Selection of Surrogate Species & Setting Population Objectives:

An Example from the Field

Presented By: Randy Wilson
USFWS Migratory Bird Field Station
Jackson, MS

LMVJV Operational Compass: Habitat Conservation To Sustain Bird Populations Through Science, Technology and Partnerships

Arkansas Game and Fish Commission, Ducks Unlimited, Kentucky Department of Fish and Wildlife Resources, Louisiana Department of Wildlife and Fisheries, Mississippi Department of Wildlife, Fisheries, and Parks, Missouri Department of Conservation, Oklahoma Department of Wildlife Conservation, Tennessee Wildlife Resources Agency, Texas Parks and Wildlife Department, The Conservation Fund, The Nature Conservancy, US Fish and Wildlife Service, US Forest Service, US Geologic Survey, Wildlife Management Institute

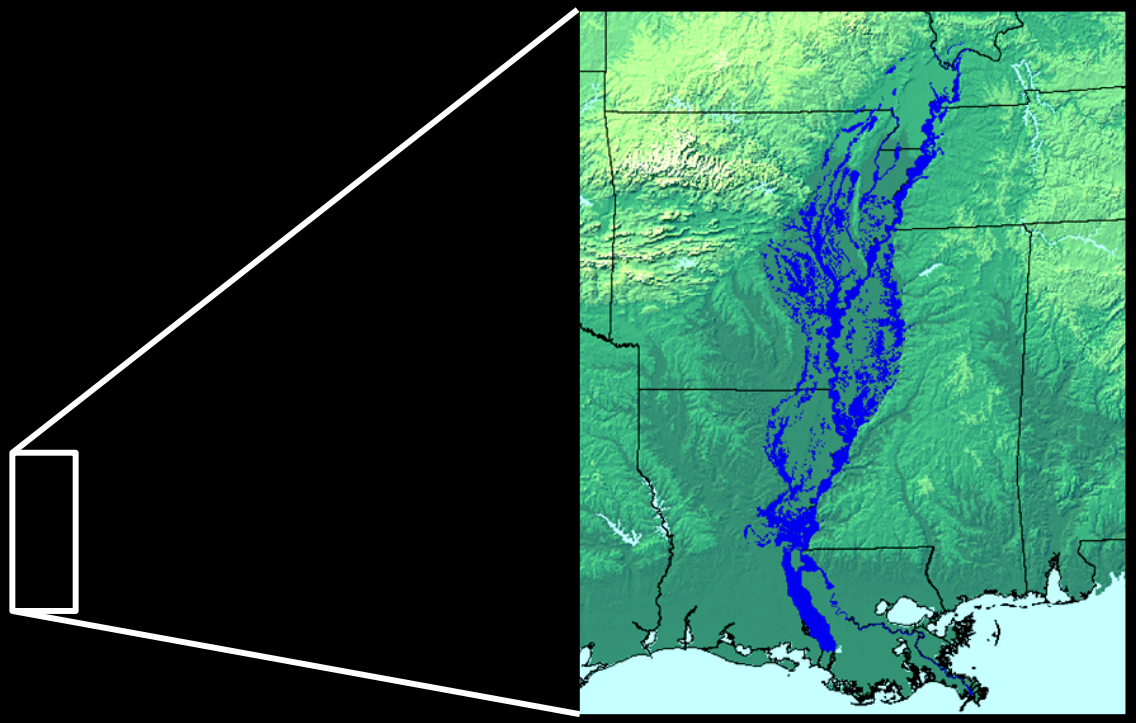
SHC Framework	Element/Product	NAWMP	PIF (IBWO)	USSCP	NAWCP	NBCI	NAWMP	PIF	USSCP	NAWCP	NBCI
Biological Planning	Biological Planning Unit	Mississippi Alluvial Valley Bird Conservation Region					West Gulf Coastal Plain Bird Conservation Region				
	Priority Species										
	Population Objectives										
	Limiting Factors										
	Species/Habitat Models										
Conservation Design	Landscape/Habitat Assessment										
	Assessment of Conservation Estate										
	Decision Support Tools										
	Habitat Objectives										
	Integrate Multiple Species Objectives										
Conservation Actions	Conservation Treatments										
	Program Objectives										
Outcome-based Monitoring	Conservation Tracking System										
	Habitat Inventory and Monitoring Program										
	Population Monitoring Program										
Assumption-driven Research	Species/Habitat Model Assumptions										
	Conservation Treatment Assumptions										
	Keyfactor/Sensitivity Analyses										
	Spatial Data Analyses										

Step 1. Develop and clearly specify management or conservation objectives.

Conservation Objective: Provide foraging habitat for overwintering ducks

Step 2a. Identify geographic scale.

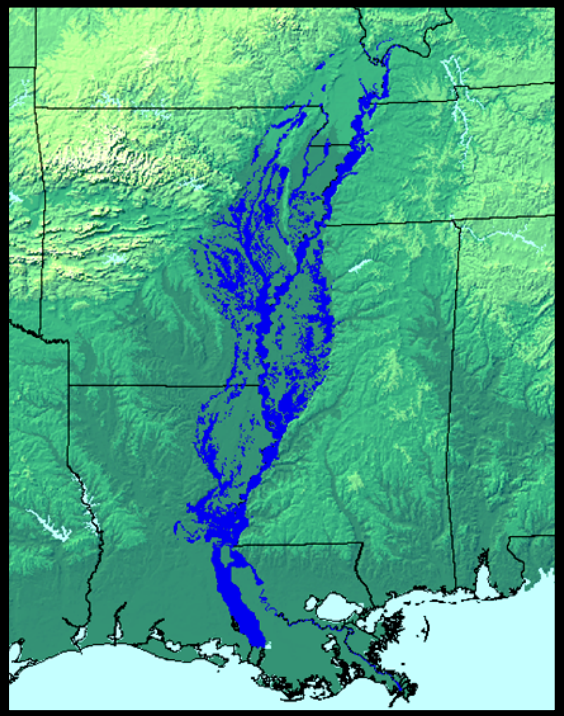
Priority Waterfowl Areas Identified in North American Waterfowl Management Plan



