

2015 California Waterfowl Breeding Population Survey¹

By

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ABSTRACT

The annual California Department of Fish and Wildlife (CDFW) breeding waterfowl population survey was conducted from 20-27 April in the Central Valley and 26-27 May in northeastern California. Survey routes established in 1992 were sampled in 2015. Drought conditions remained throughout much of California for winter and spring although, northeastern California received above average late spring rains. Central Valley complimentary agriculture (mostly rice) and wetland habitats, received reduced and delayed surface water allotments from those of 2013-14. Reduced allotments are also anticipated for the 2015-16 season.

The total breeding duck population estimate for California is $315,450 \pm 42,000$, down 30 percent ($Z=-1.64$, $P=0.101$) from $448,750 \pm 69,360$ in 2014. The estimated breeding population of mallards is $173,865 \pm 28,175$, down 27 percent ($Z=-1.05$, $P = 0.292$) from the estimate of $238,670 \pm 54,600$ from the same areas in 2014; however differences are not statistically significant given the large confidence intervals. The estimated Canada goose population from the historic breeding range is $44,320 \pm 16,370$ up 23 percent ($Z=0.09$, $P=0.928$) from 2014 ($Z=0.09$, $P=0.928$).

¹ Data are preliminary.

METHODS

The procedures used in conducting this survey generally follow those contained in the United State Fish and Wildlife Service (USFWS) and Canadian Wildlife Service (CWS) protocol or standard operating procedures (SOP) for waterfowl breeding population survey (USFWS and CWS 1987). SOPs relative to the California survey are as follows:

Survey Timing

Nesting season in most areas of California is long compared to northern nesting areas. A range of 48 to 54 days existed between 10 percent and 90 percent of nest initiation in the Suisun Marsh during 5 years of study (McLandress *et al.* 1996). In the Central Valley and the Suisun Marsh about half the nests are initiated by the last week of April, however, in northeastern California nest initiations are later due to the increase in elevation and cooler temperatures. In northeastern California about 50 percent of the nests are initiated by mid-May.

Based upon this chronology of nesting, surveys in the Central Valley are conducted during the last week of April, and in northeastern California by mid-May. This selection of survey dates is based on nesting phenology of mallards and is independent of migration chronology although the survey can be delayed due to weather conditions. In addition, some species are still present in the State but are not known to nest in California in any significant numbers or at all. These survey dates likely miss early nesting mallards and pintails.

Survey Flight Time

Survey flights are scheduled to begin no later than 2 hours after sunrise and are completed no later than 1400 hours each afternoon. This timing facilitates use of Sacramento Executive Airport as a daily stopping point (except in northeastern California) and minimizes travel expenses and repeated non-survey flight hours.

Survey Flight Path

Transects within Central Valley strata (Sacramento Valley, Delta, San Joaquin Valley, and San Joaquin Desert strata) 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.

Survey Sample

The California survey utilizes the double-sampling procedure employed by the SOP's. A segment is an 18-statute mile (29 km) sampling unit having a total width of 1/4 mile (400 m), i.e., 1/8 mile (200 m) on each side of the aircraft. A transect is generally a continuous series of segments, except in the Northeastern stratum where segments and transects are disjunct. 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). A transect is the sampling unit.

The protocol prescribes two observer- biologists in addition to a pilot. The pilot does not survey waterfowl but concentrates on flight safety, speed and altitude, and segment navigation. Each observer counts all ducks, geese, and coots within 660 ft. (200 m) of, and on opposite sides of, the aircraft.

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 intervals. The San Joaquin Desert segments are spaced 28 miles apart due to decreased waterfowl habitat and numbers, and flight crew and time constraints. East and West Valley transect 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. elevation line.

The Napa valley is surveyed with transects designed to fit within the geographic features of the valleys. The Northeastern California transects were also selected to fit within geographical areas and to provide a representative sample of historically (prior to 1991 redesign) surveyed areas. The Suisun Marsh transects follow traditional routes established by the Department and therefore provides continuity with surveys from past years.

