

Central Valley Joint Venture Monitoring & Evaluation Plan



Photo by Steven R. Emmons



Photo by Shaun Oldenburger



Photo by Brendan Lynch



Photo by Dan Skalos



Breeding Waterfowl

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Introduction

Mallards (*Anas platyrhynchos*) comprise 70% of the waterfowl breeding in the Central Valley (e.g., 194,000 in 2009; California Department of Fish and Game, unpublished aerial survey data), and substantial information is known about the nesting biology of this species in California (McLandress et al. 1996). As a result, planning efforts for breeding waterfowl are based primarily on our understanding of the breeding ecology of mallards; therefore we will use this species as a focus for monitoring and evaluation purposes. Like most Joint Ventures with objectives for breeding waterfowl, and consistent with current ecological understandings, we will work under the assumption that quantity and quality of habitat limits population growth of waterfowl populations in California. The mechanisms for these limits are often manifested through measurable changes in demographic vital rates.

Vital rates (e.g. breeding propensity, nesting success, duckling survival, hen survival) reflect the quantity and quality of habitats. Vital rates almost assuredly vary temporally and geographically in California. Habitat improvements based on measures of vital rates to increase waterfowl production and subsequent breeding population size, will be constrained by scaling issues. That is, specific vital rate information is needed in all of the important mallard nesting regions of the Central Valley to better inform habitat management. An increased understanding of mallard nesting biology in these regions might be difficult to attain, however. Nonetheless, the CVJV requires additional data on nesting biology at local scales to better plan and implement habitat programs. The goal of such programs will be to identify and increase vital rates as appropriate, but also to conduct field research to increase data sets useful to assist land management decisions that could increase breeding population size. We envision habitat actions developed specifically for breeding mallards in the Central Valley using grant programs (e.g., NAWCA) and/or existing habitat programs (e.g., California Waterfowl Habitat Program, Inland Wetlands Conservation Program, California Duck Stamp Program) as funding sources. We propose adaptive management to identify linkages between habitat conditions and the subsequent response of mallard nesting populations.

Many of the programs in this plan seek to improve our understanding of the influences of habitat on mallard nesting productivity. Whereas, several other species of waterfowl breed in the Central Valley, they occur in smaller numbers and have different life histories and habitat requirements. Therefore, they are not specifically considered in the CVJV 2006 Implementation Plan. Subsequent updates will require information to develop biologically meaningful breeding population objectives for these species (cinnamon teal [*Anas*

cyanoptera], northern pintails [*A. acuta*], wood ducks [*Aix sponsa*], redheads [*Aythya americana*], Canada geese [*Branta canadensis moffeti*]).

The CVJV Technical Committee held a two-day waterfowl research meeting in 2005 to develop and prioritize a comprehensive list of information needs for both wintering and breeding waterfowl in the Central Valley. Subsequent to the meeting, the list was organized by category and returned to the participants for prioritization. Individual ranks were combined and the final product was a list that was prioritized overall and within sub-groupings (Appendix 1). In 2007, CVJV partners hosted the California Mallard Summit, a two-day workshop with the goal of summarizing existing information on breeding mallards and identifying information shortfalls. That led to the development of a comprehensive strategy for research and management of breeding mallard populations in California, with an emphasis on the Central Valley and northeast California. The prioritized list from the 2005 meeting served as a foundation for discussion, with a refined list emerging as an initial product of the Mallard Summit. A review team distilled this list to five priority monitoring and evaluation needs that form the foundation of this chapter of the M & E plan for breeding mallards.

1. Breeding Habitat Database and Tracking

Issues: No single database tracks specific habitat gains and losses in the Central Valley; hence the CVJV cannot assess overall progress in meeting breeding habitat objectives.

Without information on breeding habitat status at local and landscape geographic and temporal scales, it will prove impossible to relate habitat conservation and management efforts to mallard vital rates and breeding population dynamics.

