Delayed Wheat Harvest Pilot Program

2020 Final Report

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Contents

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Summary

In response to the continued decline of California's breeding mallard population, California Waterfowl Association (CWA) developed and executed a privately funded pilot program to implement the delay of small grain harvest in the Sacramento Valley in the spring of 2020. The program provided an incentive payment of $30-$40/acre for growers to delay harvest until July 1-15, allowing nests to hatch safely. Funding from private donors was secured in late February, forcing a short application period of 3 weeks (March 5-25). Despite this, grower interest was strong, resulting in 81 fields totaling 7,566 acres — 10.5% of the total acreage of planted winter wheat in the Sacramento Valley. CWA entered into contract with 15 growers (17 fields) from four counties (Colusa, Sacramento, Sutter and Yolo), totaling 1,750.6 acres of small grains; there was a single control field (69 ac) located on a farm participating in the program. Fields ranged in size from 15-210 acres; average field size was 103 acres.

The majority of growers (54%) opted for the latest harvest period (July 11-15) for the highest pay rate ($40/ac) in their contract. While 33% of growers harvested between July 6-10 for $35/ac, 13% opted for the earliest harvest date (July 1-5) for $30/ac. This suggests that the reward of the incentive payments outweighed the risk of crop loss, which is not surprising considering the market value of winter wheat at that time (KCBT $4.49/bu).

We completed field appraisals using a standardized rubric with a variety of desirable field characteristics to rank applicant fields. The most decisive parameters were distance to water and proximate water source. The three primary water source categories that fields fell under were planted rice, wetland and irrigation canal/ditch. While there were multiple proximate water sources for many fields, we grouped them by their primary source. The majority of fields (53%) were situated near planted rice, 29% were near irrigation canals/ditches, and 18% had wetlands as their primary proximate water source.

From April 22 to June 30, 2020, we conducted semi-monthly indicated breeding pair (IBP) surveys on 18 fields (17 enrolled fields and one control). On average, fields were surveyed 5 times. Observers recorded all waterfowl species seen, their status (lone hen/drake, pair, 3-bird flight, group, flock) and their activity (fly, land, flush) during the early morning 5-minute survey duration. For the purpose of this program, we only considered lone hens, pairs and 3-bird flights "true" IBPs if they were seen landing in or flushing from the field in question. Otherwise, lone hens/drakes, pairs and 3-bird flights that did not land or flush from the field were recorded as non-confirmed IBPs (non-IBP). We assumed non-confirmed IBPs were likely nesting in the surrounding area and/or the enrolled grain field.

Given the short timeline, and funding and staffing constraints, we were unable to collect sufficient survey data (small sample size with insufficient control group) to make strong analytical inferences. Common sense, investigative statistics from previous studies (Skone et al. 2016, Hoekman et al. 2006, McLandress et al. 1996, Loughman et al. 1990) and the descriptive statistics from this project suggest that having the program available is better for local duck production than not having it at all. Our descriptive statistics provide proof of concept and suggest that fields with proximate water sources of rice or wetlands were more productive than fields with irrigation canals or ditches. Fields located near planted rice had a range of 0-11 IBPs, with an average of 3.5 total IBPs observed per field. However, the number of total non-IBPs recorded was impressive, with a range of 3-42 and an average of 19 total non-IBPs. Fields situated near a summer wetland had a range of 4-7 total IBPs with an average of 5, and a range of 6-35 total non-IBPs with an average of 22. Fields that appeared to be the least productive were those that had irrigation canals/ditches as their primary water source. Total IBPs ranged from 0 to 1, and

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non-IBPs ranged from 1 to 6. All fields recorded non-confirmed IBPs, meaning those birds could be nesting in the grain field or in the surrounding area. There were four fields that recorded zero IBPs; three had irrigation as their primary water source, and one was in rice country.

On May 21, 2020, CWA was granted permission to conduct a single nest search on a portion of the only control wheat field, Keller Ranch, K7. Total field size was 69 acres, and crews hand-dragged a quarter of it (17 acres). This resulted in locating 15 active mallard nests, one depredated nest and one northern harrier nest. We monitored nests until they were hatched, abandoned or depredated. A single hen was captured and marked with a GSM transmitter that stopped working on June 4, 2020. Considering that we were able to conduct only a single search (typically new nests are found with semi-monthly searches and begin in April), the apparent nest density of 0.94 is outstanding. Results from this field's IBP survey data consisted of a total of 5 IBPs and 26 non-IBPs, and salvage efforts revealed an additional 29 nests. Crop damage was minimal because seed heads were not yet desiccated; most notable damage was caused by footpaths to drag rope and check nests.

In an effort to better understand the dynamics of ag-nesting mallards, we attempted to capture and mark nesting hens with GSM-transmitters in a variety of crops. We partnered with the USGS in 2019 to determine feasibility; we marked two cover crop-nesting mallards that would ultimately have their nests salvaged prior to cover being cut and incorporated into the field. Of those two, one is still operational and transmitting. Her behavior is striking – much of it was spent in an ag setting in both 2019 and 2020, with the exception of her wing molt and some of the 2019-20 duck season spent at the Sacramento NWRC and in the Butte Sink. In 2020, we received six refurbished GSM Ecotone transmitters and a single new Ornitella transmitter from USGS, and we marked six additional hens in various cover. Unfortunately, we were able to receive location data from only one of the six Ecotone transmitters; there were no issues with the Ornitella transmitter. We hope to continue marking ducks that breed in the ag-dominated landscape of the Central Valley, but the cost of units (~$5,000/each) will limit us.

In order to achieve a robust dataset for this program, we suggest surveying additional control fields (those not delaying harvest), increasing survey frequency of all fields and including additional survey parameters. The purpose of additional monitoring is to build upon our dataset to produce statistics that can provide guidance and actionable protocols for the program. It will also help to tease apart the inherent nuances of the program and explore any correlative relationships. For example, pairing delayed fields with non-delayed fields for IBP surveys would increase statistical power. Pairing field IBP data with daily nest survival (achieved by multiple nest searches with weekly nest monitoring) would be ideal to examine the relationship between IBP observations and nests on the ground.

Other monitoring options to get at nest density and nest success with minimum crop damage could include post-harvest nest searches, and nest searches and brood surveys with drones. All of these options are costly and time-consuming. Ultimately our goal is to have the ability to clearly identify the factors that determine productive wheat fields for breeding ducks, i.e. what specific field attributes or combination of attributes will attract the most breeding ducks, or produce the most ducks at the lowest cost? This will help to prioritize fields, therefore dispersing incentive payment funds in the most efficient way. Without additional funding for staffing needs and costs of a drone operator, these monitoring techniques will not be employed in 2021. We will, however, attempt to conduct IBP surveys on some waitlisted (null) fields in 2021.

In July, after fields were harvested, CWA mailed participants their incentive payments as well as a short survey. The survey consisted of basic questions about their experience with the program and the productivity of their crop. Response rate was 74% (11 of 15 growers), and it was overwhelmingly positive. All but one said they'd enroll in the program again (and the one did not rule it out), 91% found the contract easy to understand, and more than half (55%) participated in the Egg Salvage Program during harvest. While two growers reported loss due to seed shatter, most (80%) felt that the productivity of their fields was not significantly compromised. On average, they produced 59.1 cwt/acre; typical grain production is 60 cwt/ac. The biggest challenges growers faced by delaying grain harvest were increased fire hazard and increased weeds.

The success of waterfowl conservation is undoubtedly tied to our ability to identify common ground with and integrate management within the dominating land cover of California – agriculture. Exploring how both can coexist, or more importantly benefit from each other, is critical to the success of recovering California's breeding ducks. Therefore, serious efforts to improve breeding duck populations need to incorporate working ag lands more frequently. The Delayed Wheat Program is a simple, cost-effective solution that in practice can be used to benefit locally breeding wildlife and provide farmers with a monetary incentive for a commodity with relatively low market prices without them losing significant value of their crop. For example, we estimate that this program likely added one duck per acre at a cost of about $34 per duck. Delaying harvest of cereal grains has the ability to positively impact breeding bird populations on a broad scale throughout the Central Valley by providing a limited habitat type at a critical time of year. This program demonstrates an economically reasonable method to attain breeding duck habitat and population objectives. Think of it as annually leasing out grain fields (habitat) for duck production (population).

