AGE RATIOS OF MALE MALLARDS HARVESTED IN EASTERN SOUTH DAKOTA

Jeremy P. Rakowicz, Jeffrey S. Gleason, and Jonathan A. Jenks
Department of Wildlife and Fisheries Sciences
South Dakota State University
Brookings, SD 57007

ABSTRACT

We analyzed harvest age ratios (immatures/adult) of male mallards (Anas platyrhynchos) (n = 146) obtained opportunistically from hunters during October - November 1995 in 3 eastern South Dakota counties (Brookings, Kingsbury, and Lake). Our objectives were to evaluate within year temporal trends in harvest age ratios for male mallards and to compare our age ratios to estimates obtained from the U.S. Fish and Wildlife Service’s (USFWS) Parts Collection Survey (PCS). Our overall age ratio (0.7 immatures/adult) for male mallards harvested in eastern South Dakota was not significantly different (P = 0.10) than the statewide PCS age ratio (1.03 immatures/adult). Harvest age ratios differed (P ≤ 0.05) across 3 time periods; 2.1 immatures/adult for early, 0.24 immatures/adult for mid, and 0.42 immatures/adult for late season. Calculated age ratios (USFWS, unpubl. data) for the 3 county region by period (0.89, 1.09, and 0.45) did not differ (P ≥ 0.05) from those generated in our study. Weather data was obtained from 3 weather stations on the study area. No differences (P > 0.05) in temperatures were found for the 3 counties; however, temperatures declined significantly (P ≤ 0.05) across time periods. We attributed differences in male mallard harvest age ratios to differential migration and local weather patterns.

INTRODUCTION

The mallard is the most common and heavily harvested waterfowl species in North America (Johnson et al., 1986; Caithamer et al., 1995). Its breeding range is the most extensive of all North American waterfowl species (Bellrose, 1976). Breeding population estimates for the mallard have shown dramatic increases over the last 2 years with an estimated 8.3 million in 1995, the highest estimate since the early 1970’s (Caithamer et al., 1995). The goal of the North American Waterfowl Management Plan (NAWMP) for breeding mallards is 8.7 million by the year 2000 (Anonymous, 1986).

Duck harvest management in the United States is driven by mallard population dynamics and is based on breeding population estimates and Canadian ponds surveyed in May (Anonymous, 1995). An estimated 2.9 million mallards were harvested in the United States in 1994 (Sharp, 1995). Effects of harvest and harvest regulations on mallards has been studied extensively (Anderson, 1975; Anderson and Burnham, 1976; Rogers et al., 1979; Burnham et al., 1984;
Within the Central Flyway, the annual mortality rate due to hunting averages 25.5% and 27.2% for mallard males and 27.2% and 38.2% for female mallards in the western and eastern tier states, respectively (Funk et al., 1971). Recovery rates of mallards banded pre-season throughout North America indicate that approximately 12% of adult males and 18% of immature males were harvested during the 1994-95 hunting season (i.e., immatures are 1.5 times more vulnerable to harvest) (Caithamer et al., 1995).

The proportion of juveniles in the waterfowl population is a good indicator of production (Baldassarre and Bolen, 1994). Two recruitment indices used by waterfowl biologists include harvest age ratios and the ratio of numbers of broods/indicated breeding pairs (March and Hunt, 1978; Kaminski and Gluesing, 1987; Rexstad et al., 1991). Age ratios can be obtained from birds examined during banding, those shot and reported by hunters, or those killed during disease outbreaks (Bellrose et al., 1961). Harvest age ratios are estimated from duck wings obtained from a random sample of hunters (Geissler, 1990). Approximately 30,000 waterfowl hunters are sent envelopes requesting they return goose tail fans and duck wings from birds they shoot (Geissler, 1990). In the Central Flyway (1995), 24,867 waterfowl parts were analyzed, of which 6,915 were wings from mallards (USFWS, unpubl. report). Changes in annual harvests and age ratios have been attributed to sampling variability (Geissler, 1990), regulations (Conroy and Krementz, 1990), number of waterfowl hunters (Fowler, 1974), geographic and temporal trends (Conroy and Blandin, 1984; Krementz et al., 1987), population size and recruitment (March and Hunt, 1978; Cowardin et al., 1985; Kaminski and Gluesing, 1986; Greenwood et al., 1987), and habitat conditions and weather (Bellrose and Compton, 1970; Alford and Bolen, 1977; Raveling and Heitmeyer, 1989; Smith and Reynolds, 1992). Our objectives were to evaluate within year temporal trends in harvest age ratios for male mallards and to compare our age ratios to estimates obtained from the USFWS PCS. We hypothesized that age ratios of male mallards should be similar throughout the hunting season.