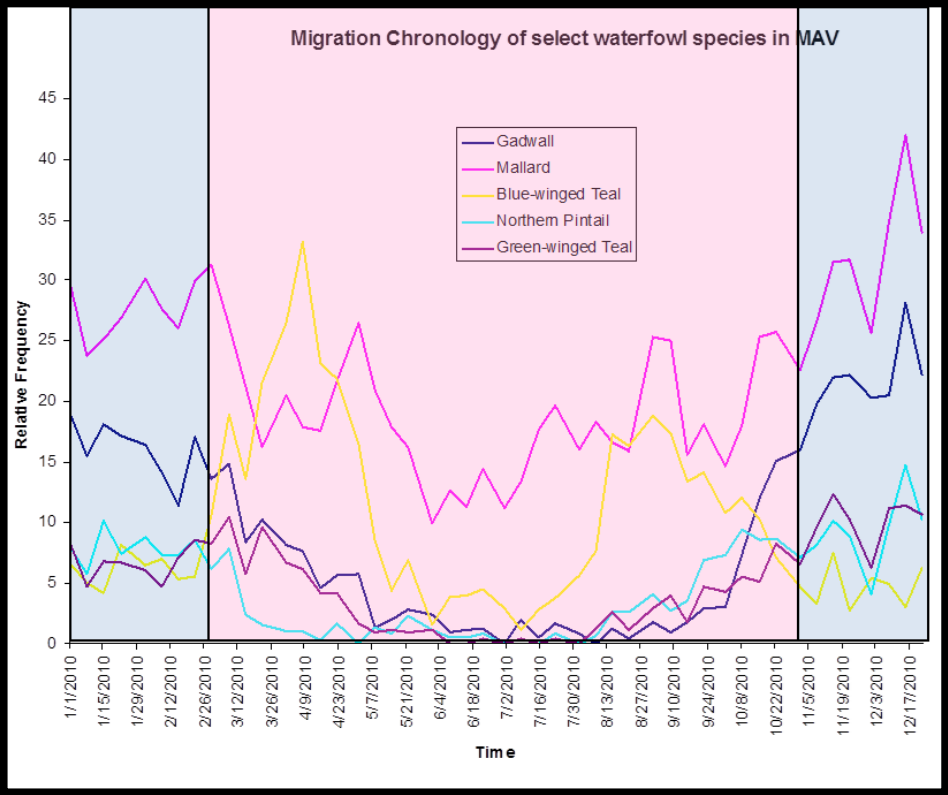
Mississippi Alluvial Valley

Step 2b. Identify temporal scale.

- ✓ Temporal Scale
  - 110-day wintering period
  - 10 November - 28 February



Mississippi Alluvial Valley



Step 3. Determine which species to consider.

DABBLING DUCKS

- Mallard
- Pintail
- Black duck
- Mottled duck
- Gadwall
- Wigeon
- Green-winged teal
- Blue-winged teal
- Shoveler
- Wood duck
- Fulvous and black-bellied whistling ducks

DIVING DUCKS

- Redhead
- Canvasback
- Lesser and greater scaup
- Ring-necked duck
- Ruddy duck
- Bufflehead
- Common and Barrow's goldeneye

MERGANSERS

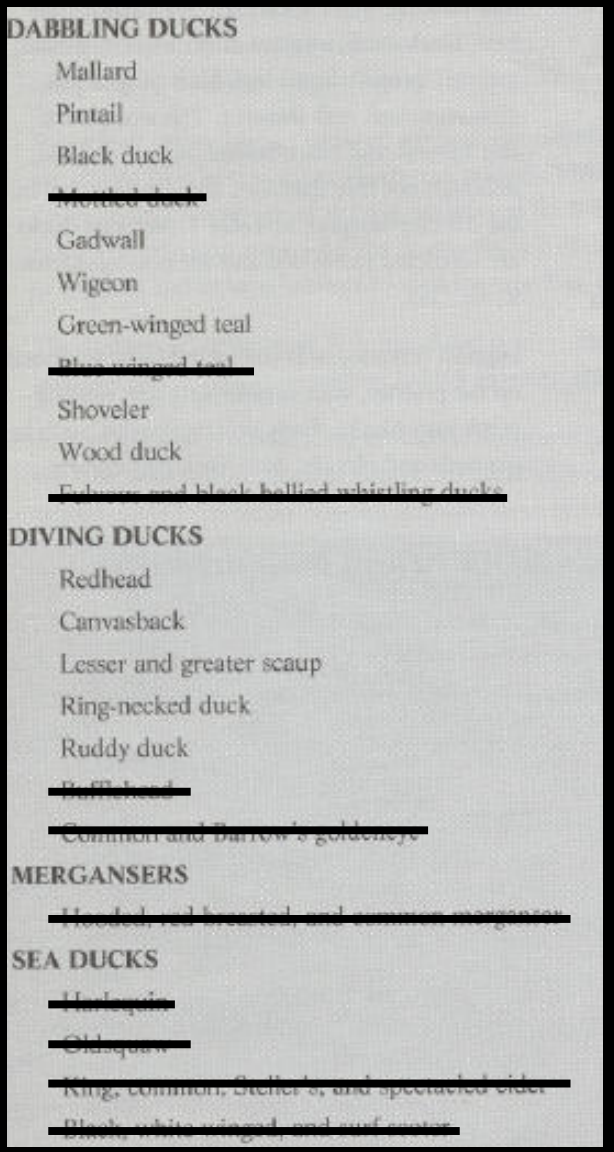
- Hooded, red-breasted, and common merganser

SEA DUCKS

- Harlequin
- Oldsquaw
- King, common, Steller's, and spectacled eider
- Black, white-winged, and surf scoter

Step 4. Select criteria to use in determining surrogate species.