Reporting Units and Survey Crew Area

California is the reporting unit and the same aerial survey crew is responsible for all strata.

Data Collection

All waterfowl data, except as noted below, are recorded as in the SOP's. The air crew records geese as pairs, singles. Observations are recorded directly to a computer using the Survey Record and Transcribe program (2014 Jack Hodges, USFWS). Each computer was linked to a GPS unit. The program simultaneously recorded observations and their coordinates into linked sound and ASCII files, respectively.

Air-Ground Comparison Data

The orientation of transects precludes ground coverage of most segments. Segments do not parallel roads but instead cross numerous private properties and deep irrigation canals and ditches. Therefore, complete counts of waterfowl for comparison to the number of waterfowl counted from fixed-wing aircraft are conducted by observers in helicopters. Helicopter comparison segments follow fixed-wing segments in all strata except Napa/Santa Rosa stratum. Segments were selected based on the relative abundance of waterfowl, representative of habitats, and the proximity to airports.

Participants

Two observer-biologists accompany a helicopter pilot as in the fixed-wing surveys, the pilot's responsibilities are flight safety and navigation, including waypoint delineation of segment beginning and ending points. Helicopters are flown at 40-45 miles per hour at an altitude of 100 feet. The two observers record waterfowl in the same manner as fixed-wing observers.

Data Analysis

A second computer program, developed by John I. Hodges, was 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 were then used for data analysis.

Because the timing of the survey is early enough to detect late north-bound migrants, grouped birds of greater than 50 are not used in the calculation of Total Indicated Birds for species that commonly nest in California (mallard, cinnamon teal, gadwall, northern shoveler, northern pintail, wood duck or coots in all strata and redhead, canvasback, bufflehead, and mergansers in the northeastern California stratum). Grouped birds from other species are not used in the calculation of Total Indicated Birds. A variance of the estimated mallard breeding population is calculated using methods described in Martin et al. 1979, through a SAS program provided by T. Sanders (USFWS) and modified for use in California (see Zezulak *et. al* 1991). Estimated variances for breeding population estimates of other species are not provided because sample sizes for calculating VCF's are too small.

Data Adjustment

The Air-Ground Visibility Correction Factor (VCF) is calculated for each waterfowl species from the data collected by fixed-wing and helicopter crews. 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. Data are combined for all California strata because a single fixed-wing crew is used in all strata.

The calculated VCF's are compared to the long-term Breeding Population Survey Visibility Rates. The current year's calculated VCF is always used for mallards (if ground survey conducted) and if the VCF falls within the indicated range for each species of the commonly seen ducks. The long term average is used for seldom seen species.

Data analysis criteria are mostly species specific. These criteria can be found in Appendix 1 of this document.

RESULTS

Breeding Population Estimates

Estimated total breeding populations decreased 29 percent in 2015 (Table 1). The decrease in breeding duck population estimates between 2013 and 2015 (approximately -135,700) is due primarily to decreases in estimated numbers of mallards (-124,800), northern shovelers (-10,300) and gadwall (-16,100).

The Northeastern stratum is used to monitor the historic breeding population of Canada Geese. In the past, management of this population has been based on the Traditional Canada Goose Survey, which was not a standardized survey. This survey is in the process of being phased out and management will be based solely on the California Waterfowl Breeding Population Survey. The Northeastern strata Canada goose population estimate in 2015 was 44,322, an increase of 30 percent from 31,209 in 2014 (Table 1).

Weather Conditions

All Central Valley strata recorded below average precipitation prior to the survey (Table 2). Since precipitation is a major driver of waterfowl breeding habitat we provide a summary of weather conditions in each stratum. Weather stations in each stratum were used to calculate total precipitation for the period of January through April. Long term averages used to calculate statistics were generated from 25 years of data.

