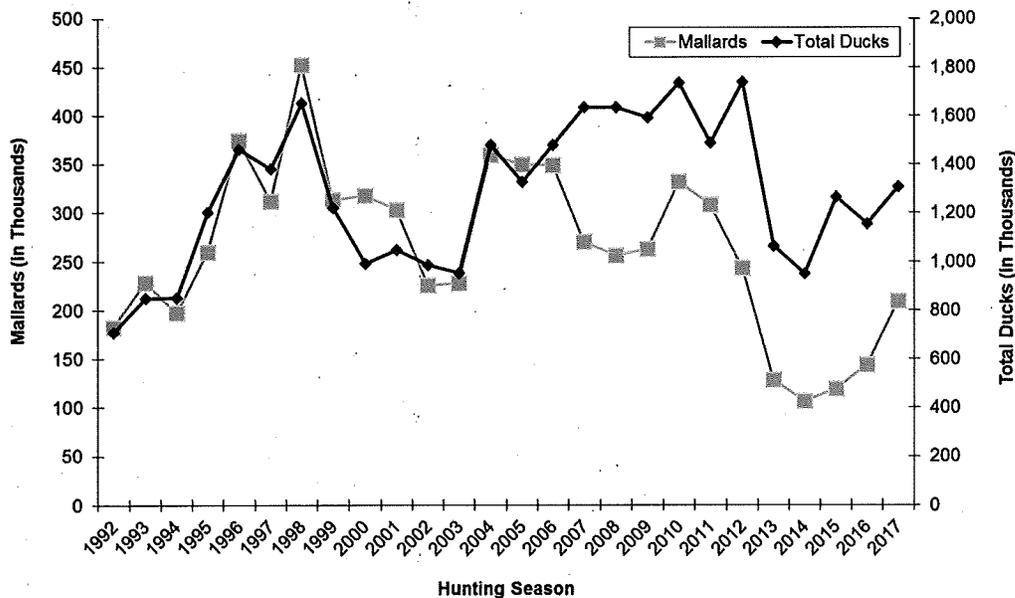
Total estimated duck harvest

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 2017-18 season is available but harvest estimates from 2018-19 will not be available until July, 2019. 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 (Appendix E, Figure D-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 D-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 can not 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 (1981-198) (Giudice 2003).

For data from mallards banded in California, the data were portioned into 4 time periods (Table D-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 D-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 D-4). However, harvest rates of immature mallards banded in California have increased between periods 1 and 4 by 62 and 30 percent 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 D-4).

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

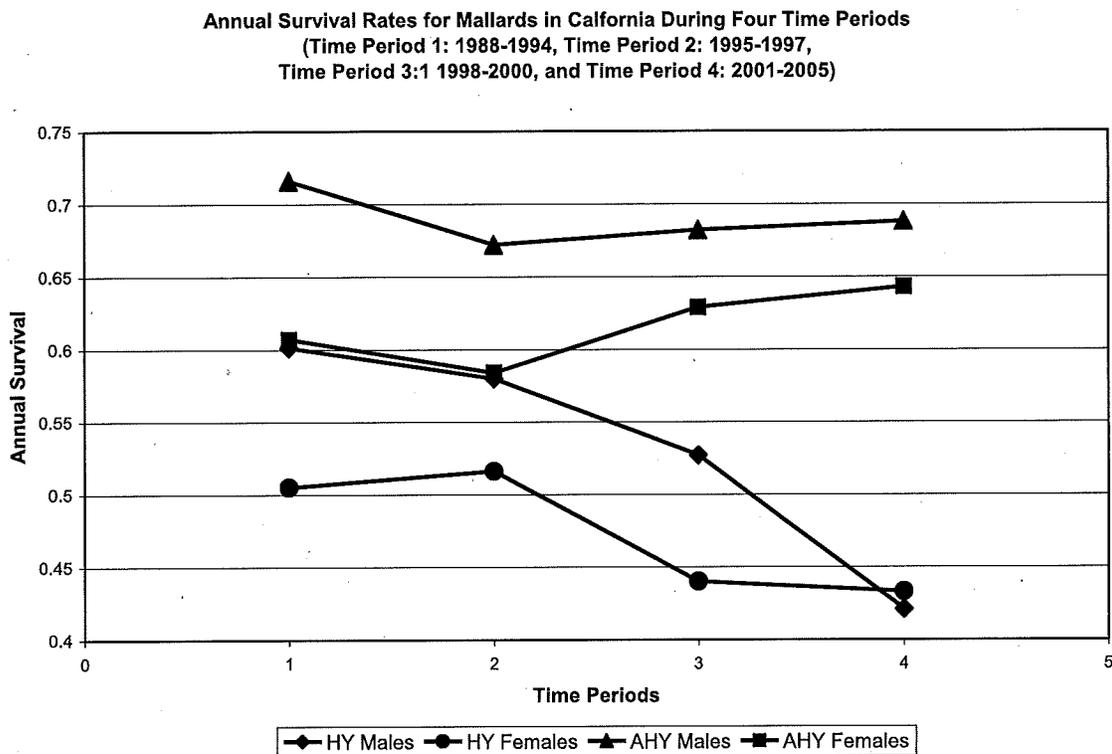
| | California (restrictive) | California (liberal) | Eastern Washington | Mid- Continent (liberal) |
|-------------------------------|-------------------------------------|---------------------------------|-------------------------------|---|
| Adult Males | 0.138 | 0.138 | 0.172 | 0.150 |
| Hatch-Year 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 D-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 D-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 D-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 (CWA) 2006 survey indicated that a majority of hunters opposed electronic decoys, but accepted wind driven decoys (CWA, 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 percent

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.