Criteria 1. Waterfowl species that overwinter in the Mississippi Alluvial Valley



DABBLING DUCKS

- Mallard
- Pintail
- Black duck
- [redacted]
- Gadwall
- Wigeon
- Green-winged teal
- [redacted]
- Shoveler
- Wood duck
- [redacted]

DIVING DUCKS

- Redhead
- Canvasback
- Lesser and greater scaup
- Ring-necked duck
- Ruddy duck
- [redacted]
- [redacted]

MERGANSERS

- [redacted]

SEA DUCKS

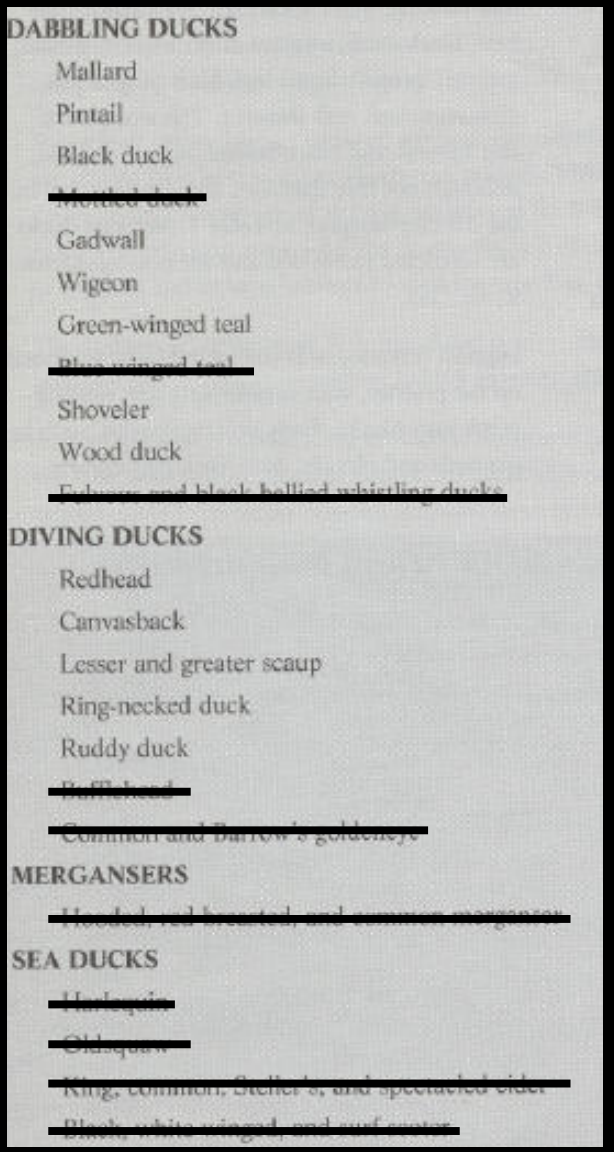
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Step 5. Establish Surrogates

Surrogate = all duck species that overwinter in the MAV

Note:

Objective: to provide habitat for overwintering ducks



DABBLING DUCKS

- Mallard
- Pintail
- Black duck
- [redacted]
- Gadwall
- Wigeon
- Green-winged teal
- [redacted]
- Shoveler
- Wood duck
- [redacted]

DIVING DUCKS

- Redhead
- Canvasback
- Lesser and greater scaup
- Ring-necked duck
- Ruddy duck
- [redacted]
- [redacted]

MERGANSERS

- [redacted]

SEA DUCKS

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Step 6. Identify species requiring special attention.

Based on the definition provided in the Draft Technical Guidance:

-- Wood Duck due to its close association with bottomlands

-- Snow Geese are given special attention due to their ability to quickly deplete food resources

Step 7. Identify population objectives

Objectives Derived from International Bird Conservation Plan

Species	Continental Objectives
Mallard	11,000,000
Northern Pintail	7,000,000
American Black Duck	1,400,000
Gadwall	2,000,000
American Wigeon	3,500,000
Green-winged Teal	3,000,000
Northern Shoveler	2,000,000
Wood Duck	3,000,000
Redhead	900,000
Canvasback	600,000
Scaup (Lesser and Greater)	8,000,000
Ring-necked Duck	1,000,000
Ruddy Duck	700,000
Total	44,100,000

Step 7. Identify population objectives

Stepping down continental objectives to a regional scale

INTEGRATING RESEARCH AND MANAGEMENT TO CONSERVE WILDFOWL (*ANATIDAE*) AND WETLANDS IN THE MISSISSIPPI ALLUVIAL VALLEY, U.S.A.

K.J. REINECKE (*) and C.R. LOESCH (**)
(*) National Biological Service, Southern Science Center, 2524 South Frontage Road, Suite C, Vicksburg, Mississippi, U.S.A. 39180
(**) U.S. Fish and Wildlife Service, Lower Mississippi Valley Joint Venture, 2524 South Frontage Road, Suite C, Vicksburg, Mississippi, U.S.A. 39180

KEY WORDS: Wildfowl, *Anatidae*, population, evaluation, foraging habitat, habitat management, winter, Mississippi Alluvial Valley, North American Waterfowl Management Plan, U.S.A.

ABSTRACT

Efforts to conserve winter habitat for wildfowl, Anatidae, *in the alluvial valley of the lower Mississippi River, U.S.A., are directed by the Lower Mississippi Valley (LMV) Joint Venture of the North American Waterfowl Management Plan (NAWMP). The Joint Venture is based on a biological framework developed through cooperative planning by wildfowl researchers and managers. Important elements of the framework include: (1) numeric population goals, (2) assumptions about potential limiting factors, (3) explicit relationships between wildfowl abundance and habitat characteristics, (4) numeric foraging habitat goals, and (5) criteria for evaluating success. The population goal of the Joint Venture for the Mississippi Alluvial Valley (MAV) is to enable 4.3 million ducks to survive winter and join continental breeding populations in spring. Currently, available data suggest that foraging habitat is the primary factor limiting duck populations in the MAV. To establish a goal for foraging habitat, we assumed the length of the wintering period is 110 days and calculated that a population of 4.3 million breeding ducks (plus 15% to account for winter mortality) would need 546 million duck-days of food in the preceding winter. Then, we used estimates of daily energy requirements, food densities, and food energy values to calculate the carrying capacity or number of duck-days of food available in the three primary foraging habitats in the MAV (flooded croplands, forested wetlands, and moist-soil wetlands). Thus, availability of foraging habitat can be used as a criterion for evaluating success of the Joint Venture if accurate inventories of foraging habitat can be conducted. Development of an explicit biological framework for the Joint Venture enabled wildfowl managers and researchers to establish specific objectives for management of foraging habitat and identify priority problems requiring further study.*

