

2017 California Waterfowl Breeding Population Survey¹

by

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Summary

The annual California Department of Fish and Wildlife waterfowl breeding population survey has been conducted since 1955. The survey was redesigned in 1991 to update methodology and has been conducted in its current form since 1992. The purpose of the survey is to estimate local waterfowl populations in major concentration areas of the state to inform management. Data from the survey were incorporated into the U.S. Fish and Wildlife Service Adaptive Harvest Management framework for Western mallards in 2008 and has since been an integral part of informing waterfowl harvest management in the Pacific Flyway.

In 2017, the survey was conducted from 30 April–4 May in the Central Valley and 9–10 May in northeastern California. The total breeding population of ducks in the survey area was down 5% from 2016, 28% below the long-term average. Mallards (*Anas platyrhynchos*) were down 25% from 2016, 42% below the long-term average. Gadwalls (*Anas strepera*) were up 23% from 2016, 16% below the long-term average. Cinnamon teal (*Anas cyanoptera*) were up 12% from 2016, 18% below the long-term average. The northeastern California population of Canada geese (*Branta canadensis*) was up 25% from 2016, 28% above the long-term average. Rainfall was above or near long-term averages across all strata and snow-water content was well above average in the Sierra and Cascade ranges. Water allocations for wetland management are 100% for all Central Valley Project management areas. Water allocation to the Klamath Basin National Wildlife Refuge Complex in Northeastern California is unclear at this time, despite ample water storage. Other areas in Northeastern California should have adequate water supply for wetland management.

¹ Data are preliminary.

Methods

The procedures used in conducting this survey generally follow those set forth in the U.S. Fish and Wildlife Service (USFWS) protocol or standard operating procedures (SOP) for the Waterfowl Breeding Population and Habitat Conditions Survey (USFWS and CWS 1987). SOPs for the California Department of Fish and Wildlife [CDFW] Waterfowl Breeding Population Survey (hereafter California survey) are as follows:

Survey Timing

In the Central Valley and the Suisun Marsh about half of the duck nests are initiated by the last week of April. A range of 48 to 54 days existed between 10% and 90% of nest initiation in the Suisun Marsh during 5 years of study (McLandress et al. 1996). In northeastern California, nest initiations are later due to the increase in latitude, elevation and correspondingly cooler temperatures. About 50% of mallard nests in northeastern California are initiated by mid-May (Zezulak et al. 1991). Based upon this chronology of nesting, surveys in the Central Valley are conducted during the last week of April and by mid-May in northeastern California. These survey dates are based on nesting phenology of mallards and are independent of migration chronology. The established survey dates likely miss early nesting mallards and pintails.

Survey Flight Time

Survey flights are scheduled to begin no later than two hours after sunrise in order to ensure adequate lighting and avoid detection problems. Surveys are completed no later than 1400 hours, which facilitates use of Sacramento Executive Airport as a daily stopping point (except in northeastern California). This also minimizes travel expenses and repeated non-survey flight hours.

Survey Sample

The California survey consists of nine strata (Fig. 1; see Zezulak 1991). A stratum is a defined geographic unit encompassing areas of similar waterfowl densities and is generally of a single or unique complex of habitat type(s). Most strata are continuous spatial units except the Northeastern stratum, where mountainous terrain separates each wetland complex.

A transect is the sampling unit of the California survey, which can have multiple segments. A transect is generally a continuous series of segments, except in the Northeastern stratum where segments and transects can be disjunct. Segments are generally 18-statute miles (29 km), except in the Napa/Santa Rosa and Northeastern strata, where some segments deviate from this standard due to the irregular shape of the survey areas. Napa/Santa Rosa is surveyed with transects designed to fit within the geographic features of the valleys. Transects in Suisun Marsh and Northeastern California were selected to provide a representative sample of areas surveyed before the 1991 redesign.

Survey Flight Path

Transects within the Central Valley are oriented 45° from true north. Most waterways in the Central Valley are oriented north-south or east-west, and the prescribed orientation is intended to minimize biases associated with transects that might run parallel or perpendicular to waterways. Latitude and longitude coordinates define each transect and all segment beginning and ending points.

