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Comparing mallard population indexes in the Mississippi Alluvial Valley between January 1988-1990 and 2005-2006

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INTRODUCTION

Despite above average breeding populations, liberal hunting seasons, and increased habitat management, many hunters in the Mississippi Alluvial Valley (MAV) contend that hunting success and the abundance of wintering mallards have decreased in recent years. Perceptions among hunters are that migration patterns have changed or mallards are concentrated on refuges and unavailable to hunters. Waterfowl managers lack data to respond to these concerns and the status of mallard populations in the MAV has become contentious.

Because aerial transect surveys developed for counting mallards in the MAV (Reinecke et al. 1992) can reduce the uncertainty regarding the status of populations, we conducted comprehensive transect surveys in January 2005 and 2006 to assess evidence for a decrease in mallard abundance. Our specific objectives were to estimate mallard population indexes in January 2005 and 2006 and compare results with estimates from 1988-1990.

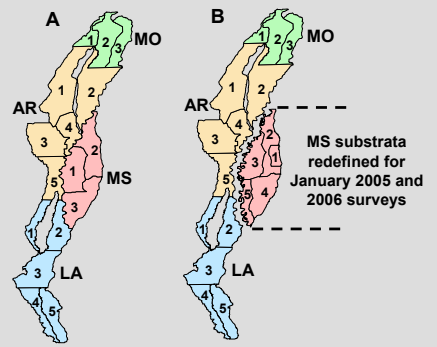
METHODS

All surveys were variations of stratified random sample designs with 2 levels of stratification, and sample units were strip transects. Areas of the MAV in Arkansas (AR), Louisiana (LA), Mississippi (MS), and Missouri (MO) served as strata, and substrata within strata were delineated to increase precision of estimates.

Surveys in January 1988-1990 used the strata (Fig. 1A) and methods described by Reinecke et al. (1992). Changes in methods used during the January 2005-2006 surveys included:

1) In January 2005 and 2006, we increased the number of substrata in Mississippi from 3 to 5 (Fig. 1B).
2) We decreased the number of observers from 2 to 1 and the transect width from 0.5 to 0.25 km in January 2005 in Mississippi and in January 2006 throughout the MAV.
3) In January 2006, we selected transects with equal probability sampling everywhere except Mississippi, where we continued to select transects with probability proportional to size (i.e., length).

Figure 1. Stratum and substratum boundaries for the January 1988-1990 (A) and January 2005-2006 (B) surveys.



We collected the following data for each observation: (1) the estimated number of mallards in each flock or group of birds using the same habitat; (2) geographic coordinates; and (3) habitat type (e.g., rice, soybean, forested wetland). After integrating these data, we exported spatial coordinates of observations and used ArcGIS and vector data representing boundaries of public lands to classify observations as occurring on public or private land.

We estimated population indexes and habitat use for each survey following methods in Cochran (1977) and Reinecke et al. (1992). We calculated mean population indexes for time periods (1988-1990 vs. 2005-2006) as simple arithmetic means and variances of the mean indexes as sums of yearly variances because we selected samples independently each year. We used a *z*-statistic to test for a difference in mean population indexes between time periods and interpreted the test as 1-sided because we predicted population change was negative.

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RESULTS AND DISCUSSION

In January 2005, we sampled 336 transects and estimated a population index of 0.99 million (SE = 72,316) mallards with a coefficient of variation (CV) of 0.07 (Table 1). In January 2006, we sampled 295 transects and again estimated a population index of 0.99 million (97,271) mallards. The population indexes for January 2005 and 2006 were less than any of the indexes from January 1988-1990 (1.15-1.79 million; Reinecke et al. 1992), although the 2004 and 2005 mid-continent fall flights of mallards were greater (9.3-9.4 million) than fall flight indexes for 1987-1989 (7.1-8.0 million). The mean of population indexes from January 2005-2006 was significantly less than the mean of indexes from January 1988-1990 ($z = 4.15$; 1-tailed $P < 0.001$).

Table 1. Estimated population indexes, SEs, and CVs by state for mallards wintering in the MAV, January 2005 and 2006.

State	*n* (transects)	Population index	SE	CV
2005				
AR	129	673,407	63,498	0.09
LA	93	84,033	13,248	0.16
MS	83	142,416	24,037	0.17
MO	31	89,206	21,078	0.24
MAV totals	336	989,061	72,316	0.07
2006				
AR	107	571,455	61,311	0.11
LA	64	193,043	41,468	0.21
MS	74	52,469	28,117	0.54
MO	50	173,040	56,502	0.33
MAV totals	295	990,007	97,271	0.10

Table 2. Mean population indexes of mallards by state for 2 time periods and the percent change between means.

State	Population index 1988-1990	Population index 2005-2006	% change
AR	801,673	622,431	- 22
LA	211,689	138,538	- 35
MS	362,209	97,443	- 73
MO	48,988	131,123	+168
MAV totals	1,424,560	989,535	- 31

For the entire MAV, the mean of mallard population indexes from January 2005 and 2006 was 31% less than the mean from surveys in January 1988-1990 (Table 2). Within states or strata, indexes increased 168% in MO but decreased 22% in AR, 35% in LA, and 73% in MS (Table 2). The pattern of changes in abundance between time periods suggested mallard densities decreased most in the southern and southeastern portions of the MAV.

Habitat use in January 2005 and 2006 was generally within the range of values observed in January 1988-1990 (Table 3), although dry conditions in January 2006 apparently resulted in increased use of rice (45%) and decreased use of soybean fields (7%). We found little evidence that mallards concentrated on refuges or public lands in January 2005 or 2006. The percentage of mallards using private land was 93% in January 2005 and 81% in 2006, whereas the percentage of private land in the MAV was 94%. Although we estimated population indexes rather than true abundance, we believe the conclusion that mallard populations have decreased is robust because visibility bias is greatest in forested wetlands (Smith et al. 1995) and use of forested wetlands varied little between time periods.

Table 3. Diurnal habitat use of mallards during aerial surveys in January 2005-2006 versus January 1988-1990.

Land use	% of population using habitat 2005-2006	1988-1990
Land cover		
Soybean	7-32	11-41
Rice	32-45	21-32
All croplands	52-77	53-85
Moist-soil	12-13	3-29
Forested wetlands	4-10	3-10
Land ownership		
Private	81-93	
Public	7-19	

CONCLUSIONS

We concluded: (1) population indexes for January 2005 and 2006 were lowest among the 5 surveys although fall flights were highest during these years; (2) the mean of population indexes from January 2005-2006 was 31% less ($P < 0.001$) than the mean from January 1988-1990; (3) habitat use in January 2005-2006 was similar to January 1988-1990; and (4) there was no evidence that mallards concentrated on refuges and were unavailable to hunters in January 2005-2006. Although we compared indexes rather than estimates of true abundance, we believe mallard populations in the MAV have decreased in recent years rather than increased as expected. The status of mallards in the MAV is a priority issue because of implications for managing habitat and harvests, and we recommend further surveys to monitor populations.