- 6 step process
  - Identify species of concern and their continental goal
  - Calculate proportion of ducks in MAV states relative to the total number in the lower 48 states
  - Calculate proportion of ducks in MAV counties relative to the total number of ducks in MAV states
  - Calculate population goals
    - Dabblers &divers – joint probabilities
  - Calculate population goals
    - Wood ducks – 10% harvest assumed
  - Sum across species and county by state

Step 7. Identify population objectives

Wintering Waterfowl Population Objectives for the Mississippi Alluvial Valley

State	Dabbling Ducks	Diving Ducks	Wood Duck	Total
Arkansas	1,474,189	78,401	322,290	1,874,880
Illinois	3,005	0	10,890	13,895
Kentucky	12,662	194	6,710	19,566
Louisiana	637,907	332,965	395,860	1,366,732
Mississippi	435,151	44,414	179,230	658,796
Missouri	65,817	3,664	26,020	95,501
Tennessee	236,884	15,066	35,500	287,450
Total	2,865,615	474,703	976,500	4,316,818

i.e., 4,316,818 ducks are expected to overwinter in the MAV.

Step 8. Test for logic and consistency.

Definition: To ensure selected surrogates are providing a valid basis for management, it is important to evaluate their effectiveness in representing the needs of the larger set of species.

Due to the process of selecting waterfowl species overwintering in the MAV and the management strategies put forth, all other duck species are considered adequately covered (e.g., vagrant blue-wing teal).

Step 9. Identify knowledge gaps and uncertainties.

The LMVJV Waterfowl Working Group has identified several key assumptions and uncertainties associated with the planning effort.

- Current model assumes all ducks are mallard size (292 k/cal/day).
- Current model assumes the winter period is 110 days for ducks.
- Current model assumes a 15% mortality factor during the winter period.
- Do energetic values by habitat type (crops, moist soil, bottomland forest) need to be revisited? If so, how?
- Do we need to account for inter-specific competition/deterioration of food resources? If so, how?
- Do we need to incorporate dry field feeding (energy values)? If so, how?
- Current response variable does not lend itself to seasonal and/or cross seasonal evaluations. What is the appropriate response variable(s) for evaluating JV progress towards meeting goals and objectives?
- Should Wood Ducks be included with other dabbling ducks to generate the habitat objectives (expressed as duck-use days)?

Explicitly state objectives for diving ducks?

Need food values for diving ducks?

Step 10. Monitor the effectiveness of the approach.

By Definition from the technical guidance…Do surrogate species adequately represent the needs of the broader set of priority species?

Short answer is yes (see step 8). In that steps 1-10 adequately represents the needs of ducks overwintering in the MAV.

However, it is unknown to what extent this process reflects the needs of non-duck species (e.g., waterbirds, etc) using these habitats during the winter period. But again, the conservation objective was to provide habitat for overwintering ducks.

In this example, species and population objectives are a means to establish habitat objectives (e.g., foraging habitat) which is the actual performance indicator, not populations nor species.

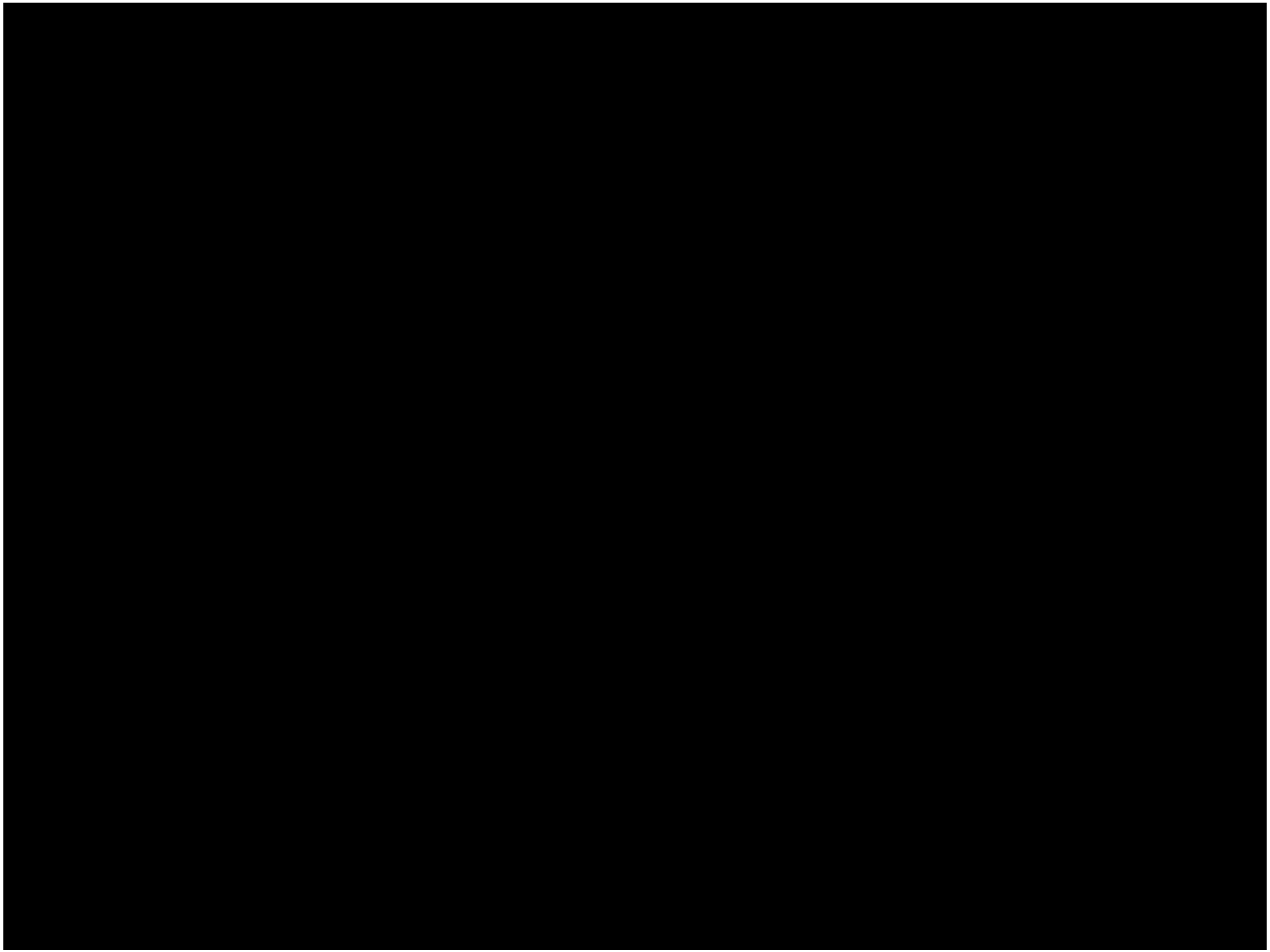
As such, the LMVJV devotes a significant amount of time and resources into tracking and monitoring habitat, not populations.