Background

For many birds, breeding habitat and agriculture are connected in complex and inseparable ways both biologically and temporally. Therefore, agricultural trends may be as important as precipitation in determining wildlife habitat quality and availability. Quantifying the extent of breeding bird use in croplands has been problematic due to the inherent nature of traditional monitoring techniques that typically result in crop damage. Consequently, croplands remain the least-known habitat type of one of the most studied game birds in North America, the mallard. California Department of Fish and Wildlife (CDFW) breeding duck surveys show that the state's mallard population has been in decline over the last decade, with significant decreases from the long-term average (LTA -28%). Moreover, the Sacramento Valley, once the top mallard-producing region in the state, has experienced the steepest decline: 44% below the LTA (Figure 1). This is likely due in large part to agricultural land-use changes throughout the state which has resulted in a deficit of upland nesting habitat and brood-rearing wetlands for locally breeding ducks.

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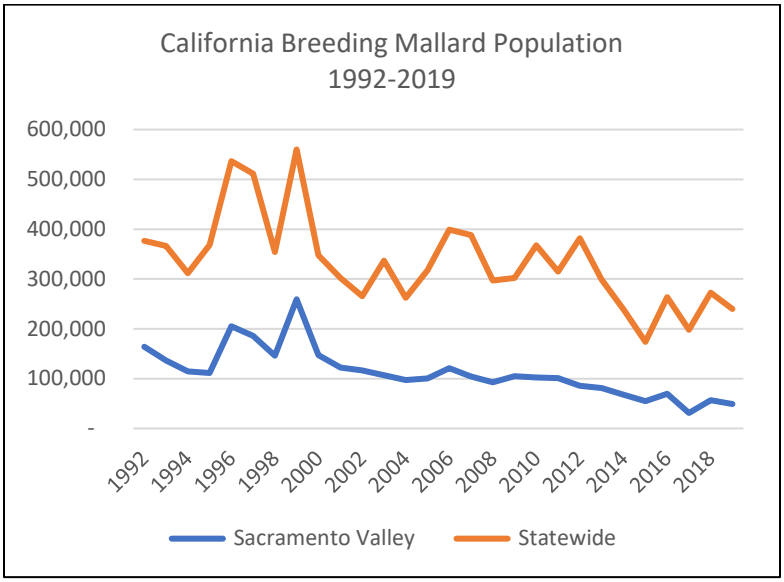
Figure 1. Long-term trends of California's breeding mallard population, Statewide and in the Sacramento Valley.



The use of small grain crops by breeding waterfowl is well documented in California. Vital rates critical to sustaining robust bird populations, such as nest density and nest success, are typically higher in winter wheat than perennial grasses or spring-planted cereals in years when fields were harvested *after* most nests had hatched. Many have concluded that small grains are a conservation tool well suited to highly cropped landscapes, like the Central Valley. However, the annual acreage of fall-seeded cereal grains has declined (Figure 2), largely due to low market prices. Wildlife friendly crops like cereal grains, pasture and various cover and row crops are being converted into permanent crops (i.e. orchards and vineyards), which hold little biological value to wildlife. According to the California Wheat Commission (CWC), in 2019 there was a total of 320,000 acres of assorted wheat varieties planted for grain in California, about 65,000 acres less than the previous year (CWC 2019). Providing payments to growers to delay harvest should be motivating given market prices ($4.49/bu; Kansas City Boards of Trade). Payments may also help reduce the rate of conversion of small-grains acres to permanent crops.

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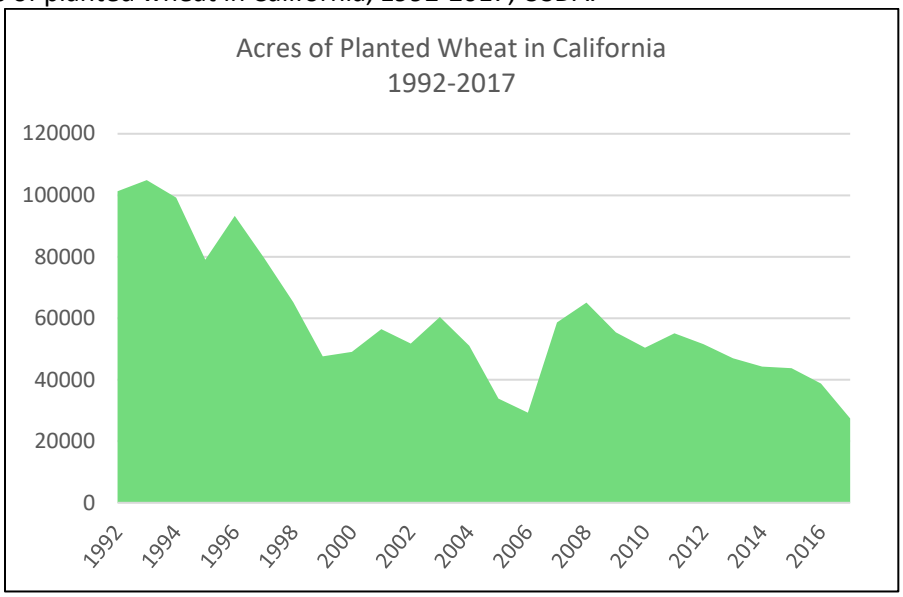
Figure 2. Acres of planted wheat in California, 1992-2017, USDA.



In the Sacramento Valley, cultivated rice lands act much like brood-rearing wetlands. Similarly, cereal grains provide vegetative cover for nesting ducks in lieu of natural uplands. But cereal grains can act as a source – or a sink – for waterfowl production, depending on timing of harvest. In most years, the wildlife-agriculture conflict occurs in May and June, when the harvest of small grains takes place simultaneous with peak waterfowl hatch. This results in complete destruction of active nests and/or mortality of hens struck by farm implements while on the nest. To alleviate this conflict, California Waterfowl Association (CWA) offers farmers an alternative – the Egg Salvage Program. This program facilitates the removal and transport of duck nests from ag fields to federally permitted hatcheries to avoid destruction by normal farming activities. Eggs are hatched, and ducklings are reared and released. Data collected through the Egg Salvage Program shows that while ducks will nest in a variety of crop types, small grains like oats and wheat are used extensively (25-44% of all salvaged nests) and at high nest densities. It is not, however, a viable long-term solution because it is not cost efficient (~$200/duck), has a limited range (due to staffing constraints) and likely produces ducklings with lower survival rates due to the absence of hens and the protection they would typically provide to their broods.

> While this program targets breeding waterfowl, several other ground-nesting species would benefit from this practice, including the red-winged black bird (*Agelaius phoeniceus*), ring-necked pheasant (*Phasianus colchicus*), American bittern (*Botaurus lentiginosus*), short-eared owl (*Asio flammeus*) and northern harrier (*Circus hudsonius*), the latter two being California state species of concern.

To address this conflict and the predominant issue of mallard decline, in early spring of 2020, the CWA developed a pilot program to demonstrate the need for an incentivized delayed small grain harvest program and to determine grower interest. The Delayed Wheat Program is a simple, economical solution that in practice can be used to benefit locally breeding wildlife and provide farmers with a monetary incentive for a commodity with relatively low market prices without losing significant value of their crop. This program is one of the only methods that is fiscally reasonable to attain breeding habitat

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objectives. This report summarizes the results of the 2020 pilot program and outlines the potential to further develop the program in 2021.

Program Objectives

The main goal of this program is to increase local duck production by creating safe and reliable upland nesting habitat within the agricultural landscape that now dominates much of California's landcover. To meet this objective, breeding duck habitat management needs to be integrated into the matrix of agricultural working lands. Securing a sustainable funding source is essential in achieving implementation on a broad scale. The most logical way to attain this is by incorporating this practice into a state or federal program, such as the Natural Resource Conservation Service (NRCS) Upland Wildlife Habitat Management practice (code 645).

Funding & Incentive Payments

Thanks to supportive CWA members, funding for grower incentive payments was secured in late February 2020. The program offered growers three incentive rates contingent on harvest date: July 1-5 = $30/ac; July 6-10 = $35/ac; July 11-15 = $40/ac. Payments make this practice economically attractive to growers, while also meeting the needs of breeding birds that nest in fall-seeded grains. Incentives will allow us to 1) assess breeding bird use and grower interest in association with the estimated agronomic benefits/costs, 2) determine appropriate payment rates and 3) create vital nesting habitat for locally breeding waterfowl and other ground-nesting species.

Geographic Location & Program Enrollment

This program took place in the Northern Sacramento Valley and was available in the following counties: Butte, Colusa, Glenn, Sacramento, Sutter and Yolo. Funding was secured in late February, resulting in a truncated application period that was approximately 3 weeks (March 5-25). Through our partnerships with the California Wheat Commission, the University of California Cooperative Extension and Northern California Water Association, over 100 farmers in the Sacramento Valley received program information. There was overwhelming support and interest from growers; CWA received 32 applications from 7 counties, totaling 81 fields and 7,566 acres. Average field size was 93 acres and ranged from 7 to 900 acres (Table 1). The total acreage registered through applications was 10.5% of the total Sacramento Valley's planted wheat acres (72,000; CWC 2019), despite the short application window, clearly demonstrating that this practice has high potential for large-scale implementation.