Transect Placement

A randomly selected starting point for the transects within the Central Valley was established just south of Red Bluff and all subsequent segments through most of the San Joaquin Valley are located at parallel 14 mile (22.5 km) intervals. The San Joaquin Desert segments are spaced 28 miles (45 km) apart due to decreased waterfowl habitat, low waterfowl numbers and time constraints. East and West Valley starting points were randomly selected and transects were placed between the border of the intensive agricultural areas of the Central Valley and the 500 ft. (152 m) elevation line.

Fixed-wing Flight Procedure

The California survey utilizes one CDFW pilot and two CDFW observer-biologists. The pilot's responsibilities are navigation, including waypoint delineation of segment beginning and ending points. The pilot maintains an air speed between 90 and 110 miles per hour (145-180 km/hr) and an altitude of 150 feet (45 m) above ground level. Each observer counts all ducks, geese, American coots (*Fulica americana*) and Sandhill cranes (*Grus canadensis*) within 660 ft. (200 m) on each side of the aircraft, creating total sample width of 1/4 mile (400 m).

Visibility Bias Correction

The orientation of transects precludes ground coverage of most segments. Therefore, the California survey utilizes the double-sampling procedure (Koneff et al. 2008), employed by the SOPs. This method incorporates a "complete count" subsample of selected segments to correct for detection bias, known as a visibility correction factor [VCF]. Helicopter comparison segments follow fixed-wing segments in all strata except the Napa/Santa Rosa stratum. Segments were selected based on the relative abundance of waterfowl, representative habitats, and proximity to airports.

Helicopter Flight Procedure

Two CDFW observer-biologists accompany a CDFW helicopter pilot as in the fixed-wing surveys. Helicopters are flown at 40-45 miles per hour (65-70 km/hr) at an altitude of 100 feet (30 m). The two helicopter observers record waterfowl in the same manner as fixed-wing observers.

Data Collection

All waterfowl data are recorded per the SOPs, except as noted in Appendix 1. Observations are recorded directly to a computer using the Survey Record Program (Jack Hodges, USFWS 2014). Each computer is tethered to a GPS unit which allows the survey software to simultaneously record observations and coordinates into linked sound and ASCII files.

Data Analysis

A second computer program, the Survey Transcribe Program (Jack Hodges, USFWS 2014), is used on the ground to replay the linked sound files and to combine the transcribed observation data with the geographic coordinates to produce a final ASCII data file. The transcribed ASCII files are used for data analysis.

Data Adjustment

A “total indicated birds” is calculated for each species on each survey segment using the criteria in Appendix 1 from both the fixed-wing and helicopter data. A mean density is calculated for each species within each stratum by averaging the density of total indicated birds for each transect. The stratum area for expansion is calculated by subtracting the transect area surveyed from the stratum area. An uncorrected estimate is calculated by multiplying the mean density by the adjusted stratum area.

The Air-Ground VCF is calculated for each waterfowl species. The VCF is the ratio of the number of ducks seen by the helicopter crew divided by the number of ducks seen by the fixed-wing crew on the VCF subsample of segments. The current year VCF is compared to long-term VCF estimates at various pooling levels (i.e, 2 years, 5 years, 10 years, etc.), as well as the USFWS long-term average in the midcontinent. The current year’s VCF is used for mallards so long as specific criteria are met (Appendix 2). The long-term average is used for seldom seen species. Once the uncorrected estimates and VCFs are generated, a population estimate is then calculated by multiplying the VCF by the uncorrected population estimate.

Results

The survey was flown from 30 April–4 May, in the Central Valley and 9–10 May, 2017 in northeastern California. Transect 20 in northeastern California was not flown due to high winds. The survey was 100% complete in the Central Valley and 95% complete in northeastern California for a total survey effort of 98.6%.