Assessment of Conservation Objective

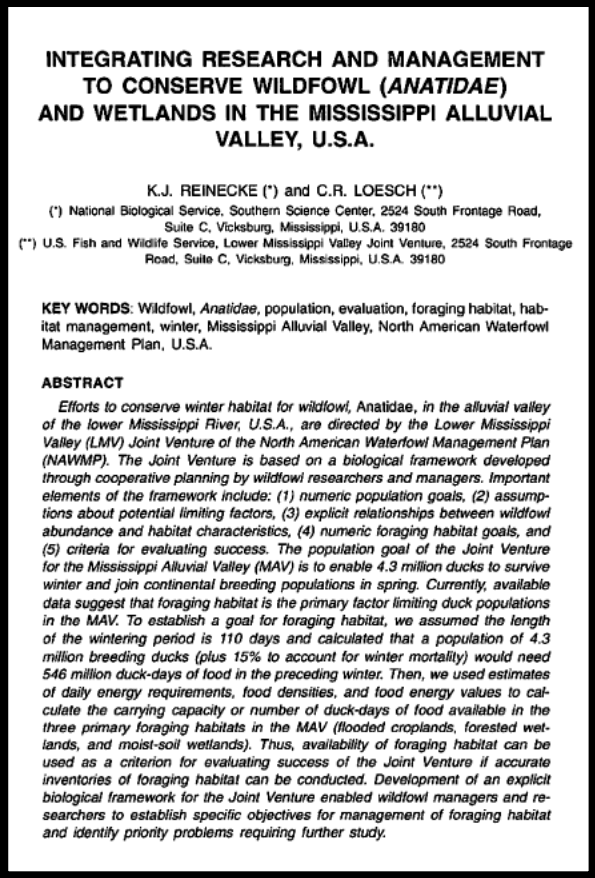
- Do we have "enough" habitat?

Waterfowl Habitat Assessment Project Results for Arkansas, December and January, 1999-2005.

Date	Natural Flood	Public Managed	Private Managed (MIP)	Private Managed (MOP)	Total DEDs Observed	DED Objective	Difference
Dec-99	32,955,669	8,470,927	10,171,457	40,011,570	91,609,623	219,427,337	(127,817,714)
Dec-01	225,598,552	42,605,355	14,282,256	37,843,378	320,329,541	219,427,337	100,902,204
Jan-03	96,699,304	43,921,870	14,296,169	37,927,125	192,844,468	219,427,337	(26,582,869)
Jan-04	25,047,100	34,003,430	9,251,295	21,991,872	90,293,697	219,427,337	(129,133,640)
Jan-05	191,809,617	47,995,139	9,284,252	50,696,038	299,785,046	219,427,337	80,357,709



Habitat Objectives



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- How much habitat is needed to provide sufficient DEDs to meet population objective?
  - 2 step process to determine sufficient DEDs
    - Increase population goals by 15% to account for winter mortality
      - 4,316,818 × 1.15 = 4,964,341 ducks
    - Multiply adjusted goal by 110 to account for the number of days ducks are present in the winter
      - 4,964,341 × 110 = 546,077,477 DEDs
  - Key questions
    - How many acres is that?
    - Do we have enough?

Step 10. Monitor the effectiveness of the approach.

By Definition from the technical guidance…Do surrogate species adequately represent the needs of the broader set of priority species?

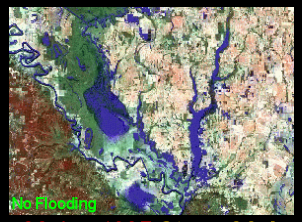
Again, this is not applicable to the process utilized by the LMVJV because no "surrogate" was identified.

In this waterfowl example, species and population objectives are a means to establish habitat objectives (e.g., foraging ha which is the actual performance indicator, not populations nor species.

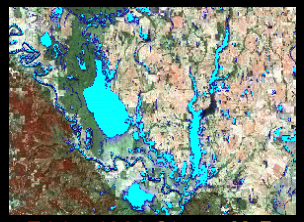
That is, to assess progress towards the biological outcome, the LMVJV does not support nor endorse population monitoring that is not explicitly tied back to addressing assumptions or data gaps underpinning the biological planning.

Instead, time and energy is devoted to assessing foraging habitat quantity and quality across the landscape.