Background: The availability of breeding habitat for waterfowl in the Central Valley has suffered from large scale urbanization and agricultural development. Currently, urban growth has expanded explosively and will continue to do so, primarily along existing transportation corridors in the Sacramento and San Joaquin Valleys. Estimation of habitat composition and availability for the entire valley may be impractical on an annual basis, but a survey of wetland and upland habitat availability for waterfowl during the breeding and post-breeding seasons might be practical. Geographic information systems (GIS) technology provides an opportunity to develop a landscape-scale breeding habitat accounting model. Most of the important geographic features, land use types, wetland types, easements, and ownerships of Central Valley habitats have been inventoried by partners of the Joint Venture (California Department of Fish & Game, California Waterfowl, Ducks Unlimited, Natural Resource Conservation Service, and US Fish & Wildlife Service). Similarly, several external and internal databases provide information on public land management (e. g. Sacramento National Wildlife Refuge Complex), conservation easements (agricultural and wetlands), and habitat types, and the California Joint Venture Project Tracking System tracks acquisition, restoration, and enhancement projects. Aerial and satellite imagery layers exist to complete a comprehensive wetland and agricultural data layer for all of the Central Valley. For breeding habitats, there is a need to inventory and track land types in the Central Valley on a more detailed manner than previously completed. Further, there is a need to integrate and manage these multiple data streams and develop a comprehensive breeding habitat accounting model.

Desired Products:

1. Establishment of regular (~ 5-year interval) inventories of key habitat types (wetlands, rice, fallow/set-aside, winter wheat, pasture and hay) throughout core mallard breeding

areas within the Central Valley (Sacramento Valley, Suisun Marsh, Delta, San Joaquin Valley, Tulare Basin)

2. Establishment of an integrated spatially-explicit (GIS-based) habitat tracking/accounting model for breeding and molting habitats in spring, summer and early fall. This model should use be linked to the California Joint Venture Project Tracking System.

Expected Outcomes:

Capability to document trends of key breeding habitats by area (basin), thus informing the CVJV on status of Implementation Plan objectives and future direction for habitat conservation.

2. Landscape Scale Vital Rates and Habitat Parameters Study

Issues: Previous studies that examined vital rates of nesting mallards in the Central Valley focused on site-specific questions conducted independently of any coordinated plans.

Information does not exist that relates vital rate data to large-scale habitat programs for mallards breeding in the Central Valley.

Background: Estimates of vital rates of breeding California mallards have been obtained from specific study sites (e. g. Grizzly Island in Suisun Marsh), rather than from wider regions (e.g. San Joaquin Valley). McLandress et al. (1996) found that nest survival (nest success) varied considerably among regions in California. Accordingly, other aspects of population dynamics of mallards (e.g., duckling survival, breeding propensity) will also likely vary in or among regions. However we lack estimates for many of these other key vital rates of mallards, and the existing estimates are variable and also study-site-specific (Oldenburger 2008). To fully understand the effects of large-scale habitat variables (e.g., upland nesting cover types, size, number and juxtaposition of wetlands) on population dynamics of California mallards, we require an integrated assessment of vital rates at greater spatial and temporal scales (Emery et al. 2005). A coordinated, Central Valley-wide effort to simultaneously collect information on habitat conditions and mallard vital rates will lead to increased understanding of the underlying source of regional differences in mallard productivity, and will help focus habitat management actions to improve rates only where necessary to induce growth of the breeding population. Long-term studies are needed to ascertain the degree to which variation in vital rates is a function of environmental variation (winter and spring rainfall), which will be beyond immediate management control.

Desired Products:

1. Concurrent estimates of key vital rates (e.g., breeding propensity of females, nest success, female success, duckling and brood survival, survival of nesting adults) throughout the important nesting areas in the CVJV.
2. Estimates of spatial and temporal variation in key landscape-scale habitat variables (i.e., amount and timing of precipitation, fallow land acreage, rice acreage, pair water,

- brood water, amount and quality and location of molting wetlands, upland nesting cover types and quality).
3. Sensitivity and elasticity analyses to identify the vital rate(s) with the greatest influence on recruitment in each nesting habitat type, geographic region and the landscape as a whole.

Expected Outcomes:

Understanding which vital rates influence recruitment by habitat type will allow CVJV partners to develop and implement conservation measures to mitigate limiting factors. Implementing conservation measures in response should result in increased breeding populations of mallards in the Central Valley.

3. Experimental Assessment of the Effects of Habitat Management on Vital Rates

Issues: Few data exist on the relationship between habitat management and the vital rates of nesting mallards in the Central Valley.