Total breeding ducks in the survey area declined by 6% from 2016, 30% below the long-term average (Table 1). The most abundant species (\pm SE) were mallards (198,392 \pm 31,863), followed by gadwall (71,765 \pm 18,666) and cinnamon teal 33,975 \pm 12,156). Mallards, gadwall and cinnamon teal comprised 54% of the ducks observed, down 30% from 2016. Mallards declined 25% from 2016 and were 42% below the long-term average. The most notable decrease occurred in the Sacramento Valley stratum, where the population was estimated at a record low 31,000, 73% below the long-term average. Gadwalls were 22% above 2016 and 16% below long-term average. Cinnamon teal were 12% above 2016 and 18% below long-term average. Notable increases in Northern pintails (*Anas acuta*), Northern shovelers (*Anas clypeata*), redheads (*Aythya americana*), ring-necked ducks (*Aythya collaris*), lesser scaup (*Aythya affinis*) and bufflehead (*Bucephala albeola*) were observed. The San Joaquin Desert and Northeastern California strata saw notable increases in many of these species. American coots were down 28% from 2016, 16% above the long-term average.

The Northeastern stratum is used to monitor the traditional breeding population of Canada geese. The northeastern California population of Canada geese were estimated at 55,224 (\pm 20,731) up 25% from 2016 and 28% above the long-term average (Table 1).

Weather conditions throughout the winter of 2016 brought abundant precipitation to much of the survey area (Table 2; NOAA 2017, Western Regional Climate Center 2017). Most strata within the Central Valley observed above average rainfall; however, the Delta (via Stockton, CA) and Suisun Marsh (via Concord, CA) were slightly below average for January–April precipitation (Table 2). Rainfall and snow-water content in the Northeastern stratum was above average across the survey area (Table 2, Table 3; NOAA 2017, Natural Resource Conservation Service 2017, Western Regional Climate Center 2017).

Discussion

Adequate rainfall created good habitat conditions (i.e., uplands and ponds) for waterfowl across the survey area. Habitat in the East Valley, West Valley and Northeastern California were in very good condition and expected to produce well. The decline in ducks in the Sacramento Valley was not expected. Low duck observations could be attributed to late flooding of rice, winter flooding of nesting habitat and/or, as mentioned in previous reports, conversion of rice and pasture to tree crops. Waterfowl in the Grasslands and Delta strata were also lower than expected given the above average winter precipitation. Flooding in these regions was mainly comprised of deep and flowing water near the banks of major rivers (e.g. San Joaquin River), which is not ideal for dabbling ducks. Waterfowl populations in the Suisun Marsh and Napa/Santa Rosa strata were high relative to previous breeding seasons. Production in these areas is expected to be very good.

Water allotments in the Central Valley are forecasted to be at maximum for wetland management and rice planting; however, the latter is not expected to be at full capacity due to the delay in planting caused by prolonged spring rain. Water allocations on Klamath Basin National Wildlife Refuge Complex are projected to be low despite adequate water supply conditions. Other areas of Northeastern California should receive adequate water supply for wetland management, a considerable improvement over previous years.

Literature Cited

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Figure 1. California Breeding Waterfowl Population Survey map.

