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Use of Nape Tags for Marking Offspring of Precocial Waterbirds

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Abstract.—Individualized markers that allow organisms to be identified without recapture are invaluable for studies of survival, movement, and behavior. Nape tags consisting of brass safety pins with unique combinations of two or three colored plastic beads were used to mark 5,868 American Coot (Fulica americana) chicks and 331 Ruddy Duck (Oxyura jamaicensis), 157 King Eider (Somateria spectabilis) and 664 White-winged Scoter (Melanitta fusca deglandi) ducklings. These markers allowed for documentation of parent-offspring interactions, post-hatching survival, brood movements and brood-mixing behaviors. Nape tags were inexpensive, easy to make, easy to observe with binoculars or spotting scopes and provided over 100 two-bead or 1,000 three-bead color combinations for individual identification. For coots, there was no evidence of color biases affecting parental care or offspring survival, although some colors (white, yellow) were easier to detect than others (brown). The only observed problem was marker loss, with tag loss rates reaching 20% near fledging age. Nape tags worked effectively on coots and ducklings and may be useful for other precocial waterbirds. Received 4 February 2011, accepted 3 May 2011.

Key words.—American Coot, color marking, King Eider, nape tag, resighting, retention, Ruddy Duck, survival, White-winged Scoter.

Monitoring post-hatching survival of precocial birds can be difficult due to mobility and secretive behavior of offspring, combined with a lack of suitable marking methods to allow for individual identification. Although hatchling shorebirds can often be marked using adult-sized leg bands (Sharpe et al. 2009), this option is not suitable for young waterfowl (Anseriformes) or rails (Rallidae). Previous methods of marking precocial waterbirds have included colored dyeing plumage either before or after hatch (Evans 1951; Eadie and Lyon 1998), web tagging (Alliston 1975), web clipping (Eichhorst 1986), plasticine-filled leg bands (Blums et al. 1994), colored nasal-tags (Sugden and Poston 1968), and miniature radio transmitters (Mauser and Jarvis 1991). Color dyeing has limited utility because of fading colors, minimal color combinations, and risk of embryo mortality if done in the egg (Evans 1951). However, in species with white color patches (e.g. Bucephala ducklings), color dyes can be effective for brood-level recognition (Eadie and Lyon 1998). Although web tags, web clipping, and plasticine-filled leg bands can provide useful data if offspring are subsequently recaptured or recovered (Blums et al. 1994), they do not allow individuals to be identified from a distance, limiting their usefulness for mark-resighting studies. Nasal markers are widely used for many species of waterfowl, but ducklings cannot be marked reliably until they are approximately 30 days old (Anderson et al. 2001). Radio transmitters with subcutaneous anchors have been used on day-old Mallard (Anas platyrhynchos) ducklings with no apparent effects (Mauser and Jarvis 1991); however, other investigators have found detrimental ef-
fects on duckling survival (Amundson and Arnold 2010b) and such markers are often prohibitively expensive.

Although nape tags were developed more than 50 years ago (Gullion 1951; Foley 1956), they have been used infrequently. Gullion (1951) found that nape tags had a retention span of up to three months on American Coots (Fulica americana), but the nickel-plated brass safety pins he used for attachment caused an acute tissue reaction. Foley (1956) found that 70% of Mallard ducklings retained nape tags from hatch until fledging. Kehoe and Mawhinney (1999) evaluated several markers on domestic Mallard ducklings, including nape tags; however, only nasal discs were recommended as a suitable marking method based on 100% retention to eight weeks of age. However, in all these examples nape tags consisted of large (2 × 3 cm, 2.5 × 10 cm) plastic or vinyl flags attached to stainless steel safety pins.

Lyons (1993) developed small nape tags consisting of size 00 brass safety pins with colored seed beads threaded onto the back of the pin; however, these tags were difficult to identify at distances beyond 20 m. In this paper, we describe our experiences using two modified nape tag designs that utilized a brass safety pin with larger colored markers consisting of either Perler beads or modified shorebird color bands (Fig. 1). These markers allowed us to identify offspring at distances up to 150 m and document behavioral interactions, movements and survival.