METHODS

Mallard wings were collected (7 October - 24 November) opportunistically from hunters in 3 eastern South Dakota counties (Brookings, Kingsbury, and Lake). We determined ages of male mallards using wing plumage (Carney, 1964; 1992). Age of male mallards was determined from the color, shape, and wear of the tertials, scapulars, and coverts (Carney, 1992). Owen and Cook (1977) determined that distinguishing adults from juveniles becomes more difficult as the hunting season progresses and it is possible that some immatures may be classified as adults and included in the adult sample. However, these same authors noted that most of the aging errors occurred after November; thus, we considered our aging techniques as accurate for our study period. In an attempt to reduce observer bias, only the first author aged wings submitted by hunters.
We assigned wings to one of 3 time periods; early (7 - 20 October), mid (21 October - 3 November), and late (4 - 24 November) depending on when they were harvested. Harvest age ratios were calculated for the 3 periods by dividing the number of immatures by the number of adults. We compared our harvest age ratios to the overall South Dakota PCS age ratios by totaling our birds (86 adults vs. 60 immatures = 146 male mallards) and calculating (i.e., that proportion of immatures/adults that equaled 146 and an age ratio of 1.03) a corresponding PCS ratio (72 adults vs. 74 immatures = 146 male mallards). We also compared our harvest age ratios by period (early, mid, and late season) to PCS ratios for the 3 county (Brookings, Kingsbury, and Lake) region. Using PCS data obtained from Sharp (1995), we compared male mallard age ratios for South Dakota to ratios obtained for the Central Flyway during 1961 - 94. Weather data were obtained from 3 weather stations on the study area; Brookings (Brookings Co.), DeSmet (Kingsbury Co.), and Madison (Lake Co.). We analyzed mean daily temperatures for the 3 counties and periods. Age ratios were analyzed using Chi-Square analysis and weather data was analyzed using Analysis of Variance (ANOVA).

RESULTS

A total of 146 (60 immatures, 86 adults) male mallard wings was collected during the season; early (38 immatures, 18 adults), mid (9 immatures, 37 adults), and late (13 immatures, 31 adults) (Table 1). A total of 332 immature and 327 adult male mallards was obtained from South Dakota during the 1995-96 PCS (USFWS unpubl. report). A total of 96 (45 immatures, 51 adults) male mallards was obtained for the 3 county area during the 1995-96 PCS; early (17 immatures, 19 adults), mid (23 immatures, 21 adults), and late (5 immatures, 11 adults) (Table 1). Male mallard age ratios from wings obtained from hunters differed significantly (P < 0.05) between the 3 periods; early (2.1 immatures/adult), mid (0.24 immatures/adult), and late (0.42 immatures/adult) but were similar (P > 0.05) to projected PCS age ratios for the 3 counties (0.89, 1.09, and 0.92) (Fig. 1). Our overall age ratio (0.7 immatures/adult) for male mallards harvested in eastern South Dakota was not significantly different (P = 0.10) from the statewide PCS age ratio (1.03 immatures/adult). South Dakota male mallard age ratios generally followed age ratios for the Central Flyway with larger yearly variations over the 33 year period (Fig. 2). Mean daily temperature did not differ (P > 0.05) among the 3 counties and thus temperature data were pooled. Mean daily temperature and wind chill index declined through the hunting season (Fig. 3). Mean daily temperatures (3 county average) were significantly different (P ≤ 0.05) for the 3 hunting periods; early (X = 28.03º C), mid (X = 18.62º C), and late (X = 15.30º C).