Background: Management of upland and wetland habitats should affect one or more vital rates of nesting mallards in California. However, few studies have experimentally manipulated habitats or predator populations to measure biological responses by ducks (e.g. Kaminski and Prince 1981, Garrettson et al. 1996), and no such work has occurred in the Central Valley. Most studies have simply observed bird densities in relation to habitat characteristics (McLandress et al. 1996), although presumably, bird densities should reflect bird response to the quality of habitat as well as the overall breeding population size. A study design to address this relationship would be difficult and expensive on a large scale. However, because, mallard home ranges are not exceedingly large (Mack et al. 2003), investigators could measure biological responses to habitat manipulations in an area of relevant size, for example, in an area sufficiently large, with proper controls, to encompass enough ducks to precisely measure differences in vital rates such that differences could be attributed to the habitat or predator population manipulation.

Habitat management and improvement is an ongoing activity. Therefore, designing alternative management programs to improve breeding habitat, while concurrently collecting vital rate data, would relatively quickly provide information for future intensive and wide-scale intensive habitat management (e.g., improved pair water distribution, useful ratios of upland to wetland acres, preferred upland vegetation types, optimal water management for prescriptions. This information would likely be region- and site-specific, and would take several years to sort out year-effects from habitat and weather effects. These studies would simultaneously quantify the management effects on habitats and subsequent vital rates, homing rates, and the cost-effectiveness of incremental recruitment.

Currently, some management practices are recommended to habitat managers based on published literature or information derived from other regions of North America, specifically California. While these habitat management practices are thought to increase waterfowl production, little empirical evidence exists that measures the effectiveness of these practices in the western United States. For example, managers assumed dense nesting cover (DNC) increased nesting densities and survival in the Canadian prairie-parkland. However, recent research indicates that DNC does not always produce the desired results when landscapes

already contain an abundance of perennial cover, even if the existing cover is in smaller blocks (Arnold et al. 2007). There remains a need to determine if site-specific “prescriptions” for habitat management result in desired increases in vital rates, nesting populations, and recruitment, and are cost-effective at a landscape scale. Because the Central Valley is a relatively small landscape, especially the areas critical to waterfowl, such studies are likely to succeed and be broadly applicable in the Central Valley.

Desired Products:

1. Knowledge of the effects of habitat variables on key vital rates and nesting densities at local habitat scales.
2. Knowledge of the effectiveness of prescribed alternative habitat upland and wetland management practices on vital rates and nesting densities.
3. A prescription for optimum upland and wetland habitat size, configuration, and location to effectively deliver enhanced breeding population size and recruitment of mallards in the Central Valley.
4. Cost estimates to achieve increased breeding population size and recruitment of young ducks per nesting pair.
5. Base line data that will support preparation of grants (e.g., NAWCA) designed specifically to enhance breeding mallard populations in the Central Valley.

Expected Outcomes:

A better understanding of how selected habitat management practices will increase the efficiency of conservation delivery and increase Central Valley breeding mallard populations. Cost analysis will allow public and private wetland managers to make informed decisions when considering trade-offs for a range of management alternatives designed to increase mallard breeding populations.

4. Molting Ecology Study

Issues: Only rudimentary knowledge is available on the geographic distribution of California mallards during the post-nesting molt.

Few estimates of survival rates of adult mallards during the flightless stage associated with post-nesting wing molt are available.

Background: Recent analyses (Oldenburger 2008) found that survival of adult females during the non-breeding period was one of the most important factors related to population growth rates of mallards in the Central Valley. The non-breeding period includes the period of wing molt, and limited data are available on survival during this period. Sparse data suggest that both northeastern California and the Central Valley are important molting destinations for mallards that breed in the Central Valley (Yarris et al 1994, Oldenburger et al. 2005 unpub. report). Further, survival of molting adult hens probably differs greatly among regions and might be related to characteristics and management of the molting wetlands (J. Fleskes, United States Geological Survey, unpub. data). Some data indicate that survival in regions where Central Valley mallards molt (Fleskes et al. 2007) is lower than most other populations in North America (Evelsizer 2002). Despite the potential importance of the post-nesting molting period to population dynamics of Central Valley mallards, information on geographic distribution and survival during this period is not sufficient to support management prescriptions to address habitat needs.

Desired Products:

1. Information on the geographic distribution of adult male and female California-breeding mallards during the respective molting periods.
2. Estimates of survival in molting areas critical for California breeding mallards.

Expected Outcomes:

Wetland managers would be better informed how to manipulate or expand molting habitats to improve survival or carrying capacity for molting birds.

5. Information Needs for Nesting Waterfowl other than Mallards

Issues: Available biological information for breeding waterfowl in the Central Valley is most extensive for mallards; therefore, current planning efforts for breeding waterfowl are based on and developed primarily for the conservation needs of mallards.