The 7 weather stations used to estimate total precipitation in the Sacramento Valley recorded 34.3 inches ($Z=-1.74$, $P=0.082$) of rainfall, well below the mean of 139.6 inches. The West Valley ($Z=-1.21$, $P=0.226$) strata recorded 8.5 inches of rainfall amongst 2 weather stations, a value below the mean of 24.2 inches. The East Valley stratum was divided into two regions, north and south, at Sacramento due to differences in precipitation in these areas. However, waterfowl population estimates are based on the entire stratum; the north and south split is only for weather purposes. Three stations were used to estimate a total precipitation value of 41.5 ($Z=-1.46$, $P=0.144$) inches in the East Valley north of Sacramento. This is below the mean of 110.6 inches for this region. The 2 weather stations used to calculate total precipitation for the East Valley stratum south of Sacramento recorded 7.6 inches of precipitation ($Z=-0.62$, $P=0.535$), well below the mean of 25.3 inches. The one weather station used to estimate precipitation for the Napa / Santa Rosa stratum recorded 5.0 inches of rainfall ($Z=-1.12$, $P=0.263$), a value below the mean of 15.8 inches. The one weather station used to estimate precipitation in Suisun Marsh indicated 11.2 inches ($Z=-1.23$, $P=.219$), which is below the mean of 25.3 inches. The one station used in the Delta stratum indicated 7.1 inches ($Z=-1.27$, $P=0.204$) of rainfall, below the mean of 17.8 inches. The four stations used in the San Joaquin Grasslands strata recorded 13.0 inches of rainfall ($Z=-0.90$, $P=0.368$), a value below the mean of 34.9 inches. The three weather stations used in the San Joaquin Desert stratum recorded 3.8 inches ($Z=-1.51$, $P=0.131$) of precipitation, a value

below the mean of 17.3 inches.

Weather data was generated in the Northeastern California stratum similar to the Central Valley, however the period of January through May was used since the survey takes place during May (Table 2). Four weather stations were used to estimate precipitation in this region. These stations recorded 32.9 (Z -0.62, P=0.535) inches of precipitation, a value below the 25 year mean of 43.0 inches. Snow pack is also a critical component of maintaining water in mountain wet meadow complexes in northeastern California. We used four (see Figure 1) U.S. Department of Agriculture Natural Resource Conservation Service Snow Telemetry (a.k.a. SNOTEL) weather stations to estimate 25 year means to generate summary statistics of snow-water content (Table 3). We estimated seasonal average snow-water content (SWC) based on data from November thru April.

The Adin Mountain station recorded an average SWC of 0.55 inches (Z-1.59, P=0.112), well below the mean of 6.66 inches. The Cedar Pass station recorded an average of 2.09 inches (Z-1.93, P=0.054) of SWC, significantly below the average of 9.92 inches. The Dismal Swamp station recorded 9.46 inches (Z-1.15, P=0.250) of SWC, a value below the mean of 16.02 inches. Finally, the Independence Lake station recorded an average of 12.03 inches (Z-1.17, P=0.242) of SWC, a value below the mean of 23.16 inches.

DISCUSSION

Drought conditions have continued in California since 2012, which makes 2015 the fourth year of the ongoing drought. Precipitation amounts during 2014–15 in the Central Valley were significantly below average at all stations during January, March and April (Table 2). Storage in major reservoirs is below normal (CDWRa 2015) causing the California State Water Resources Control Board to impose some of the earliest water delivery curtailments to all users. While fall-planted cereal grains and other grasses reached suitable heights for nesting waterfowl in the Central Valley by early April, delays in rice irrigation deliveries and concomitant disking of "set-aside" lands to comply with water transfer regulations reduced nesting habitat in the Central Valley (CDWRb 2015).

Precipitation in Northeastern California was above average overall due to heavy rains in February and May (Table 2), however, snow water content was at some of the lowest observed levels in the thirty years SNOTEL data has been collected (Table 3). Most the rainfall observed in Northeastern California occurred near the Nevada Stateline improving breeding conditions in that region for waterfowl. Conditions further north and east in this strata were much drier, thus overall habitat conditions for breeding waterfowl were fair to poor.

Decreased habitat availability in the Central Valley probably accounts for the decline in most dabbling ducks, whereas reduced snowpack to maintain mountain meadow complexes in northeastern California likely accounts for the declines in that region.