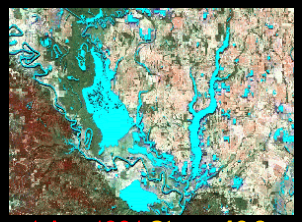
Habitat Assessment - Quantity



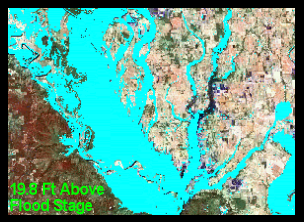
26 Jan 1985 **Stage 36.4**



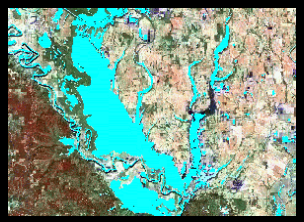
7 Mar 1988 **Stage 43.5**



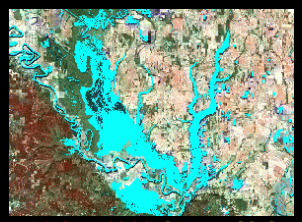
1 Apr 1991 **Stage 46.3**



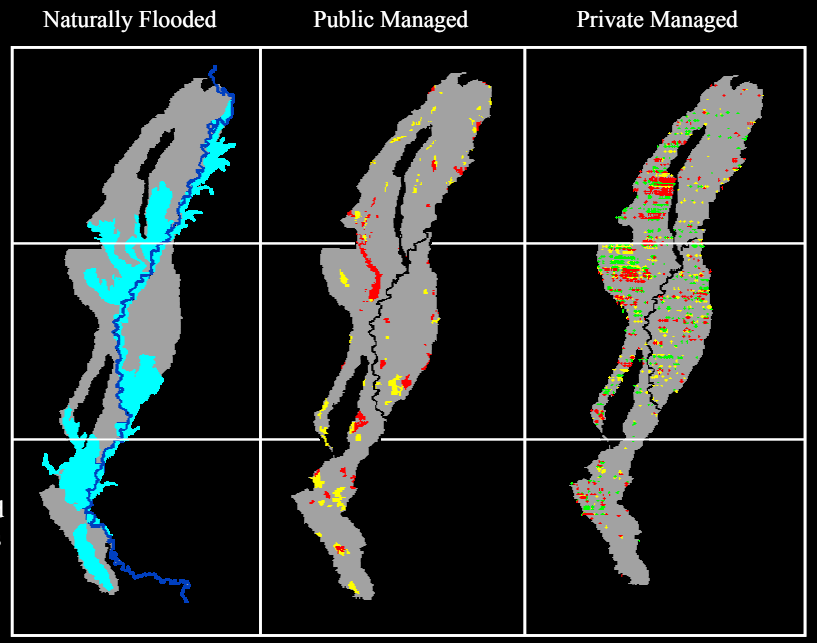
13 Jan 1983 **Stage 59.8**



21 Mar 1987 **Stage 52.6**



11 Apr 1989 **Stage 49.8**



Habitat Assessment - Quality

Management and Conservation Article

Depletion of Rice as Food of Waterfowl Wintering in the Mississippi Alluvial Valley

DANIELLE M. GREER,[1,2] *Cooperative Wildlife Research Lab, Southern Illinois University, 251 Life Sciences II, Carbondale, IL 62901, USA*
BRUCE D. DUGGER,[2] *Cooperative Wildlife Research*
KENNETH J. REINECKE, *United States Geological Su*
USA
MARK J. PETRIE, *Ducks Unlimited Incorporated, Puri*

ABSTRACT Waterfowl habitat conservation strateg
carrying capacity is limited by available food, and increasi
food abundance and depletion is insufficient to test thi
waste rice seed is depleted before spring migration. We
mass when waterfowl arrived in late autumn and departe
2001], n = 20 [2001–2002]) and compared seed mass
waterfowl and other processes. Finally, we used an experi
abundance and if the seed mass at which waterfowl cease
ha. Mean seed mass was greater in late autumn 2000 than
than 2001–2002 (91.3 vs. 55.7 kg/ha) and did not dif
deterioration inside and outside exclosures, we estimate
21.1 kg/ha (25.1%) in 2001. When we manipulated
treatments (48.7 kg/ha; P = 0.205) and did not differ
waterfowl consumed rice at different times in winter,
above 50 kg/ha. Results indicated waterfowl likely cons
our empirical estimates but was ≤48% (winters pooled
profitability limits waterfowl feeding in MAV rice fields
47.2 kg/ha; and 3) increasing available rice by increasing
and exploring the potential for producing second or
73(7):1125–1133; 2009)

KEY WORDS food availability, food depleti

Historically, the Mississippi Alluvial Valley (MAV
largest forested wetland in North America (ap
million ha; Reinecke et al. 1989). However, constr
>1,500 km of levees along the Mississippi River,
drainage, and clear-cutting of timber for ag
development removed approximately 80% of
bottomland hardwood forests (Twedt and Loesc
Despite these changes, the MAV still supports con
significant waterfowl populations, because severe
have adapted to the agricultural landscape by consu
and other grains in harvested fields (Reinecke et
Waste rice, or rice grain remaining in fields after H
an important agricultural food for migrating and
waterfowl in the MAV. Rice is more rea
deterioration when flooded (Nelms and Twedt 1
provides more metabolizable energy than most g
natural foods (Kaminski et al. 2003). Addition
MAV is a major rice-producing area in the Unit
and harvests nearly 900,000 ha annually (U.S. De

[1] *E-mail: daniellerutka@aol.com*
[2] *Present address: Department of Wildlife and Fisheries Sci*
A&M University, 210 Nagle Hall, College Station, TX 7
[3] *Present address: Department of Fisheries and Wildlife, O*
University, Corvallis, OR 97331, USA

Greer et al. • Winter Depletion of Rice by Waterfowl

Journal of Wildlife Management 74(1):94–101; 2010; DOI: 1

Management and Conservation Artic

Weather-Related Indice
Winter Dabbling Duck
Middle North America

MICHAEL L. SCHUMMER,[1] *Department of Wildlif*
RICHARD M. KAMINSKI, *Department of Wildlife a*
ANDREW H. RAEDEKE, *Missouri Department of C*
DAVID A. GRABER, *Missouri Department of Conser*