Table 1. Applications received for the Delayed Wheat Program pilot year March 5-25, 2020.

County	# Applicants	# Fields	Total Acres	Avg. Field Size
Butte	2	4	316	79
Colusa	12	21	1765	84
Glenn	1	2	1033	517
Sacramento	3	18	1131	63
Solano	1	1	126	126
Sutter	7	11	1243	113
Yolo	6	24	1952	81
Total	32	81	7566	93

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Field Appraisals & Contracting

CWA completed applicant field appraisals using a standardized rubric with a variety of desirable field characteristics (e.g. distance to water, proximate water source; Appendix A). Fields located in rice-growing regions or near a reliable summer water source (wetlands, creeks, sloughs, etc.) had an advantage during the appraisal period and subsequent ranking. After completion, high-ranking applicants were invited to enter into the contract phase (Appendix B), while all others were waitlisted. Farmers on the waitlist were made aware that they could potentially receive funding later on in the summer (e.g. if a contracted grower harvested prior to agreed date), encouraging them to put off harvest longer. CWA contracted with 15 growers (17 fields) from four counties (Colusa, Sacramento, Sutter and Yolo), totaling 1,751 acres of small grains (Table 2). Successful applicant fields ranged in size from 15 to 210 acres, and average field size was 103 acres. CWA began semi-monthly biological monitoring surveys thereafter.

Table 2. Successful applicants for the 2020 Delayed Wheat Program pilot year.

County	# Applicants	# Fields	Acres	Avg. Field Size
Colusa	5	5	538	91
Sacramento	3	4	340	68
Sutter	4	4	598	149.5
Yolo	3	4	275	91.7
Total	15	17	1751	103

Grower Outreach: Post-Harvest Survey

In July, after fields were harvested, CWA mailed participants their incentive payments as well as a short survey (Appendix D). The survey consisted of basic questions about their experience with the program and the productivity of their crop. Response rate was 74% (11 of 15 growers), and it was overwhelmingly positive (Appendix E). All but one said they'd enroll in the program again (and the one didn't rule it out), 91% found the contract easy to understand, and more than half (55%) participated in the Egg Salvage Program during harvest. While two growers reported loss due to seed shatter, most (80%) felt that the productivity of their fields was not significantly compromised. On average, they produced 59.1 cwt/acre; typical grain production is 60 cwt/ac. The biggest challenges growers faced by delaying grain harvest were increased fire hazard and increased weeds.

Biological Monitoring:

Indicated Breeding Pair Surveys

Monitoring consisted of semi-monthly indicated breeding pair (IBP) surveys, which provide an estimation of breeding bird use and bird diversity. IBP surveys were conducted on all contracted fields and one control field (Keller Ranch, K7) beginning on April 22 and ending on June 30, 2020; there was an average of 5 surveys per field. Executing these surveys on waitlisted fields would have been ideal, but funding and time constraints resulted in only one additional field (Keller Ranch) to be surveyed. Our survey methods followed those developed and used by the US Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service (CWS) during the annual Waterfowl Breeding Population and Habitat Survey, with modifications pertinent to this program size and design.

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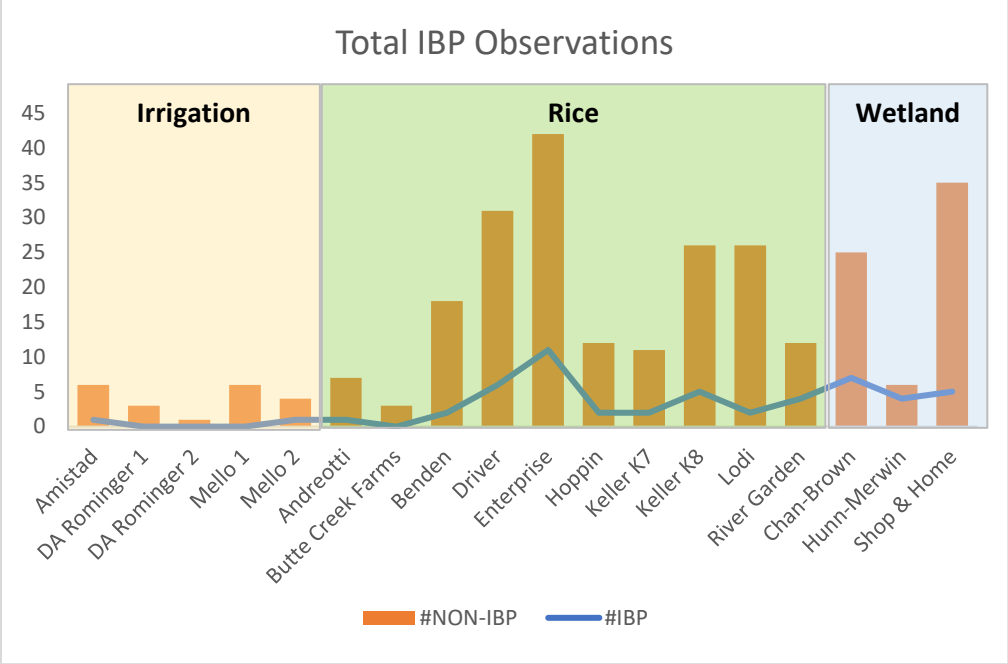
Field conditions (e.g. temperature, wind speed, etc.) and proximate water conditions (dry, partially flooded, fully flooded) were recorded during each survey. Surveys were 5 minutes in duration and were conducted between sunrise and 7:00 a.m. All birds seen and heard were recorded. All ducks were assigned a status – pair, lone hen, lone drake, 3-bird flight, group (less than 5 birds) and flock (5+ birds). Duck activity (flying, flushing, landing, 3-bird flight) was also recorded in association with each identified IBP. For the purpose of this program, we only considered lone hens, pairs and 3-bird flights "true" IBPs if they were seen landing in or flushing from the field in question. Otherwise, lone hens/drakes, pairs and 3-bird flights that did not land or flush from the field were recorded as non-confirmed IBPs (non-IBP). We assumed non-confirmed IBPs were likely nesting in the surrounding area and/or the enrolled grain field. For a more in-depth look at field data sheets and methodologies used, reference Appendix C (IBP protocol and field data sheet).

Survey data was entered and proofed in Microsoft Excel and included numbers of confirmed IBPs, non-confirmed IBPs and field attributes (e.g. condition of proximate water – dry, partially flooded, fully flooded). Given the short timeline, and funding and staffing constraints, we were unable to collect sufficient survey data (small sample size with insufficient control group) to make strong analytical inferences. Our descriptive statistics provide proof of concept and suggest that fields with proximate water sources of rice or wetlands are more productive than fields with irrigation canals or ditches (Figure 3).

Figure 3. Total confirmed (IBP) and non-confirmed (non-IBP) indicated breeding pair observations grouped by primary proximate water source.



Fields located near planted rice had a range of 0-11 IBPs, with an average of 3.5 total IBPs observed per field. However, the number of total non-IBPs recorded was impressive, with a range of 3-42 and an average of 19 total non-IBPs. Fields situated near a summer wetland had a range of 4-7 total IBPs with an average of 5, and a range of 6-35 total non-IBPs with an average of 22. Fields that appeared to be the

least productive were those that had irrigation canals/ditches as the primary water source. Total IBPs ranged from 0-1, and non-IBPs ranged from 1-6. All fields recorded non-confirmed IBPs, meaning those birds could be nesting in the grain field or in the surrounding area. There were four fields that recorded zero IBPs; three had irrigation as its primary water source, and one was in rice country (Table 3).

Table 3. Summary of program field characteristics, 2020.