Appendix E. Estimated Retrieved Harvest of Certain Ducks in California, 1962-2017.

| Year | Mallard | Gadwall | American Wigeon | G-w Teal | B-w/Cin. Teal | Northern Shoveler | Pintail | Wood Duck | Red-head | 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 |
| 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 |
| 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 |
| Averages: | | | | | | | | | | | | |
| 1961-17 | 262.8 | 65.6 | 164.4 | 275.4 | 41.4 | 143.0 | 299.6 | 21.8 | 7.4 | 14.2 | 62.3 | 1,346.5 |
| 1961-65 | 235.1 | 32.3 | 168.0 | 194.3 | 49.2 | 118.9 | 343.1 | 17.2 | 4.9 | 3.6 | 69.1 | 1,235.5 |
| 1966-70 | 334.7 | 51.6 | 238.1 | 317.2 | 47.9 | 173.4 | 735.2 | 17.8 | 8.6 | 21.0 | 94.3 | 2,039.8 |
| 1971-75 | 288.0 | 50.9 | 204.1 | 307.6 | 62.4 | 159.9 | 680.7 | 21.8 | 8.6 | 20.9 | 75.0 | 1,879.9 |
| 1976-80 | 265.8 | 43.2 | 190.9 | 333.1 | 44.3 | 136.6 | 535.8 | 25.8 | 7.9 | 19.2 | 72.5 | 1,675.1 |
| 1981-85 | 269.7 | 48.7 | 110.6 | 208.2 | 43.9 | 112.9 | 263.7 | 19.7 | 9.4 | 14.3 | 61.7 | 1,162.7 |
| 1986-90 | 196.2 | 43.7 | 90.6 | 169.6 | 23.1 | 75.5 | 136.1 | 13.8 | 3.8 | 8.1 | 35.8 | 796.3 |
| 1991-95 | 205.9 | 58.2 | 100.3 | 209.4 | 21.6 | 78.3 | 100.3 | 22.4 | 5.1 | 9.7 | 42.0 | 853.1 |
| 1996-00 | 355.4 | 89.0 | 154.2 | 292.6 | 47.3 | 151.5 | 145.0 | 28.0 | 9.6 | 15.1 | 55.3 | 1,343.0 |
| 2001-05 | 299.4 | 93.3 | 153.5 | 260.9 | 46.7 | 117.6 | 92.7 | 28.9 | 7.0 | 6.1 | 58.6 | 1,164.6 |
| 2006-10 | 293.9 | 119.8 | 215.6 | 397.0 | 44.7 | 217.6 | 170.0 | 32.5 | 8.0 | 15.6 | 69.5 | 1,614.6 |
| 2011-15 | 181.0 | 80.4 | 179.7 | 302.0 | 25.6 | 226.2 | 162.1 | 13.1 | 9.0 | 22.0 | 53.8 | 1,300.9 |
| 2016-17 | 176.5 | 91.8 | 172.1 | 369.3 | 39.4 | 154.4 | 127.4 | 17.9 | 6.2 | 16.7 | 58.0 | 710.4 |
| % Change from: | | | | | | | | | | | | |
| 2016 | 45.8% | 57.9% | 16.8% | -6.6% | -33.5% | 21.4% | -11.8% | 100.0% | 102.4% | -11.9% | 8.3% | 1032.3% |
| 1961-17 | -20.4% | 71.4% | 12.8% | 29.5% | 8.6% | 18.4% | -60.1% | 9.4% | 12.3% | 9.6% | -3.3% | -3.0% |
| % State's Total Duck Harvest: | | | | | | | | | | | | |
| 2017 | 16.0% | 8.6% | 14.2% | 27.3% | 3.4% | 13.0% | 9.1% | 1.8% | 0.6% | 1.2% | 4.6% | |
| 1961-17 | 19.5% | 4.9% | 12.2% | 20.5% | 3.1% | 10.6% | 22.3% | 1.6% | 0.5% | 1.1% | 4.6% | |

* Preliminary Data

Appendix F. 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, its timing, sea level rise, changes in the timing and length of the four seasons, declining snow packs 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 1812 9th Street, Sacramento 95811). 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 1812 9th Street, Sacramento 95811).

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 1812 9th Street, Sacramento 95811) 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 summary, 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 1812 9th Street, Sacramento 95811).