DISCUSSION

The use of harvest age ratios obtained from U.S. Fish and Wildlife Service’s Parts Collection Survey has been widely accepted as an index to recruitment (Baldassarre and Bolen, 1994). However, the differences between production
estimates (i.e., nest success and brood production) and harvest age ratios has been a concern for some time. Currently, the USFWS uses 3 variables to predict annual production; spring breeding population size, number of July ponds, and an index of brood production (Martin et al., 1979; Kaminski and Gluesing, 1987). Kaminski and Gluesing (1987) documented an inverse relationship between recruitment rates and breeding population size and a positive relationship between recruitment rates and May and July ponds for mallards. These authors hypothesized that a population exhibiting high recruitment in year 1(year t) may show a decline the following year (year t + 1) due to a preponderance of yearling females which exhibit a lower reproductive potential (i.e., density-dependent reproduction). These authors used unadjusted harvest age

Table 1. Male mallards harvested in 3 eastern South Dakota counties, 1995.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>NUMBER</th>
<th>AGE</th>
<th>DATA SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
<td>Immatures</td>
<td>This study</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>09</td>
<td>Immatures</td>
<td>This study</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>Immatures</td>
<td>This study</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>Immatures</td>
<td>USFWS PCS</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>Immatures</td>
<td>USFWS PCS</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>05</td>
<td>Immatures</td>
<td>USFWS PCS</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Adults</td>
<td></td>
</tr>
</tbody>
</table>

Definitions:
Period = 1 (7 - 20 October)
2 (21 October - 3 November)
3 (4 - 24 November)
Number = Number of immature and adult male mallards harvested in Brooking, Kingsbury, and Lake counties.
Figure 1. Comparison of male mallard age ratios by time period from data derived from this study and the U.S. Fish and Wildlife Service’s Parts Collection Survey, 1995.

Figure 2. Comparison of male mallard age ratios for South Dakota and the Central Flyway, 1961–95.
ratios and the number of broods/indicated pairs from ground surveys as indices of recruitment. We do not believe the variation in recruitment determined from age ratios results from PCS techniques (i.e., the ability of individual participants to correctly sex and age wings). Hopper and Funk (1970) determined the classification rate (i.e., aging) of mallard wings by Wing-bee participants to be 84.2% to 90.3% during 1966 and 1967, respectively. Differences in accuracy were attributed to a participant’s experience with wing techniques. Because our techniques for aging mallards were similar to those used by the USFWS, error in aging the male mallards in our sample was assumed to be similar to that of the PCS.

Male mallard age ratios obtained from hunters in the 3 county region generally followed age ratios obtained from the PCS (Fig. 1). Information regarding hunting effort by period and the number of total hunters participating in this study were not obtained. However, hunter effort throughout the season may have a major influence on harvest age ratios (March and Hunt, 1978). If hunter effort is concentrated during the early period one would expect a larger proportion of immatures (i.e., local or hatch-year males) to be harvested (at least in the production states) as opposed to the late period when one would expect the opposite to be true. Hunter effort for our study was assumed to be similar to hunters randomly selected to participate in the PCS.