Farm	Proximate Water Type	Co.	Actual Harvest Date	Acres	# Surveys	# Confirmed IBP	# Non-Confirmed IBP	# Bird Species
Amistad	irrigation	Sacramento	11-Jul	32	6	1	6	13
DA Rominger 1	irrigation	Yolo	2-Jul	15	5	0	3	4
DA Rominger 2	irrigation	Yolo	2-Jul	50	5	0	1	6
Mello 1	irrigation	Sacramento	12-Jul	65.4	6	0	6	10
Mello 2	irrigation	Sacramento	12-Jul	66.7	6	1	4	11
			Average	45.8	5.6	0.4	4	8.8
Andreotti	rice	Sutter	1-Jul	70	5	1	7	7
Butte Creek	rice	Colusa	13-Jul	24	4	0	3	9
Benden	rice	Colusa	13-Jul	72.5	4	2	18	8
Driver	rice	Colusa	6-Jul	155	4	6	31	7
Enterprise	rice	Sutter	8-Jul	180	5	11	42	6
Hoppin	rice	Sutter	11-Jul	208	5	2	12	3
Keller K7	rice	Colusa	13-Jul	113	2	2	11	5
Keller K8 (control)	rice	Colusa	6-Jul	69	4	5	26	8
Lodi	rice	Colusa	12-Jul	173	4	2	26	8
River Garden	rice	Yolo	6-Jul	210	5	4	12	10
			Average	127.5	4.2	3.5	18.8	7.1
Chan-Brown	wetland	Sacramento	7-Jul	96	6	7	25	10
Hunn-Merwin	wetland	Sacramento	11-Jul	80	6	4	6	13
Shop & Home	wetland	Sutter	6-Jul	140	6	5	35	4
			Average	105.3	6	5.3	22	9

Nest Searches

Keller Ranch, located in Grimes, California, had two grain fields; one that was in contract for this program (113 ac; harvested July 13-15) and one that was harvested when it reached proper moisture levels (i.e. control field; harvested July 6-10; 69 ac). IBP surveys were conducted at both sites, and CWA was permitted to conduct a single nest search on a 17-acre subsample (25%) of the control field on May 21, 2020. Nest searching methods followed Klett et al. (1986) and were modified to reduce damage to the crop; i.e. rope was dragged by hand and only a single search took place. Damage was minimal because seed heads were not yet desiccated; most notable damage was caused by footpaths to drag the rope and check nests.

A total of 15 active mallard nests (average clutch size = 8), one depredated nest and one northern harrier nest were located and marked for future visits. Four additional nest visits were made to determine nest fate (Table 4). We attempted to capture nesting hens with a dip net for gsm-transmitter attachment. This proved to be difficult due to the audible nature of walking in a wheat field, but we were successful in trapping and marking a single hen on May 21, 2020. On June 1, her nest was completely destroyed by predators, shortly followed by the cessation of her transmitter on June 4, 2020.

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In summary, this single search revealed an apparent nest density of 0.94 nests/acre and a nest success of 33%; the minimum required to sustain a breeding population is 15%. Most nests were depredated (50%), mainly by crows. Considering that we were able to conduct only a single search (typically new nests are found during semi-monthly searches that begin in early April), the apparent nest density of 0.94 is outstanding. Results from this field's IBP survey data consisted of a total of 5 IBPs and 26 non-IBPs, and salvage efforts revealed an additional 29 nests.

Table 4. Keller Ranch nest search & salvage data, 2020

	Date	Field	# Acres Searched	# Nests	# Hatch	# Depredated	# Dead Hens (dep)	# Research Abandon	Active when Salvaged	Apparent Nest Success	Apparent Nest Density (nests/ac)
Search	5/21-6/4	Control	17	16	4	8	1	4	0	33%	0.94
Salvage	7/6-10	Control	69	29	5	14	5	-	9	-	0.42
Salvage	7/13-15	Contract	113	6	0	3	1	-	3	-	0.05

GSM-Transmitters

In an effort to better understand the dynamics of ag-nesting mallards, we attempted to capture nesting hens in a variety of crops to mark with GSM-transmitters (Table 5). We partnered with the USGS in 2019 to determine feasibility; we marked two cover crop-nesting mallards that would ultimately have their nests salvaged prior to cover being cut and incorporated into the field. Of those two, one is still operational and transmitting (transmitter #182148). Based on location and accelerometer data, we deduced that she attempted to nest twice in 2020, with her second attempt being successful. Both her nest attempts were fairly late in the summer, with her first nest in a cover crop field and the second on a rice levee. Her behavior is striking – much of it is spent in an ag setting, with the exception of her wing molt and some of the 2019-20 duck season spent at the Sacramento NWRC and in the Butte Sink (Figures 4 & 5.).

Table 5. Summary of GSM-transmitter deployment for ag-nesting mallard hens and egg salvaged ducklings, 2019 & 2020.

	2019	2020				
Crop Type	Beans/vetch	Oats/vetch	Wheat	Rice Levee	Egg Salvaged Duckling	**Total**
# GSM Deployed	2	4	1	1	2	**10**
Nest Fate	Salvage	Salvage	Depredated	Hatched	-	**0**
# Operational	1	0	0	1	1	**3**

In 2020, we received six refurbished Ecotone GSM-transmitters and a single new Ornitella transmitter from USGS. We marked six hens in various cover. Unfortunately, we were able to receive location data from only one of the six Ecotone transmitters; there were no issues with the Ornitella transmitter (Table 6). The hen mallard marked with the Ornitella transmitter (#180676) was trapped nesting on a rice check levee in Grimes. Her movements were shorter and more localized than the bird captured in Meridian in 2019 (Figure 6). We hope to continue marking ducks that breed in the ag-dominated landscape of the Central Valley, but the cost of units and data plans (~$5,000/each) will limit those efforts. These costs were graciously covered by USGS during our 2019-2020 endeavors.

Table 6. GSM-Transmitter details of ag-nesting mallard hens and egg salvaged ducklings, 2019 & 2020.

Date of Capture	Trans. Type	Operational	Age	Sex	Crop Type	Location	Nest Fate	Clutch Size	Comments
6/17/19	Ornitella	Yes	Adult	F	Cover Crop: beans/vetch	Meridian, CA	Salvaged	8	Nest salvaged post-transmitter attachment
5/19/20	Ornitella	Yes	Adult	F	Rice levee	Grimes, CA	Hatched - 2	10	Nest partially depredated - 8 eggs
6/18/20	Ecotone	Yes	Duckling	M	Salvaged - ag field	Sacramento Valley	-	-	Duckling released in rice
6/17/19	Ornitella	No	Adult	F	Cover Crop: beans/vetch	Meridian, CA	Salvaged	9	Nest salvaged; last transmission 8/16/2019
5/20/20	Ecotone	No	Adult	F	Cover Crop: oats/vetch	Woodland, CA	Salvaged	10	Nest salvaged post-transmitter attachment
5/21/20	Ecotone	No	Adult	F	Wheat	Grimes, CA	Depredated	9	Nest salvaged; last transmission 6/4/2020
5/27/20	Ecotone	No	Adult	F	Cover Crop: oats/vetch	Woodland, CA	Salvaged	9	Nest salvaged post-transmitter attachment
6/18/20	Ecotone	No	Duckling	F	Salvaged - ag field	Sacramento Valley	-	-	Duckling released in summer wetland
6/29/20	Ecotone	No	Adult	F	Cover Crop: dock/vetch	Durham, CA	Salvaged	9	Nest salvaged; last transmission 6/29/2020

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Figure 4. Location data of ag-nesting hen mallard 182148, 2019-2020.