Information on breeding biology necessary to manage habitats for other species is limited or lacking.

Background: Addressing the conservation needs of mallards in the Central Valley may also benefit other species (e.g., gadwall [*Anas strepera*]), but many other nesting waterfowl species have different life history and habitat requirements (i.e., redhead). Additionally some populations of resident waterfowl (e.g., Canada geese) may be locally abundant to the point of causing conflicts with landowners or municipalities. To better inform future biological planning for other species of breeding waterfowl, more basic biological information is needed. We propose that a series of monographs be prepared for species of waterfowl, other than mallards, that breed in the Central Valley in significant numbers. The general outline provided by the Birds of North America (e.g., Wooding and Michot 2002), California Bird Species of Special Concern (Shuford and Gardali 2008), and Pacific Flyway species management plans (Pacific Flyway Council 2006) would serve as models for these species monographs.

Desired Products:

Species accounts that summarize current biological information and critical information needs to initiate conservation planning in the Central Valley for western Canada geese, cinnamon teal, gadwall, northern pintail, redheads, and wood ducks. Each species account will include:

1. Historic and current distribution within the Central Valley.
2. Population status
3. Habitat use for breeding
4. Conservation and management issues
5. Status of conservation activity (surveys and banding, habitat programs, etc.)
6. Monitoring and evaluation recommendations

Expected Outcomes:

Information from species accounts will be used to develop biological foundation upon which to base future CVJV conservation planning.

Table 1. Central Valley Joint Venture monitoring and evaluation issues and products for breeding waterfowl.

<i>Issue</i>	<i>Rank</i>	<i>Product</i>	<i>Monitoring¹ or Evaluation²</i>	<i>Breeding Waterfowl Research Topics (Appendix 1)</i>
<i>Breeding Habitat</i>	1	Periodic inventory of key habitats	M	C.1; C.2; E.2
<i>Database & Tracking</i>		Spatially-explicit habitat tracking model	M, E	C.1; C.2; E.2
<i>Landscape Scale Vital Rates Study</i>	2	Estimates of key vital rates	E	A.1; A.3-.4; B.3; B.4; E.1; E.2; F.1; F.2
		Spatial & temporal variation in habitats	E	B.3-5; G.1; G.2
		Sensitivity & perturbation analysis	E	A.2
<i>Assessment of Habitat Management on Vital Rates</i>	3	Effect of habitat on vital rates	E	B.1; B.3-B.5; D.1-D.4; E.2; F.1; J.1
		Effectiveness of alternative management	E	B.1-5; D.2
		Optimal restoration design	M, E	D.1-4; F.1;
		Cost of increased recruitment	E	
<i>Molting Ecology Study</i>	4	Distribution during molt	M, E	A.1; E.2; H.1; J.1
		Estimates of survival during molt	E	E.2
<i>Information Needs for Non-mallards</i>	5	Species accounts/ M&E recommendations	M, E	I.1

¹ Monitoring: operational surveys or regular ongoing data collection ² Evaluation: occasional assessments to update plans, document trends in biological and social environment

Table 2. Current status and expected frequency of Central Valley Joint Venture monitoring and evaluation activities.

<i>Activity</i>	<i>Expected Frequency</i>	<i>Current Status</i>
<i>Products from M&E Plan</i>		
Periodic inventory of key habitats	every 5 years	
Spatially-explicit habitat tracking model	new info	Existing databases not currently linked or set up to track habitat loss/conversion
Estimates of key vital rates	new info	Yarris et al. 1994; McLandress et al. 1996; Oldenburger 2008
Spatial & temporal variation in habitats	new info	
Sensitivity & perturbation analysis	new info	
Effect of habitat size, configuration, and management on vital rates	new info	
Effectiveness of alternative management		
Optimal restoration design		
Cost of increased recruitment	new info	
Distribution during molt	new info	Yarris et al. 1994; Oldenburger et al. 2005, unpublished report
Survival during molt	new info	J. Fleskes, USGS, unpublished data
Species accounts for non-mallards	new info	Some information available in Shuford and Gardali 2008 for redhead
<i>Other on-going & operational activities</i>		
California BPOP Survey	Annually	Operational and current
Pre-season Banding	Annually	Operational and current; expect new Flyway banding plan in 2010
Pacific Flyway Harvest Parts Survey (wingbee)	Annually	Operational and current

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Woodin, M.C. and T. C. Michot. 2002. Redhead (*Aythya americana*), in The Birds of North America (A. Poole and F. Gill, eds.), No. 695. Birds N. Am., Philadelphia.