Table 1. Statewide duck, American coot and Canada goose¹ population estimates.

DABBLERS	MALL	GADW	AMWI	GWTE	CITE	NSHO	NOPI	WODU
2015	173,865	58,290	1,893	2,143	28,534	12,834	772	8,421
SE	28,175	21,787	839	1,621	8,531	4,509	365	2,746
LTA ²	348,787	86,571	5,028	4,106	42,253	33,719	6,253	8,322
% LTA	-50.2%	-32.7%	-62.4%	-47.8%	-32.5%	-61.9%	-87.7%	1.2%
% Previous YR	-27.2%	-37.5%	-49.6%	-66.4%	-7.6%	-60.1%	-19.8%	-1.8%
DIVERS	MERG	REDH	CANV	LESC	RNDU	GOLD	BUFF	
2015	181	1,316	277	1,295	2,054	0	2,166	
SE	170	960	191	1,195	2,025	0	1,381	
LTA	464	3,159	998	5,203	561	320	3,135	
% LTA	-61.0%	-58.3%	-72.3%	-75.1%	266.2%	N/A	-30.9%	
% Previous YR	-88.5%	-67.9%	-93.6%	-20.0%	110.5%	N/A	0.8%	
GEESE & COOTS	NE CAGO	AMCO	TOTAL DUCKS					
2015	44,322	470,654	315,577					
SE	16,368	184,344	42,004.8					
LTA ³	42,590	232,612	568,797					
% LTA	4.1%	102.3%	-44.5%					
% Previous YR	42.0%	-24.5%	-29.7%					

¹Northeastern Canada goose population data only.

²LTA's derived 1992-2015.

³Northeastern California Canada Goose LTA derived 1993-2015.

Table 2. Current year and long term average^{1,2} precipitation (in inches) by CA BPS stratum.

Stratum	Year	January	February	March	April	Spring Total	Spring z-score	
SACRAMENTO VALLEY ³	2015	0.6	26.6	2.3	4.9	34.3	-1.74	
	LTA	43.0	44.3	34.6	17.6	139.6		
WEST VALLEY ⁴	2015	0.2	7.1	0.3	0.9	8.5	-1.21	
	LTA	7.6	7.3	6.3	2.9	24.2		
EAST VALLEY (NORTH) ^{5,6}	2015	0.4	19.5	2.0	19.6	41.5	-1.46	
	LTA	33.5	35.0	26.9	15.1	110.6		
NAPA/SANTA ROSA ⁷	2015	0.1	3.1	0.3	1.5	5.0	-1.12	
	LTA	4.5	5.2	4.6	1.5	15.8		
SUISUN ⁸	2015	0.0	7.6	0.5	3.1	11.2	-1.23	
	LTA	7.8	9.1	5.5	2.8	25.3		
DELTA ⁹	2015	0.0	3.8	0.0	3.3	7.1	-1.27	
	LTA	7.4	7.3	0.2	3.0	17.8		
GRASSLANDS ¹⁰	2015	0.1	7.3	0.4	5.2	13.0	-0.90	
	LTA	11.4	11.3	5.9	6.1	34.7		
EAST VALLEY (SOUTH) ¹¹	2015	0.2	4.2	0.4	2.7	7.6	-0.62	
	LTA	5.8	5.5	9.0	4.9	25.3		
DESERT ¹²	2015	0.3	2.1	0.2	1.2	3.8	-1.51	
	LTA	4.9	4.6	5.2	2.6	17.3		
NORTHEASTERN CA ¹³	2015	1.87	10.67	5.80	2.23	12.34	32.91	-0.62
	LTA	9.60	7.26	8.59	7.74	9.82	43.01	

¹Data acquired from NOAA NCDC online database or RAWS station online data, long term averages derived from 1990-2015.

²For stratum with large area a sum of precipitation was calculated from numerous weather stations was used. Not all station data was complete therefore nearby stations were used as supplements (see Figure 1).

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

⁴Weather stations used: Stonyford (USC00048580), Thomas Creek (RAWS)

⁵East Valley was separated at Sacramento due to differences in weather to be more informative however BPOP data analyzes this stratum as one.