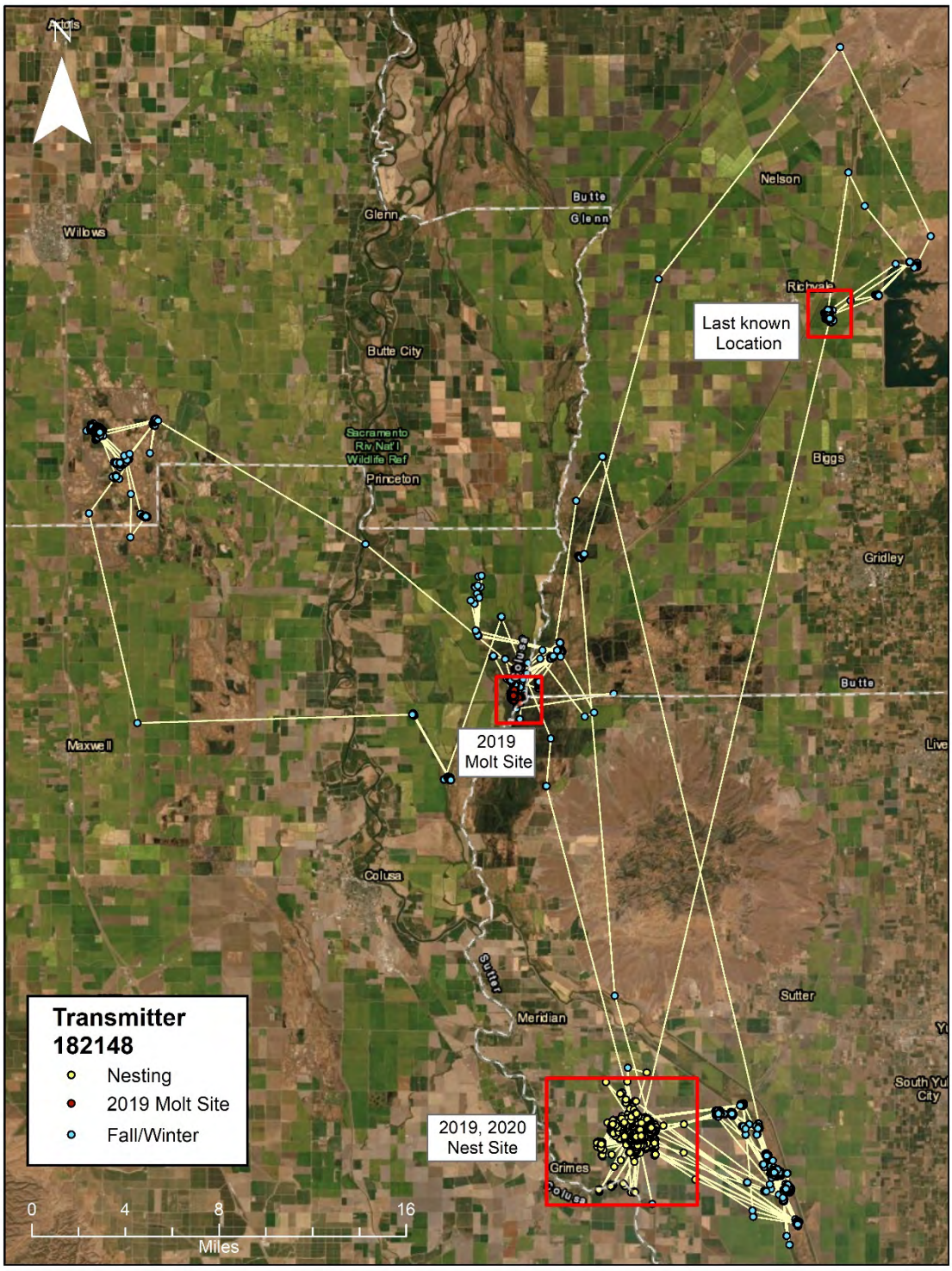

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Figure 5. Nesting and brooding location data from hen mallard 182148 during the 2020 nesting period.

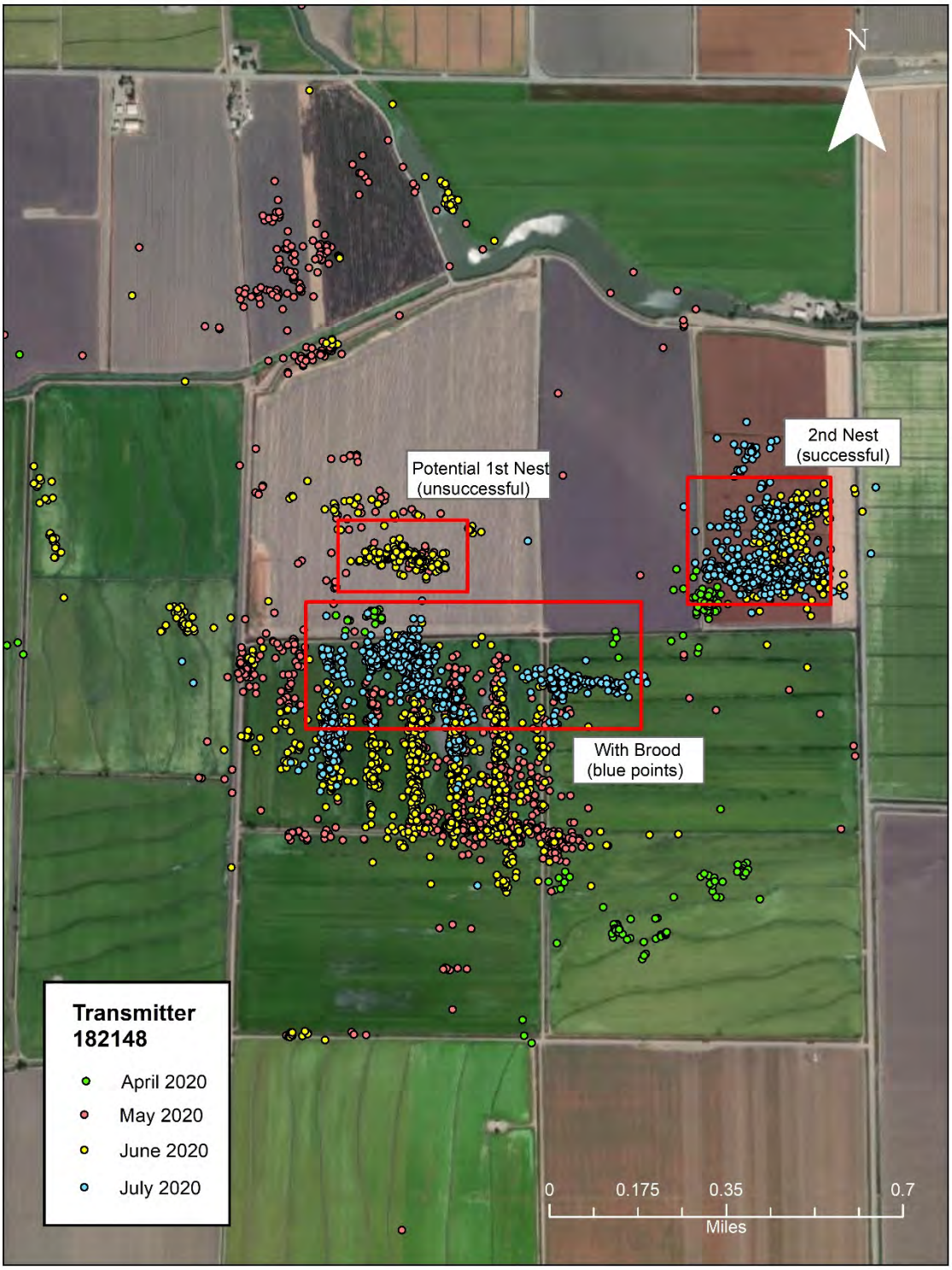

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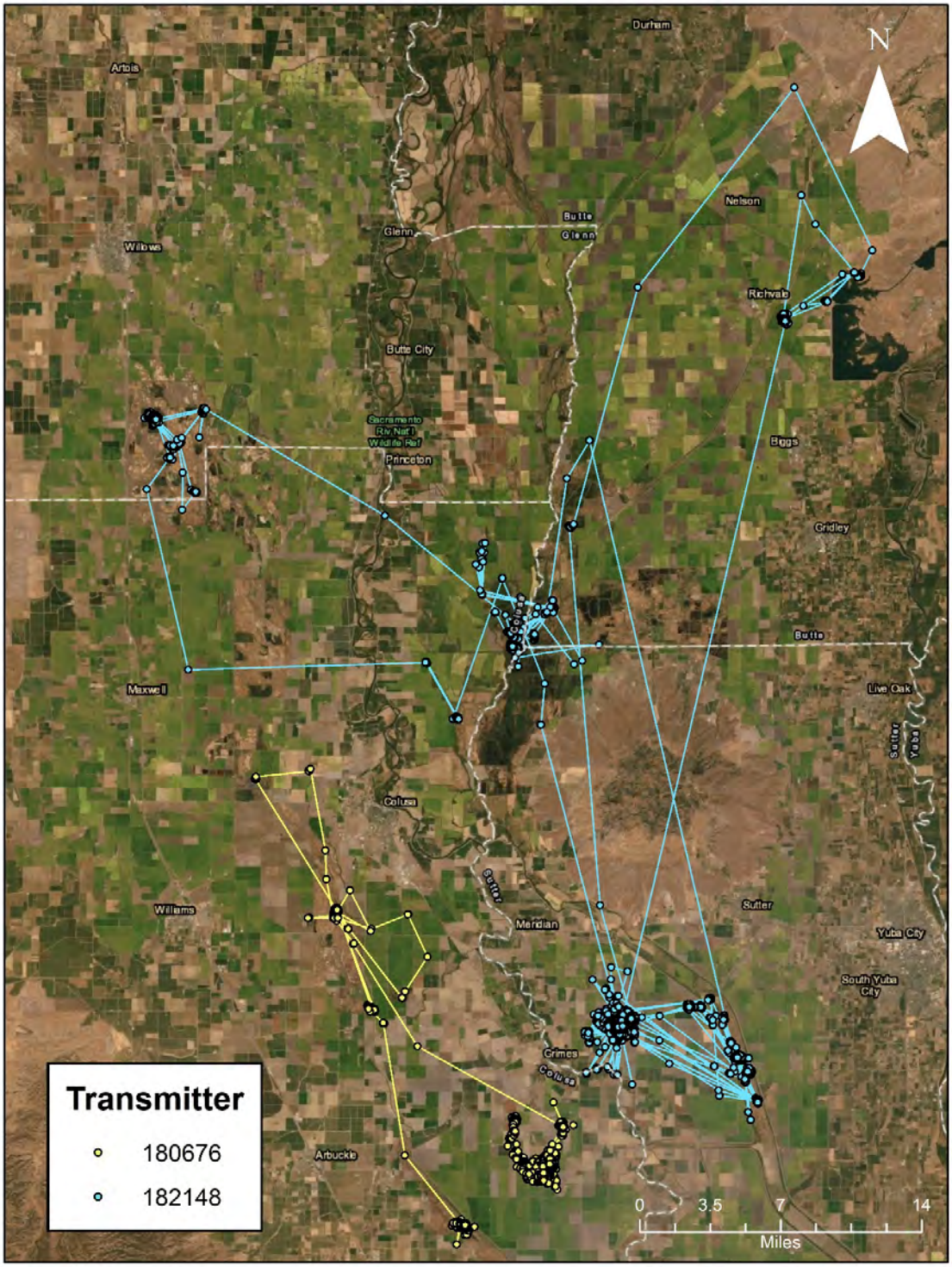
Figure 6. Movement information of two mallard hens marked while nesting in agricultural lands in 2019 and 2020.