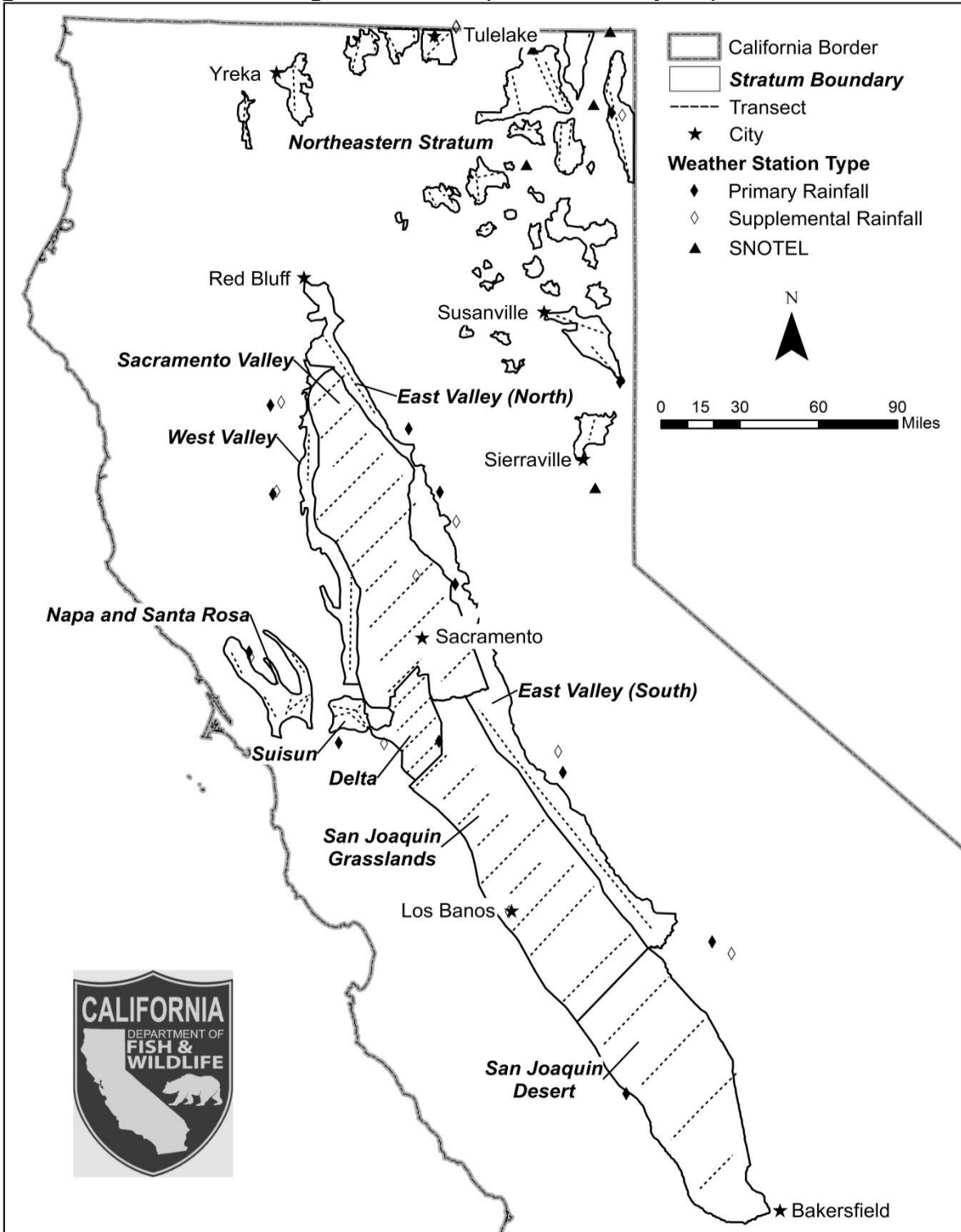


Table 1. California Breeding Waterfowl Population Survey estimates (2017)

Species	2017		2016		LTA ⁴	% Change from 2016	% Change from LTA
	Pop. Est. ²	SE ³	Pop. Est.	SE			
Mallard	198,392	31,863	263,774	35,602	339,733	-24.8	-41.6
Gadwall	71,765	18,666	58,380	13,896	84,817	22.9	-15.5
American Wigeon	2,866	1,864	1,867	623	4,708	53.5	-39.1
Green-winged Teal	1,845	869	2,863	2,292	3,868	-35.5	-52.3
Blue-winged Teal	0	0	0	0	0	---	---
Cinnamon Teal	33,975	12,156	30,221	7,141	41,472	12.4	-18.1
Northern Shoveler	14,964	6,231	10,821	3,669	32,117	38.3	-53.4
Northern Pintail	23,162	10,065	10,372	5,248	7,062	123.3	228.0
Wood Duck	2,007	927	6,899	1,896	8,024	-70.9	-75.0
Redhead	12,616	5,075	4,089	1,920	3,558	208.5	254.5
Canvasback	1,135	636	3,474	1,926	1,098	-67.3	3.3
Scaup	5,506	2,256	494	518	5,031	1014.3	9.4
Ring-necked Duck	4,933	1,517	1,077	478	749	357.9	558.7
Goldeneye	0	0	0	0	295	---	---
Bufflehead	3,709	1,429	1,598	868	3,096	132.1	18.4
Ruddy Duck	18,081	11,634	21,432	13,905	15,419	-15.6	-17.3
Common Merganser	1,574	1,435	428	262	506	267.6	211.2
TOTAL DUCKS	396,530	43,529	417,791	41,999	559,042	-5.1	-28.1
Canada Geese ¹	55,224	20,731	44,323	11,234	43,165	24.6	27.9
American Coot	278,588	110,176	388,628	2,291	240,381	-28.3	15.9