⁶Weather stations used: Paradise (GHCND:USC00046685), Bangor (RAWS) and Lincoln (RAWS).

⁷Weather station: was Santa Rosa (RAWS).

⁸Weather station used: Antioch (GHCND: USC00040232).

⁹Weather station used: located in Stockton (GHCND:US1CASJ0011).

¹⁰Weather stations used: Green Springs (RAWS), Stockton (GHCND:US1CASJ0011), Los Banos (RAWS) and Modesto (GHCND:USW00023258).

¹¹Weather stations used: Green Springs (RAWS) and Francher Creek (RAWS).

¹²Weather stations used: Francher Creek (RAWS), Kettleman Hills (RAWS) and Hanford (GHCND:USC00043747).

¹³Weather stations used: Juniper Creek (RAWS), Doyle (RAWS), Tulalake (GHCND:USC00049053) and Cedarville (GHCND:USC00041614).

Table 3. Current year and long term average¹ snow water content (in inches) in Northeastern CA BPS strata.

Location²	Year	NOV	DEC	JAN	FEB	MAR	APR	Season Average	Season Average z- Score
Adin Mountain ³	2015	0.02	1.02	1.97	0.20	0.08	0.02	0.55	-1.59
	LTA	1.05	3.78	6.81	9.45	11.31	7.53	6.66	
Cedar Pass ⁴	2015	0.34	2.61	4.84	3.38	1.33	0.04	2.09	-1.93
	LTA	1.71	5.23	8.83	12.41	16.13	15.23	9.92	
Dismal Swamp ⁵	2015	1.28	7.68	11.69	13.36	12.72	10.03	9.46	-1.15
	LTA	2.34	8.27	14.38	19.78	25.23	26.12	16.02	
Independence Lake ⁶	2015	0.42	8.85	11.87	16.52	18.25	16.26	12.03	-1.17
	LTA	2.92	10.36	19.29	27.62	36.76	41.98	23.16	

¹Long term averages derived from all station data available.

²Data from NRCS SNOTEL stations, see Figure 1 for locations.