Discussion

The success of waterfowl conservation is undoubtedly tied to our ability to identify common ground with and integrate management within the dominant land cover of California's Central Valley – agriculture. Exploring how wildlife and agriculture can coexist, or more importantly benefit from each other, is critical to the success of recovering California's breeding ducks. Therefore, serious efforts to improve our breeding duck populations need to incorporate working ag lands more frequently.

Currently, most breeding-waterfowl conservation efforts focus primarily on natural upland habitats, which can be expensive and small-scaled. Based on data from past California breeding waterfowl research, CWA's Egg Salvage Program and results from this pilot program year, we know ag fields are heavily used by waterfowl throughout their annual cycle – especially during the spring and summer. This study is one of the first to mark ducks breeding in ag lands with GSM transmitters. Rudimentary movement data suggests we are missing vital information on the various relationships, associations and challenges of ducks that choose to regularly utilize various agricultural landcovers for nesting and brood rearing. In addition, this particular cohort of California mallards makes up an unknown proportion of the state's breeding mallard stock, leaving one to question whether we are adequately meeting their specific habitat needs.

Investing in programs that improve the odds for wildlife in an agrarian-dominated state, at minimal cost without labor-intensive and potentially destructive interventions, is low-hanging fruit for conservation. This program demonstrates an economically reasonable method to attain breeding duck habitat and population objectives; think of it as annually leasing out grain fields (habitat) for duck production (population). We estimate that this program likely added one duck per acre at a cost of about $34 per duck, a much cheaper alternative to habitat acquisition/restoration or egg salvage. The Delayed Wheat Program is a simple, cost-effective solution that in practice can be used to benefit locally breeding wildlife and provide farmers with a monetary incentive for a commodity with relatively low market prices without losing significant value of their crop. It also has the ability to positively impact breeding bird populations on a broad scale throughout the Central Valley.

Future Program Funding

In May of 2020, CWA sought, but did not receive, the NRCS Conservation Innovation Grant to fund a more detailed analysis of this program's costs and benefits. While this was disappointing, the NRCS is currently working to incorporate delayed grain harvest into their Upland Wildlife Habitat Management Specification for Wildlife Conservation Practice 645. Through this collaboration, CWA will work with the NRCS to develop a one-page release document for farmer solicitation and will continue to provide monitoring support (compliance and bird surveys) for successful properties. The application period for this practice is expected to be available to growers in late winter or early spring of 2021, but payment rates are currently unknown. This should be viewed positively because it will provide the bulk of farmer payments, making fundraising proceeds available to increase incentive payments as needed and potentially help pay for some of the additional monitoring mentioned in this report.

This partnership, coupled with strong farmer response and promising data from the field, signals pivotal momentum. To capitalize on that momentum, we are seeking private donations to continue the program in 2021, with two concrete goals: enroll more fields and expand data-collection. Additional data will demonstrate the program's efficacy and help secure large-scale grant funding for 2022.

Literature Cited

Anderson, W. 1957. A waterfowl nesting study in the Sacramento Valley, California, 1955. California Department of Fish and Game.

Brady, CM and MP Herzog. 2016. Direct Recovery Rates of Egg Salvaged and Wild Mallards in California, 1986-2014. Poster at the 6th North American Duck Symposium.

Buderman, FE, JH Devries, and DN Koons. 2020. Changes in climate and land use interact to create an ecological trap in a migratory species. Animal Ecology 00:1–17. Online Early.

Bushaw, J. 2020. Applications of Unmanned Aerial Vehicles for Conducting Mesocarnivore and Breeding Waterfowl Surveys in Southern Manitoba. LSU Master's Theses. 5095. https://digitalcommons.lsu.edu/gradschool_theses/5095

California Waterfowl Association. 2006. Factors that influence nesting ecology of waterfowl in the Sacramento Valley of California: an evaluation of the conservation reserve enhancement program. Final Report to the California Department of Fish and Game. California Waterfowl Association, Roseville, CA.

California Wheat Commission. 2019. California wheat variety survey. Final Report. California Wheat Commission, Woodland, CA: Available from: http://californiawheat.org/wp-content/uploads/2019/08/VS-2019-Report-updated-8.14.19.pdf

Central Valley Joint Venture. 2020. Central Valley Joint Venture 2020 Implementation Plan. Sacramento, CA: U.S. Fish and Wildlife Service. Available from: www.centralvalleyjointventure.org/science/2020-implementation-plan

Devries, JH, LM Armstrong, L Moats, and PT Thoroughgood. 2008. Waterfowl nesting in fall-seeded and spring-seeded cropland in Saskatchewan. The Journal of Wildlife Management 72: 1790-1797.
Duncan, DC, and JH Devries. 2018. Agricultural destruction of Northern Pintail nests on cropland in prairie Canada. Avian Conservation and Ecology 13(2):6.

Earl, JP. 1950. Production of Mallards on Irrigated Land in the Sacramento Valley, California. The Journal of Wildlife Management 14: 332-342.Emery, RB, DW Howerter, LM Armstrong,

MG Anderson, JH Devries, and BL Joynt. 2005. Seasonal variation in waterfowl nesting success and its relation to cover management in the Canadian prairies. The Journal of Wildlife Management 69: 1181-1193.

Hohman, WL, EB Lindstrom, BS Rashford, and JH Devries. 2014. Opportunities and challenges to waterfowl habitat conservation on private land. Wildfowl 4:368-406.

Hoekman, ST, TS Gabor, MJ Petrie, R Maher, and HR Murkin. 2006. Population Dynamics of Mallards Breeding in Agricultural Environments in Eastern Canada. The Journal of Wildlife Management, 70: 121-128.

Goelitz, WA. 1918. Destruction of nests by farming operations in Saskatchewan. The Auk 35: 238-240.

Girard, GL. 1941 Girard. 1941. The Mallard: its management in Western Montana. The Journal of Wildlife Management, 5: 233-259.
Green, C. 2003. Reducing mortality of grassland wildlife during haying and wheat harvesting operations. Division of Agricultural Sciences and Natural Resources, Oklahoma State University.

Klett, AT, HF Duebbert, CA Faanes, and KH Higgins. 1986. Techniques for studying nest success of ducks in upland habitats in the Prairied Pothole Region. United States Department of the Interior, Fish & Wildlife Service. Resource publication 158: 1-38.

Loughman, DL, GS Yaris, and MR McLandress. 1991. An evaluation of waterfowl production in agricultural habitats of the Sacramento Valley. Progress Report to the California Department of Fish and Game. California Waterfowl Association, Roseville, CA.

McLandress, MR, GS Yarris, AEH Perkins, DP Connelly, and DG Raveling. 1996. Nesting Biology of Mallards in California. The Journal of Wildlife Management, 60: 94-107.

Skalos, D and M Weaver. 2019. California waterfowl breeding population survey report. California Department of Fish and Wildlife, Sacramento CA. Available here: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=146708&inline

Skone, BR, JJ Rotella, and JJ Walker. 2016. Waterfowl production from winter wheat fields in North Dakota and South Dakota. The Journal of Wildlife Management 80:127-137.