ABSTRACT Research on effects of key weather
investigated relationships between changes in relative a
weather variables at midlatitude locations in North
temperature and snow cover data from the Historical
abundance of ducks in Missouri, USA, during autu
(CumulativeWSI; calculated as mean daily temp – de
consecutive days with snow cover) had the greatest weig
CumulativeWSI reflected current and cumulative effects
icing, on food availability for ducks. The CumulativeW
North American waterfowl given different climate
investigations should address interactions between Cu
harvest, and other anthropogenic influences to increase

KEY WORDS *Anas platyrhynchos*, climate, d

From 1955 through 2005, annual mean air ten
increased in North America, with greatest inc
winter (Walther et al. 2002, Hengeveld et al
Additionally, simulations have indicated a similar
fying pattern in coming decades (Ruosteenoja et
Field et al. 2007). Changes in climate and extreme
events may have ecological consequences, including
logical shifts in species' life cycles and possibly asyr
(Glynn 1990, Anderson and Sorenson 2001, Thor
2001, Crick 2004, Inkely et al. 2004). Phenological
waterfowl and other birds include changes in t
breeding and migration, as well as population dist
(Walther et al. 2002, Parmesan and Yohe 2003, Se
al. 2006). Researchers have investigated influe
climate change and weather events on spring
and breeding waterfowl (Sedinger et al. 2006, DeVi
Bauer et al. 2008). Although an understanding
influencing movement and distribution of migrator
important for conservation planning (Johnson et
Browne and Dell 2007, Newton 2008), little infi
exists concerning influences of weather events on ab
of waterfowl during the nonbreeding season,
encompassing nearly 9 months of the annual cycle
species (Baldassarre and Bolen 2006).

Temperature and snow cover seem to influence tir
extent of the southerly migration by northern her
waterfowl (Bellrose 1980, Nichols et al. 1983, Švažas et al.
2001). Theoretically, when temperature declines below a
threshold, remaining at northern latitudes becomes more
energetically costly than migrating southward to a warmer

[1] *E-mail: mschummer@cfr.msstate.edu*

Northward shifts in distribution of wintering wa
increase habitat demands at midlatitudes of Nor
where only 10–15% of historic wetlands remai
the lowest proportion in North America (Dahl
Although long-term climate data indicate a t
increased temperatures and reduced snow c

94 The Journal of Wildlife Mana

Notes

Comparison of Agricultural Seed Los
Unflooded Fields on the Tennessee
Wildlife Refuge

Melissa A. Foster, Matthew J. Gray,* Craig A. Harper, Johnathan G. Walls

M.A. Foster, M.J. Gray, C.A. Harper
University of Tennessee, Department of Forestry, Wildlife and Fisheries, 274 Ellingto

J.G. Walls
Auburn University, School of Forestry and Wildlife Sciences, 602 Duncan Drive, Aub

Abstract

Waterfowl exploit seed resources in agricultural fields to help meet the e
the energetic, and various life-history activities. Biologists commonly flood ag
seed for waterfowl and to provide hunting opportunities. Previous studies suggest t
simultaneous comparison of seed loss with unflooded fields has not been made. We c
in wire-mesh bags placed in an unflooded agricultural field vs. seed submersed in a fl
Refuge from October 2007 to January 2008. Agricultural seed mass declined 40–5
unflooded field. Corn, soybean, and grain sorghum seed mass declined 42%, 87%, a
submersion, which was similar to previous studies that measured seed loss in floode
loss in unsubmersed mesh bags was 1.3–6.9 times lower than scattered seed lying
separate experiment. We hypothesize lower rates of seed loss in mesh bags compar
bags, which are commonly used in seed fate studies. Our results suggest biologist
immediately prior to the arrival of waterfowl and be aware that absolute estimates of
be biased negatively.

Keywords: waterfowl management; agriculture; food resources; flooding; corn; soybe

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Citation: Foster MA, Gray MJ, Harper CA, Walls JG. 2010. Comparison of agricultural
the Tennessee National Wildlife Refuge. *Journal of Fish and Wildlife Management* 1(

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Wildlife Service.

* Corresponding author: mgray1 1@utk.edu

Introduction

Waterfowl must acquire substantial energy in nonbreeding
areas to rebuild lipid reserves metabolized during southward
migration, meet energy needs associated with thermoregula-
tion and winter life-history activities (e.g., courtship), and
accumulate sufficient resources for return flight to northern
breeding areas (Neely and Dawson 1971; Williams et al. 1993).
The amount of cropland on the landscape has increased over
the past 100 y, which has increased the abundance of
agricultural seed available for wildlife. Agricultural seed is a
primary food resource for waterfowl in migrating and wintering
areas (Baldassarre and Bolen 1984; Delnicki and Reinecke 1986;
Combs and Fredrickson 1996; Heitmeyer 2006). Agricultural
grains have more true metabolizable energy than moist-soil
seeds or acorns (Petrie et al. 1998; Checkett et al. 2002;
Kaminski et al. 2003), and yield per unit area for unharvested

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Management and Conservation Article

Habitat Use by Female Mallards in the Lower Mississippi
Alluvial Valley

BRUCE E. DAVIS,[1] *School of Renewable Natural Resources, Louisiana State University, Baton Rouge, LA 70803, USA*
ALAN D. AFTON, *United States Geological Survey, Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University, Baton Rouge, LA 70803, USA*
ROBERT R. COX, JR., *RC Store, P.O. Box 712, Ipswich, SD 57451, USA*