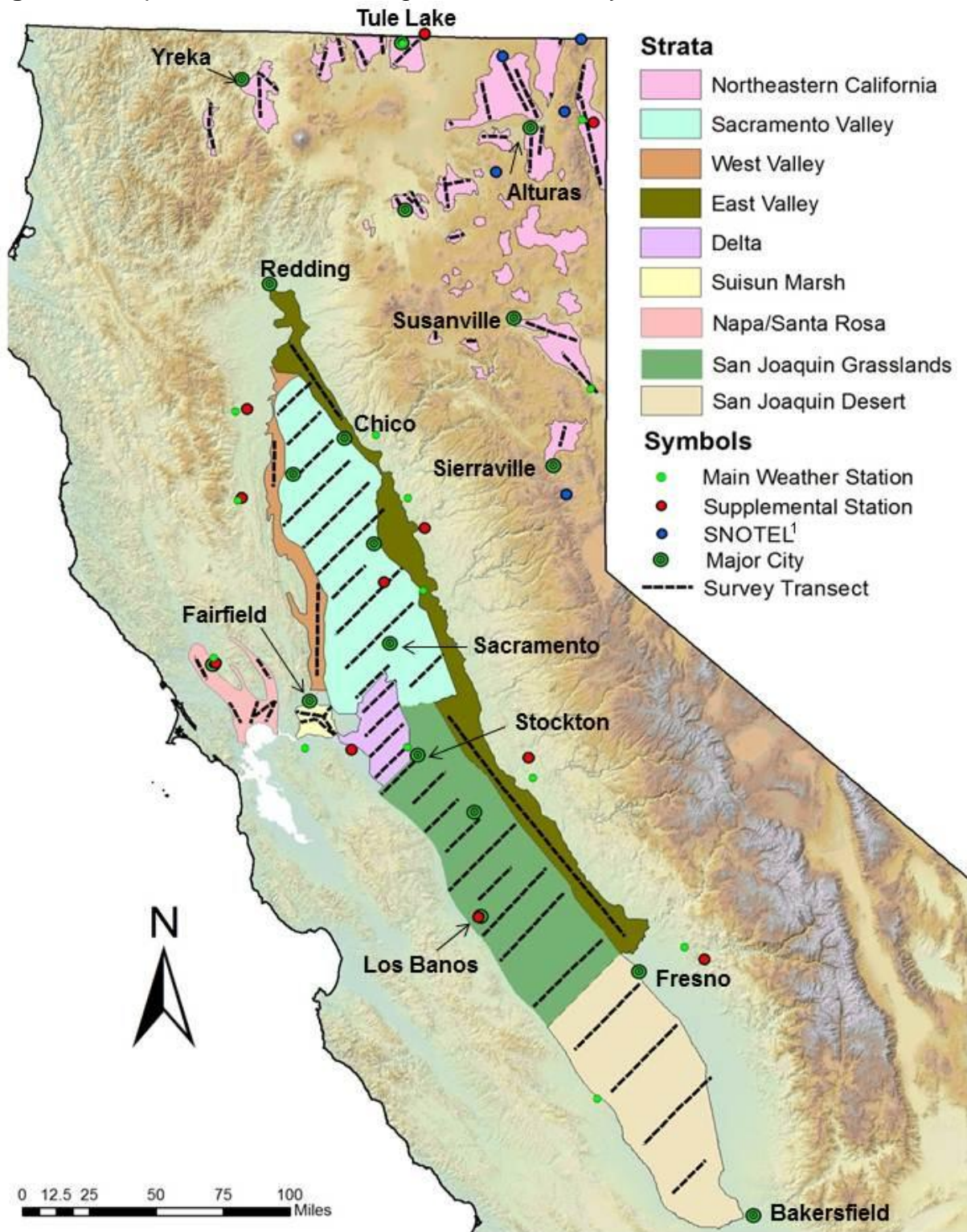
³Data from 1985-2015.

⁴Data from 1979-2015.

⁵Data from 1981-2015.

⁶Data from 1979-2015.

Figure 1. Map of California Breeding Waterfowl Survey



¹SNOTEL is U.S. Department of Agriculture Natural Resource Conservation Service Snow Telemetry weather station.

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Appendix 1

Guidelines for California Breeding Pair Survey Data

Data Collection

Definitions

Lone Drake:	Single isolated drake without a visible associated hen.
Flocked Drakes:	4 or less drakes in close association.
Pair:	Male and female in close association.
Group:	5 or more of mixed-sex grouping of the same species in close Association which cannot be separated into singles and pairs.

Entry of Survey Data

1290	Mergansers	Singles x2, Pairs x2, Groups x1
1320	MALL	Singles x2, Pairs x2, Groups x1
1350	GADW	Singles x2, Pairs x2, Groups x1
1370	AMWI	Singles x2, Pairs x2, <i>exclude Groups</i>
1390	AGWT	Singles x2, Pairs x2, <i>Groups <8</i>
1410	CITE	Singles x2, Pairs x2, Groups x1
1420	NSHO	Singles x2, Pairs x2, <i>exclude Groups</i>
1430	NOPI	Singles x2, Pairs x2, Groups x1
1440	WODU	Singles x2, Pairs x2, Groups x1
1460	REDH	Singles x1, Pairs x2, Groups x1
1470	CANV	Singles x2, Pairs x2, <i>exclude Groups</i>
1490	LESC	Singles x1, Pairs x2, <i>exclude Groups</i>
	Do not count scaup in Napa and Suisun Strata	
1500	RNDU	Singles x1, Pairs x2, Groups x1
1510	COGO	Singles x2, Pairs x2, Groups x1
1530	BUFF	Singles x2, Pairs x2, Groups x1
1670	RUDU	Singles x1, Pairs x2, Groups x1
1720	CAGO	Singles x1, Pairs x2, Groups x1
2210	AMCO	Singles x1, Pairs x2, Groups x1