USFWS and CWA. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. Department of the Interior; Fish and Wildlife Service and Environmental Canada; Canadian Wildlife Service.

Yarris, GS and DL Loughman. 1990. An evaluation of waterfowl production on set-aside lands in the Sacramento Valley, final report to the California Department of Fish and Game. California Waterfowl Association, Roseville, CA.

APPENDICES

Appendix A. Field Appraisal & Rubric

Appraisal of applicant grain fields maximized available funds by ensuring the best-suited fields were successful. Prior to contracting and implementation, CWA evaluated enrolled grain fields using a standardized rubric. Rubric field parameters included grain condition (height and density), proximate water source (wetland, rice, canal, irrigation ditch) and distance to water; water-related variables were weighted more heavily. Combined, these characteristics helped to determine the grain fields that would perform best under delayed harvest management. Resulting field scores were used to rank applicants from low waterfowl production potential to high; those with the highest field scores were funded to successfully implement this practice.

It is worth noting that planted rice is the most abundant summer water source for breeding ducks in the Sacramento Valley; therefore, it is one of the more important parameters in predicting breeding bird use of cereal grains. Current water policies will inevitably result in more years of reduced water allocations to rice growers. In the future, USGS and NCWA will advise on regional water allocations and their impact on planted rice acres, particularly those that are subsequently fallowed. This will help to ensure that the program funds optimal grain fields and avoids enrolling fields juxtaposed to fallowed rice land. Ideally, this would be completed prior to the conclusion of field assessments.

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2020 CWA WINTER WHEAT PROGRAM Ac

FARM/RANCH NAME: **FIELD #:** 1=

COUNTY: 2=

Date: 3=

Evaluator: 4=

No.	Factor	Max Points	Field 1	Field 2	Field 3	Field 4
1	Proximate Water Source	50	0	0	0	0
2	Distance to water	38	0	0	0	0
3	Condition of Grain Crop	10	0	0	0	0
4	Condition of Grain Field	20	0	0	0	0
5	Other	22	0	0	0	0
	TOTAL	**140**	**0**	**0**	**0**	**0**

1. Proximate Water Source (Include all that apply)		**Max**	**1**	**2**	**3**	**4**
	Planted Rice +/or Summer Wetland	20				
	Creek, slough, riparian area	15				
	Canal (man-made)	10				
	Irrigation ditch (looks permanent)	5				
	SUB-TOTAL	50	0	0	0	0
2. Distance to Water Source (Include all that apply) *= 0, 2, 3, 5 x # field sides bordered by* **:**						
	Planted Rice +/or Summer Wetland	x 5				
	Creek, slough, riparian area	x 3				
	Canal +/or Irrigation ditch	x 2				
	Urban Use, Non-Beneficial Ag/ habitat (wooded stip, shelter belt, etc.)	0				
	Other: ¼ - ½ mile from beneficial ag +/or summer wetlands	+3				
	Other: ¼ - ½ to canal +/or irrigation ditch	+1				
	SUB-TOTAL	38	0	0	0	0
3. Condition of Grain Crop = *Overall look & health of field - assess waterfowl nesting attractiveness*						
may use 1/2 points as needed; 0-5,	Height (see description on back)	5				
	Density (see description on back)	5				
	SUB-TOTAL	10	0	0	0	0
4. Condition of Grain Field (see description on back)						
may use 1/2 points as needed; 0-5, 0-10	% Flooded	5				
	Spring Irrigations	5				
	Natural features & unique habitat values	10				
	SUB-TOTAL	20	0	0	0	0
5. Other qualities (Include all that apply)						
	Regional breeding duck "Hot Spot"	10				
	CWA Egg Salvage or other breeding habitat conserv. Programs	10				
	Habitat Conservation Programs: CWA, CDFW, NRCS, USFWS, NGOs	2				
	SUB-TOTAL	22	0	0	0	0
	GRAND TOTAL		**0**	**0**	**0**	**0**

NOTES:

Appendix B. Contract

Determining Payment Rates: Following the appraisal process, growers with high-ranking fields were invited to enter into contract. Fields that failed to score high enough to make the funding cutoff received a waitlist number which corresponded to where that field is in the queue among the other waitlisted fields. During the contract process, the grower identified their delayed harvest date (July 1-15) and the corresponding payment rate ($30-S40/ac); payments are dependent on harvest date. The method used during the 2020 Pilot Program year was broad and lumped payment rates and harvest dates into three groups: July 1-5 = $30/ac; July 6-10 = $35/ac; July 11-15 = $40/ac. A second option to determine optimal payment rates entails a baseline payment of $20/acre to delay harvest until July 1; a daily increase of $1.43 is added to the baseline payment with every additional day in which harvest is delayed (latest date offered is July 15, when most duck nests have hatched). Using this method, the maximum payment rate a grower can receive is $40.02/ac to delay harvest until July 15. Method of payment rates for growers in 2021 will be dependent upon feedback from growers and the NRCS, assuming there is collaboration with them.

Waitlist: In 2020, there was an excess of fields that did not score high enough to receive funding but still had a high probability of hosting a variety of ground-nesting species. Those on the waitlist were encouraged to keep their crop on as long as possible as additional funds may become available. Surplus funds can become available under two circumstances: 1) grower harvests prior to the specified contract date, but after July 1 (due to various environmental factors, e.g. wind event); this will result in a reduced payment corresponding to the date harvest actually took place, and 2) grower harvests prior to July 1, in which case they will receive no payment. These funds are then available to those on the waitlist while simultaneously encouraging growers to leave fields unharvested longer in hopes of funding. The importance of monitoring harvest dates in real-time is inherent to this process and was not an issue in 2020.

Implementation: Implementation simply means delaying harvest by an average of 2-4 weeks. Compliance checks were made semi-monthly during bird surveys. Growers notified CWA of any harvest date changes as soon as the decision was made and prior to actual harvest.

Cereal Grain Nesting Fields Agreement

A cooperative project between growers in the Northern Sacramento Valley and the California Waterfowl Association (CWA)

Under this agreement, dated _____ and covering the period between _____ and _____, CWA and the Cooperator, (**Farm Name, Name, address, & phone # of farmer signing contract**), seek to provide temporary breeding habitat for ground-nesting birds in fall-planted cereal grains as part of normal agricultural operations. This agreement is not a lease, and the Cooperator retains full control of the land covered under this agreement.

Ranch Name	Co.	Field ID/#	# Acres	Nearest crossroads	Status
Ranch-Farm	Yolo	1	32	Road X & Ave Y	Fund
Ranch-Farm	Sac.	2	160	Road Y & Road Z	Wait list #08

The Cooperator and CWA agree:

1. Enrolled field(s) have a history of participating in the CWA Egg Salvage Program and/or good waterfowl production potential.

   ☐ **Please contact me regarding Egg Salvage Efforts**

2. Enrolled field(s) are adjacent to or near a summer water source (e.g. planted rice fields, riparian corridor, summer wetland, irrigation canals, etc.) which will serve as transport water to brood rearing habitat and/or final brood rearing destination for ducklings.

3. Payments will be dependent upon date of harvest (please check the date/payment you plan to participate at):

   a) Enrolled fields must not be disturbed by means of harvesting, haying, grazing, mowing, disking or other means until **July 1-15.**

   b) The incentive payment of **$30-40 per acre for delaying harvest until July 1-15** will be made to Cooperator by CWA after a final compliance check and verification of acreage via GPS.

   ☐ July 1-5: $30/acre

   ☐ July 6-10: $35/acre

   ☐ July 11-15: $40/acre

4. During the term of the contract, Cooperator agrees to provide CWA access to 1) verify acreage with GPS; and 2) conduct multiple surveys to monitor bird activity to evaluate program efficacy. Monitoring activities will include weekly breeding pair surveys (from a CWA vehicle), and post-harvest nest searches (sub-sample of fields - time permitting).

5. If the Cooperator disturbs fields prior to the expiration of this agreement, no incentive payment will be made.

6. If the Cooperator chooses to forfeit the incentive payment by disturbing their crop during the term of this agreement, CWA requests that the Cooperator notifies CWA as soon as possible and will participate in CWA's Egg Salvage Program during harvest.