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Appendix 1. Monitoring, Evaluation & Research needs identified in the 2005 Waterfowl Research Meeting.

A. BREEDING EVALUATION	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Long term studies	36	1
	2. Density dependent model	33	2
	3. Breeding propensity	29	6
	4. Mallard re-nesting	22	13
	5. Mallards as indicator spp.	21	14
B. TARGETED EVALUATIONS	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. CREP, WRP, LIP, etc.	32	3
	2. Mosq. Abate. Impacts to wetland productivity	31	4
	3. Nest success by crop type/ag practices	28	7
	4. Breeding success habitat variables	27	8
	5. Effects of (DUHU) mgt. at GIWA	22	13
C. SURVEYS & DATA	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Develop surveys for T-storm maps	30	5
	2. Refinement of habitat data layers	23	12
	3. Review and compile grey literature. See also: Mallards as indicator spp. (above)	21	14
D. LANDSCAPE CONFIGURATION	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Size, #, distribution of brood ponds & uplands	29	6
	2. Optimum % of brood ponds vs. seasonal wetlands	28	7
	3. Effect of size & age on brood pond productivity	27	8
	4. Brood pond size vs. upland size	22	13

E. POST BREEDING	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Cross-seasonal energetics	28	7
	2. Survival & habitat characteristics of molting areas	27	8
F. BROOD ECOLOGY & SURVIVAL	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Brood success in wetlands w/ lg. blocks of rice	27	8
	2. Spatial & temporal variation in brood survival	24	11
G. FOOD & PRODUCTIVITY	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Invertebrate productivity in rice	25	10
	2. Productivity of late winter/early spring habitat	24	11
H. PREDATORS	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Baseline predator information	26	9
I. OTHER SPECIES	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Redheads & summer water	23	12
J. SUISUN MARSH	<i>Topic</i>	<i>Score</i>	<i>Overall Rank</i>
	1. Effects of tidal wetland restoration	22	13
	See also: DUHU @ GIWI (above)	22	13

Appendix 2. 2005 Central Valley Joint Venture Waterfowl Research Meeting Participants.

<i>Name</i>	<i>Organization</i>
Josh Ackerman	University of California-Davis
Dr. John Eadie	University of California-Davis
Dr. Joe Fleskes	USGS Dixon Field Station
Alan Forkey	USDA-NRCS
Catherine Hickey	PRBO
Rob Holbrook	Central Valley Joint Venture
Dean Kwasny	California Department of Fish and Game
Dan Loughman	California Waterfowl Association
Mike Miller	USGS Dixon Field Station
Rick Morat	U.S. Fish & Wildlife Service (facilitator)
Shaun Oldenburger	University of California-Davis
Dennis Orthmeyer	California Waterfowl Association
Ruth Ostroff	Central Valley Joint Venture
Peter Perrine	California Wildlife Conservation Board
Dr. Mark Petrie	Ducks Unlimited, Inc.
Dr. Fritz Reid	Ducks Unlimited, Inc.
Bob Shaffer	Central Valley Joint Venture
Mike Wolder	U.S. Fish & Wildlife Service
Dennis Woolington	U.S. Fish & Wildlife Service
Dan Yparriguirre	California Department of Fish and Game

Appendix 3. 2007 California Mallard Summit Participants.

<i>Name</i>	<i>Organization</i>
Josh Ackerman	USGS
Ed Burns	USDA-NRCS
Mike Carpenter	USFWS
Rob Capriola	California Waterfowl Association
Bill Cook	California Department of Fish and Game
Dr. John Eadie	University of California-Davis
Dr. Joe Fleskes	USGS Dixon Field Station
Craig Garner	Ducks Unlimited
Jessica Groves	USDA-NRCS
Rob Holbrook	Central Valley Joint Venture
Dean Kwasny	California Department of Fish and Game
Jeremy Kwolek	California Waterfowl Association
Dan Loughman	California Waterfowl Association
Dave Mauser	USFWS
Jake Messerli	California Waterfowl Association
Mike Miller	USGS Dixon Field Station
Shaun Oldenburger	University of California-Davis
Peter Perrine	California Wildlife Conservation Board
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