ABSTRACT Mallard (*Anas platyrhynchos*) populations in the lower Mississippi Alluvial Valley (LMAV), USA, historically averaged 1.6 million and represented the largest concentrations of wintering mallards in North America. Effective management of this wintering population requires current information on use of habitats. Accordingly, we employed radiotelemetry techniques to assess proportional use of habitats by female mallards during winters 2004–2005 and 2005–2006. We divided winters into 4 time periods defined by hunting seasons (FIRST, SPLIT, SECOND, and POST) and recorded diurnal and nocturnal locations. We examined variations in proportional use of habitats and use of areas closed to hunting due to effects of age (immature or ad), winter (2004–2005 or 2005–2006), time period (SECOND or POST), individual female, and all potential interactions of these effects, using locations recorded during the latter 2 time periods. We found that diurnal and nocturnal proportional use of habitats varied inconsistently among time periods and winters. Mean proportional use of forested wetlands ranged from 0.475 to 0.816 and from 0.428 to 0.764 during diurnal and nocturnal sampling periods, respectively. Diurnal proportional use of areas closed to hunting varied inconsistently among time periods and winters. Mean proportional use of areas closed to hunting ranged from 0.183 to 0.423 during diurnal sampling periods. Nocturnal use of areas closed to hunting varied inconsistently among female ages and time periods and among female ages and winters. Mean proportional use of areas closed to hunting ranged from 0.211 to 0.445 during nocturnal sampling periods. Our research suggests that forested wetlands in the LMAV provide important wintering habitats for female mallards; continued restoration and establishment of these habitats should benefit female mallards. (JOURNAL OF WILDLIFE MANAGEMENT 73(5):701–709; 2009)

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KEY WORDS *Anas platyrhynchos*, Arkansas, compositional analysis, forested wetland, hunting, Louisiana, mallard, Mississippi Alluvial Valley, radiotelemetry, winter.

The Mississippi Flyway contains the most important migration corridors for North American mallards (*Anas platyrhynchos*), and the lower Mississippi Alluvial Valley (hereafter LMAV), USA, historically supported the largest wintering concentrations of the species, averaging 1.6 million (Bellrose 1976, Bartonek et al. 1984). Landscapes in the LMAV have been altered due to flood-control projects and agricultural land drainage, causing extensive wetland losses and degradation (Goldstein 1988). Fragmentation of remaining forested wetlands has been widespread, and <25% of native bottomland hardwood forests remain in the LMAV (Wolf et al. 1986). Consequently, considerable habitat restoration efforts have been undertaken in this region, and acreage of timberland has increased recently in some portions of the LMAV (Forsythe and Gard 1980, Reinecke et al. 1989, Faulkner et al. 1995, King and Keeland 1999). The Wetlands Reserve Program (WRP) has provided incentives for increased restoration and reforestation of habitats in the LMAV, but evaluations of WRP program impacts on wildlife populations are limited (King et al. 2006). Little information is available regarding mallard use of this highly fragmented, altered, and dynamic landscape in the LMAV. Similarly, little information is available regarding mallard use of closed areas. Areas closed to hunting (by statute or governmental authority) may reduce disturbance by humans and provide opportunities for information sharing by waterfowl (Ydenberg et al. 1983).

[1] *E-mail: bdavi29@lsu.edu*

Further, little is known about nocturnal habitat use of mallards, although habitats used nocturnally may serve as important feeding and roosting areas for dabbling ducks (Guillemain et al. 2002).

Waterfowl habitat management within the LMAV has focused on agricultural and moist-soil habitats (Reinecke et al. 1989, Kross et al. 2008). However, information is lacking regarding use of these habitats relative to that of forested wetlands. Previous estimates of habitat use in the LMAV were derived from aerial surveys (e.g., Dell et al. 1987), but visibility biases may make accurate abundance estimates from aerial count data in some habitats difficult (Smith et al. 1995).

Heterogeneity in proportional use of habitats and use of closed areas may be related to several factors. Nichols et al. (1983) showed the proportion of mid-continent breeding mallards wintering in the MAV varied with winter precipitation. Similarly, weather conditions during winter may impact mallard habitat use at a local scale. Weather varied markedly in the LMAV between the 2 winters of our study; 2004–2005 was very wet and 2005–2006 was very dry (Davis 2007). Some dabbling ducks increase their use of closed areas in response to hunting (Migoya et al. 1994, Cox and Afton 1997), but relative use of closed areas by mallards, in relation to hunting seasons, has not been investigated in the LMAV. Some heterogeneity in proportional habitat use by ducks may be explained by female age. Reinecke et al. (1987) reported age-specific survival rates for radiomarked

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Operational Compass

LMVJV Operational Compass: Habitat Conservation To Sustain Bird Populations Through Science, Technology and Partnerships

Arkansas Game and Fish Commission, Ducks Unlimited, Kentucky Department of Fish and Wildlife Resources, Louisiana Department of Wildlife and Fisheries, Mississippi Department of Wildlife, Fisheries, and Parks, Missouri Department of Conservation, Oklahoma Department of Wildlife Conservation, Tennessee Wildlife Resources Agency, Texas Parks and Wildlife Department, The Conservation Fund, The Nature Conservancy, US Fish and Wildlife Service, US Forest Service, US Geologic Survey, Wildlife Management Institute

SHC Framework	Element/Product	NAWMP	PIF	USSCP	NAWP	NBCI	NAWMP	PIF	USSCP	NAWP	NBCI
Biological Planning	Biological Planning Unit	Mississippi Alluvial Valley Bird Conservation Region					West Gulf Coastal Plain/Ouachitas Bird Conservation Region				
	Priority Species										
	Population Objectives										
	Limiting Factors										
	Species/Habitat Models										
Conservation Design	Landscape/Habitat Assessment										
	Assessment of Conservation Estate										
	Decision Support Tools										
	Habitat Objectives										
	Integrate Multiple Species Objectives										
Conservation Actions	Conservation Treatments										
	Program Objectives										
Outcome-based Monitoring	Conservation Tracking System										
	Habitat Inventory and Monitoring Program										
	Population Monitoring Program										
Assumption-driven Research	Species/Habitat Model Assumptions										
	Conservation Treatment Assumptions										
	Keyfactor/Sensitivity Analyses										
	Spatial Data Analyses										

Operational Compass

- Primary focus on NAWMP

LMVJV Operational Compass: Habitat Cons

Arkansas Game and Fish Commission, Ducks Unlimited, Kentucky De
Missouri Department of Conservation, Oklahoma Department of Wildlife
Fish and

SHC Framework	Element/Product	NAWMP
Biological Planning	Biological Planning Unit	
	Priority Species	
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	Integrate Multiple Species Objectives	
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