7. Cooperator designates (**Name of signing Farmer**) as the contact person for this agreement

8. CWA designates Caroline Brady (916) 275-1018 as the contact person for this agreement

Cooperator

_____ _____ _____
Print Name Signature Date

California Waterfowl Association

_____ _____
Jake Messerli, Chief Operating Officer Date
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Appendix C. Indicated Breeding Pair Survey Protocol & Data Sheet

Goal: Estimate bird use; estimate indicated breeding pairs (IBP) if possible
Challenge: double counting birds → over-estimating
Mitigation: 5 min observations; one point/field with ability to scan 100% of field; count only confirmed field arrivals /departures of designated IBPs

BASIC SURVEY PARAMETERS

Frequency: Semi-monthly (weekly preferred)
Start/end times: ½ hour before sunrise to 0700 hours
 # points: 1 point/field (depending on field size and shape – use 2 if necessary but minimize potential to overlap observations & double-count)
  - 100% of field should be scanned in as few points as possible – max 2

Point location: Anywhere along the perimeter of the field that is drivable and gives the most advantageous viewpoint; mark with flagging & *labeled* GPS point (Ranch, field ID, acres)
Duration/point: 5 min/point
Scanning direction: All; scan entire field
Scanning distance: Unlimited distance→ fields are relatively small (15-210 ac), and ducks are large bodied birds that can be identified and sexed from far distances by sight (~400 yards) and with binoculars (~800 yards)
Species of interest:
  - Primary: All ducks, mainly mallards
  - Secondary species: Pheasants, short-eared owls, harriers, American bitterns – note presence & if suspected breeding pair
  - Tertiary species: All other birds – note presence (seen/heard during survey)

DATA RULES

- **Bird status:**
  - **LH (#) =** Lone hen(s)
  - **LD (#) =** Lone drake(s)
  - **P (#) =** Pair (1, 2, 3 etc.)
  - **FLK =** Flock (>4 birds) - mixed/not mixed species - specify size, species & sex ratio
    - Often 3-bird flights can consist of more than 2 males; this is considered a flock – clearly denote in observations if the flight looks like a pursuit
  - **G** = Group (2-4 birds) – specify size & sex ratio
  - **3BF =** 3-bird flights (2 drakes, 1 hen)
- **Determining status & behavior of IBPs:**
  - IBP Status:
    - Lone hen
    - Pair
    - 3BF
    - Flush from within survey field
    - Settle down into survey field
  - IBP Behavior:

DATA COLLECTION

- **Basic data:**
  - Date
  - Observer initials
  - Location (ranch, field ID, acres)
  - Survey start/end time
  - Survey conditions (cloud cover, wind speed, temperature)
- **Observational data for IBPs:** *Specifically note # of confirmed IBPs observed during survey including ducks, hawks, and waterbirds*

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- Time (for IBP observations only)
- Record IBP status & behavior
  - # of IBPs (LH, P & 3BF) exhibiting nesting behavior (flushing from within the field **OR** settling down into the field)
  - Record time as it may help tease apart double counting issues
  - Do not record multiple behaviors
  - Continue to take notes, especially if you think you're observing 1 LH/P multiple times
- Species & sex (male/female)

- **All other bird activity:** Record all bird activity you see throughout the survey period
  - # birds with associated status; list them
  - Do not record time
  - Do not record multiple behaviors, just # of and status; this will help estimate duck activity among fields.
  - Continue to take notes, especially if you think you're observing the same group/flock/lone drake multiple times
- **Other data:** Record any other information or field characteristics that you think will be useful in determining the production of the field in question (this can be done after completing 1st survey):
  - Signs/visual confirmation of predators (GHOW, skunk, raccoons, otters, mink, etc.)
  - Challenges ducklings may face upon leaving the nest +/or field
    - Dry wooded areas that likely house predators
    - Highways, gravel roads, levee roads, etc.

2020 CWA DELAYED WHEAT HARVEST WATERFOWL SURVEY DATA SHEET

Date: _____ **Observer:** _____

Ranch: _____ **Time start:** _____

Field ID/#: _____ **Time end:** _____

Acres: _____ **TOTAL Mins:**

IBP STATUS & BEHAVIOR RULES

STATUS:
- Lone hen
- Pair

BEHAVIOR:
- Flushing out of survey field
- Landing into survey field

STATUS

LH (#) = Lone hen
LD (#) = Lone drake
P (#) = Pair
G (#) =Group (2-4 birds)
3BF = 3-bird flights
FLK = Flock (>4 birds) - size, spp & sex ratio
FLK/3BF = 3-bird flight w/ >2 drakes

PROXIMATE WATER SOURCE

Circle all that apply:

- Rice	- Dry	- Partially flooded	- Fully flooded
- Wetland	- Dry	- Partially flooded	- Fully flooded
- Riparian	- Dry	- Partially flooded	- Fully flooded
- Canal	- Dry	- Partially flooded	- Fully flooded

Estimate temperature, cloud cover (% of sky covered by clouds), and approximate wind speed at start.

_____° F Temperature _____mph Wind _____% Cloud Cover

Species	Time	Status (LH or P)	Behavior (Flush or land in field)	IBP (Y/N)	NOTES

TALLY ALL OTHER NON-IBP OBSERVATIONS

LH	LD	P	G	FLK	3BF	OTHER

Notes(non-IBP):

Appendix D. Post-Harvest Grower Survey, 2020.

Survey Questions

- How would you rate the ease of participating in this program?
  - o Very easy
  - o Somewhat easy
  - o Neutral
  - o Somewhat difficult
  - o Very difficult
- Would you participate in this program again?
  - o Yes
  - o No
  - o Not sure
- Was the contract easy to understand?
  - o Yes
  - o No
  - o Not sure
- How many Cwt/ac did your field produce? _____
- Did you experience significant loss by delaying harvest?

  _____
- What was the biggest challenge for you in delaying the harvest of your grain field (check all that apply)?
  - o Loss due to shatter
  - o Weeds
  - o Increased fire hazard
  - o Accommodating the delayed timing with other ongoing farming activities
  - o Other _____
- Was there anything that you did to mitigate these challenges?

  _____

  _____
- Did you harvest your fields, or did a custom harvester complete the work?
  - o Landowner
  - o Custom harvester
- Did you use a stripper header or conventional header for harvest?
  - o Stripper header
  - o Conventional header
- When did your latest irrigation take place? _____
- Was your field on furrows?
  - o Yes
  - o No
  - o Not sure
- Did you participate in salvaging of bird nests while harvesting any other fields that were not enrolled in the program or your delayed field?
  - o Yes
  - o No
- Any other comments, questions, or suggestions for next year?

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Appendix E. Summary of participant responses from the post-harvest survey, 2020.

	# Responses	Answers	
1) How would you rate the ease of participating in this program?	11	91%	found participation was easy
Very easy		9	
Somewhat easy		1	
Neutral		0	
Somewhat difficult		1	
Very difficult		0	
2) Would you participate in this program again?	10	90%	yes, would participate again
Yes		9	
No		0	
Not sure		1	
3) Was the contract easy to understand?	11	91%	easy to understand
Yes		10	
No		1	
Not sure		0	
4) How many cwt/ac did your field produce?	10	Range = 30-79 cwt; avg. = 59.1 cwt	
30-50 cwt		3	
60-64 cwt		4	
70-79 cwt		3	
5) Did you experience significant loss by delaying harvest?	10	80%	experienced no significant loss
Yes		2	1 grower - experienced ~5% loss due to shatter
No		5	
Not significant		2	
Unsure		1	

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6) What was the biggest challenge for you in delaying the harvest of your grain field?	11			Multiple choice answer
Loss due to shatter			2	Reported yes in Q #5; one of which unsure if participate again
Weeds			4	
Increased fire hazard			4	One grower explicitly requested fire insurance for 2021 in Q#13
Accommodating the delayed timing with other ongoing farming activities			3	
Other			1	Anxiety over waiting
7) Was there anything that you did to mitigate these challenges?	7		71%	did nothing to mitigate
No			5	
Slow harvester down			1	
Have fire insurance			1	
8) Did you harvest your fields, or does a custom harvester?	11		100%	landowner harvested
Landowner			11	
Custom harvester			0	
9) Did you use a stripper header or conventional for harvest?	11		73%	conventional header
Stripper header			3	
Conventional header			8	
10) When did your latest irrigation take place?	11		64%	irrigated in March/April
Non-irrigated			4	
March			3	
April			4	
11) Was your field on furrows?	11		45%	on furrows
Yes			5	
No			6	
Not sure			0	

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12) Did you participate in salvaging of bird nests while harvesting any other fields that were not enrolled in the program or your delayed field?	11		55%	participated in egg salvage
Yes			6	
No			5	
13) Any other comments, questions, or suggestions for next year?	7			Overall positive
Fire insurance			1	
Thank you			3	
Continue program			4	1 requested more representation in Sacramento Co.

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