¹Northeastern Canada goose estimates only. Long-term averages generated from 1993-2017.

²Population estimate.

³Standard error.

⁴Long-term average; 1992-2017.

Table 2. Precipitation (inches) ¹ across California Breeding Waterfowl Population Survey strata (2017)

Strata ²	Year	Jan	Feb	Mar	Apr	May	Spring Total	Z-Score
Sacramento Valley ³	2017	53.4	50.5	15.0	18.1	--	137.0	1.48
	LTA ⁴	26.3	26.1	18.8	11.0	--	82.2	
West Valley ⁵	2017	18.1	16.7	3.7	4.0	--	42.5	1.15
	LTA	9.1	8.0	6.9	3.3	--	27.3	
East Valley (North) ^{6,7}	2017	35.3	33.8	11.3	14.2	--	94.5	1.69
	LTA	16.7	17.1	12.2	7.9	--	53.8	
Napa/Santa Rosa ⁸	2017	15.4	12.1	3.2	4.2	--	34.9	1.79
	LTA	5.1	5.4	4.7	1.6	--	16.7	
Suisun ⁹	2017	10.0	6.6	2.7	2.8	--	22.1	-0.23
	LTA	7.8	8.8	5.4	2.7	--	24.7	
Sac/San Joaquin Delta ¹⁰	2017	5.7	5.3	1.5	1.6	--	14.1	-0.41
	LTA	7.2	7.0	0.3	2.9	--	17.5	
Grasslands ¹¹	2017	22.3	16.5	5.8	6.7	--	51.3	0.64
	LTA	11.9	11.1	6.2	6.2	--	35.3	
East Valley (South) ¹²	2017	20.2	13.4	4.4	6.7	--	44.7	0.67
	LTA	6.6	5.7	8.9	5.0	--	26.1	
San Joaquin Desert ¹³	2017	12.4	7.2	1.7	3.0	--	24.3	0.78
	LTA	5.3	4.5	5.0	2.6	--	17.4	
Northeastern CA ¹⁴	2017	23.9	20.1	7.1	8.7	1.2	61.1	0.57
	LTA	12.0	9.3	10.2	8.6	10.2	50.3	

¹Data acquired from NOAA NCDC online database or RAWS station online data, long term averages derived from 1990-2017.

²For stratum with large area, a sum of precipitation was calculated from numerous weather stations.

³Weather stations used: Stonyford (RAWS), Thomas Creek (RAWS), Paradise (GHCND:USC00046685), Bangor (RAWS) and Lincoln (RAWS), Sacramento (GHCND:USW00023232), and Marysville (GHCND:USC00045385).

⁴Not all station data was complete therefore nearby stations were used as supplements (see Figure 1).

⁵Weather stations used: Stonyford (USC00048580), Thomas Creek (RAWS)

⁶East Valley was separated at Sacramento due to differences in weather to be more informative, however BPOP data analyzes this stratum as one.

⁷Weather stations used: Paradise (GHCND:USC00046685), Bangor (RAWS) and Lincoln (RAWS).

⁸Weather station used Santa Rosa (RAWS).

⁹Weather station used: Antioch (GHCND: USC00040232).

¹⁰Weather station used: located in Stockton (GHCND:US1CASJ0011).