During the last 3 years, considered as “good” production years, mallard harvest age ratios (both sexes) for the Central Flyway have increased only slightly (i.e., 1993 = 0.66, 1994 = 0.90, 1995 = 0.88) (Sharp, 1995). However, South Dakota (Fig. 2) and North Dakota (i.e., production states) have age ratios at or exceeding 1.00, whereas the southern tier states (i.e., wintering states) of Oklahoma, Texas, and New Mexico generally fall well below this mark. The USFWS weights the age ratios in a manner that takes into account the larg-

Figure 3. Ambient temperature and wind chill index by period; early (7–20 October), mid (21 October–3 November), and late (4–24 November).
er proportion of hunters contributing parts from certain states, i.e., Texas (1995-
96 = 1,062 mallard wings). In most years, Texas is 1 of the top states con-
tributing parts to the Wing-bee which depresses the overall Central Flyway mal-
lard age ratios (i.e., below 1.00). The Central Flyway states of North Dakota,
South Dakota, and eastern Montana lie within the Prairie Pothole Region (PPR),
generally considered to be the “duck factory” of North America (Smith et al.,
1964). However, mallard age ratios in the Central Flyway are generally the
lowest of all 4 Flyways (Sharp, 1995). Waterfowl biologists and researchers
alike do not fully understand the discrepancy between production estimates
and harvest age ratios.

Differences between production estimates and harvest age ratios may like-
ly be a result of an individual bird’s physical condition (Kendeigh et al., 1977).
The physical condition of a bird influences its habitat use (Nichols et al., 1983),
dominance rank and pair status (Jorde, 1981; Jorde et al., 1983), flocking be-
havior (Bain, 1980; Hepp et al., 1986), and its mobility and migration tenden-
cies (Hepp et al., 1986). Individuals in poor condition are more likely to uti-
itize habitats other than “preferred” increasing their vulnerability to harvest
(Bain, 1980). Birds in poor condition are less dominant and may not be paired.
Subordinate birds, which in this case are immature male mallards in poor con-
dition, are forced to use habitats in which food availability and quality is low
(Rabenberg, 1982) and thermoregulatory costs are high (Jorde et al., 1984).

Results from our study indicate that using harvest age ratios obtained dur-
ing the early period (i.e., the first 2 - 3 weeks of season) from the northern pro-
duction states may provide a more accurate estimate of recruitment. In our
study, age ratios for male mallards may have declined during mid and late sea-
son periods due to differential costs of thermoregulation for immatures and
adults associated with declining temperatures and a snowstorm that occurred
on 24 October, decreasing the number of immature male mallards available to
be harvested (Figs. 1 and 3). Birds in poor condition may be more mobile and
have more to gain (i.e., higher benefit:cost ratio) from migrating than birds in
good condition (i.e., adult males). This mobility and migration tendency in-
creases the likelihood of immature male mallards contacting hunters (Olson,
1965; Hepp et al., 1986). Body weights of immature male mallards are less
than adults (Owen and Cook, 1977) and thus, basal metabolic rate per gram of
body mass would be greater for immatures. Using body weights from Owen
and Cook (1977) and formulae from Kendeigh et al., (1977) we calculated a 3%
increase in basal metabolic rate per gram of body mass for immature versus
adult male mallards. Thus, the energetic costs of remaining in South Dakota
during mid to late season when temperatures are low would be energetically
greater for immatures. Because of the adult male mallard’s larger body size
and pair status (Jorde, 1981; Paulus, 1983) immature males may be relegated
to the edges of flocks increasing their vulnerability to predation (Powell, 1974;
Kenward, 1978) as well as increasing their thermoregulatory costs (Jorde et al.,
1984). Consequently, energetic costs of immature male mallards remaining in
South Dakota may actually be higher than our calculated 3%.
ACKNOWLEDGMENTS

We would like to thank the many individuals who donated wings. We would like to thank P. Padding and B. H. Powell both from the U.S. Fish and Wildlife Service’s Office of Migratory Bird Management, Laurel, Maryland for providing 1995-96 Wing-bee data as well as E. Martin for providing assistance with the literature review. Reviews of earlier drafts of this manuscript were done by R. Johnson, S. Vaa and K. Higgins. This project was supported by South Dakota State University and the South Dakota Cooperative Fish and Wildlife Research Unit in cooperation with the U.S. Fish and Wildlife Service, South Dakota Department of Game, Fish and Parks, and the Wildlife Management Institute.

LITERATURE CITED