¹¹Weather stations used: Green Springs (RAWS), Stockton (GHCND:US1CASJ0011), Los Banos (RAWS) and Modesto (GHCND:USW00023258).

¹²Weather stations used: Green Springs (RAWS) and Fancher Creek (RAWS).

¹³Weather stations used: Fancher Creek (RAWS), Kettleman Hills (RAWS) and Hanford (GHCND:USC00043747).

¹⁴Weather stations used: Tulelake (GHCND:USC00049053), Cedarville (GHCND:USC00041614), Juniper Creek (RAWS; Alturas), Doyle (RAWS; Honey Lake), Vinton (GHCND:USC00049351; Sierra Valley)

Table 3. Snow-water content (inches)¹ across Northeastern California survey stratum (2017)

Location	Year	Nov	Dec	Jan	Feb	Mar	Apr	Season Average	Z- Score
Adin Mountain ²	2017	0.0	2.2	4.4	13.3	20.5	19.0	9.9	0.89
	LTA ²	1.0	3.8	6.9	9.8	11.8	7.8	6.9	
Cedar Pass ³	2017	0.3	3.2	7.7	13.1	20.8	21.4	11.1	0.27
	LTA	1.7	5.3	9.0	12.6	16.4	15.3	10.1	
Dismal Swamp ⁴	2017	1.0	3.7	10.3	23.1	37.5	45.8	20.2	0.70
	LTA	2.3	8.2	14.4	20.1	25.8	26.8	16.3	
Independence Lake ⁵	2017	2.3	6.8	12.6	43.1	70.2	77.0	35.3	1.23
	LTA	3.1	10.4	19.2	28.1	37.8	43.1	23.6	

¹Data from NRCS snow telemetry stations, see Figure 1 for locations.

²Data from 1985-2017.

³Data from 1979-2017.

⁴Data from 1981-2017.

⁵Data from 1979-2017.

Appendix I. Guidelines for California Breeding Waterfowl Survey data

Definitions

Total Indicated Birds:	Drakes, Pairs and Groups combined.
Lone Drake:	Single isolated drake without a visible associated hen.
Flocked Drakes:	Four or fewer drakes in close association.
Pair:	Male and female in close association.
Group:	Five or more of mixed-sex grouping of the same species in close association which cannot be separated into singles and pairs.

Total Indicated Birds = Lone drakes x 1, Pairs, x 2, Groups x 1 (AOU_Num)

- Redhead (1460): exclude groups greater than 8
- Ring-necked Duck (1500)
- Lesser Scaup (1490): do not count in Napa and Suisun Strata
- Ruddy Duck (1670)
- Canada Goose (1720): count all broods separately
- Greater white-fronted goose (1710)
- American Coot (2210)
- Sandhill Crane (2060)
- Mute Swan (1782)

Total Indicated Birds = Lone drakes x 2, Pairs x 2, Flocked Drakes x 1, Groups x 1

- Common Merganser (1290)
- Mallard (1320)
- Gadwall (1350)
- American Wigeon (1370): exclude groups
- American Green-winged Teal (1390): exclude groups greater than 8
- Cinnamon Teal (1410)
- Northern Shoveler (1420): exclude groups
- Northern Pintail (1430)
- Wood Duck (1440)
- Canvasback (1470): exclude groups
- Common Goldeneye (1510)
- Bufflehead (1530)
- Blue-winged Teal (1400)

Appendix II. Guidelines for Determining Annual Visibility Correction Factor (VCF)

California VCFs are to be used for most species. The preference is for the current year VCF to reflect habitat or general conditions, especially for mallards. Sample size and Coefficient of Variation (CV) rule: at least 40 observations for the helicopter and fixed wing crews with a CV of 20% or less. If VCF is 1.0, or less do not use. If current year does not meet criteria, use previous year until criteria are met. Pooling can be used if criteria cannot be met and single year estimate is deemed not reasonable (VCF of 1.5 or less for mallards). In the case of scaup, ring-neck duck, mergansers, and goldeneye (species with few detections/low abundance in California) use U.S Fish and Wildlife Service VCF.