Figure 1. Nape tag designs used on American Coot and Ruddy Duck hatchlings (left; pin size 00 with two plastic Perler beads) and on King Eider and White-winged Scoter ducklings (right; pin size 0 with three plastic color-band tabs).
RESULTS

We marked 5,868 American Coot chicks with nape tags in 1991 (N = 1,060), 1997-1999 (N = 1,611), 2004-2005 (N = 662), and 2005-2008 (N = 2,535). In 1991, the proportion of unmarked chicks increased with mean age (\( Y = 0.048 - 0.0006 \times \text{Age} + 0.00006 \times \text{Age}^2; R^2 = 0.59, P < 0.0001 \)); mean estimated tag loss was <10% for the first 40 days but exceeded 20% after 60 days (Fig. 3). Apparent survival to 40 days of age was 0.502 (SE = 0.048) for 860 coot chicks marked by the senior investigator versus 0.514 (SE = 0.042) for 197 chicks marked by an assistant, a difference that we attribute to tag loss rather than mortality. At least 27 coots marked in
1991 still had tags after 70 days, but regular observations ceased when chicks reached 60 days of age. Observed tag loss during the first 30 days of life averaged 5.9% over four years in British Columbia, but was lower in the last two years when all chicks were marked by a single investigator (Table 1). Cumulative tag loss was small relative to total mortality, especially during the last two years (Fig. 4). Losing a tag did not affect subsequent survival ($\chi^2 = 1.3$, $P = 0.26$, $N = 16$ broods). Although parents frequently tousled chicks (Shizuka and Lyon 2010), we never observed tag loss resulting from tousling. Six chicks from the British Columbia study still retained nape tags in subsequent years when they were observed as breeding adults.

The presence of red or orange tags had no effect on feeding rate ($\chi^2 = 2.2$, $P = 0.14$)

Table 1. Observed losses of nape tags from American Coot chicks during the first 30 days of life in British Columbia, 2005-2008. Numbers are total tagged chicks released at nests, total chicks observed at a later age, chicks observed with apparent tag loss, and percent tag loss.

<table>
<thead>
<tr>
<th>Year</th>
<th>Tagged</th>
<th>Observed</th>
<th>Tag loss</th>
<th>% tag loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>342</td>
<td>303</td>
<td>23</td>
<td>7.6</td>
</tr>
<tr>
<td>2006</td>
<td>928</td>
<td>683</td>
<td>63</td>
<td>9.2</td>
</tr>
<tr>
<td>2007</td>
<td>647</td>
<td>499</td>
<td>24</td>
<td>4.8</td>
</tr>
<tr>
<td>2008</td>
<td>618</td>
<td>527</td>
<td>9</td>
<td>1.7</td>
</tr>
<tr>
<td>Totals</td>
<td>2,535</td>
<td>2,012</td>
<td>119</td>
<td>5.9</td>
</tr>
</tbody>
</table>
or tousling rate of coot chicks in British Columbia ($\chi^2 = 0.01, P = 0.94, N = 63$ broods). Survival declined significantly with increasing hatching order ($\chi^2 = 16.0, P < 0.0001$), but was not affected by the presence of red or orange tags ($\chi^2 = 1.0, P = 0.33$). In 1991, survival of coot chicks was not influenced by any of the ten tag colors that were used ($Z \leq 1.22, P \geq 0.022$ for all colors), and our analysis had 85% power to detect survival differences of 0.042-0.049 at early ages (0-20 days of age) and 0.014-0.020 at later ages (20-40 days of age). However, detection probabilities were higher for chicks marked with white or yellow and lower for chicks marked with brown beads (Fig. 5), and a model recognizing these differences in detection probabilities had an 11.48 reduction in AIC$_c$ versus an otherwise identical model that treated all colors equally.

On three occasions in 1991 and two occasions in 2004-2005, coot chicks were observed with their lower bill caught in the safety pin, but all five chicks were observed later and had freed their bills. No deleterious effects of markers were observed for 56 nape-marked coots kept in captivity for three years.

We marked 331 Ruddy Ducks, 157 King Eiders, and 664 White-winged Scoters using uniquely colored nape tags. Other than scar tissue following tag loss, no effects of nape tags were observed on ducklings. In four different contrasts, nape tags had no significant effect on survival of Ruddy Ducks ($\chi^2 = 1.29 - 2.12, P = 0.15 - 0.26$); moreover, this was the only covariate examined that had no effect on survival, indicating that study design and sample sizes were adequate to detect meaningful real differences in survival (Pelayo 2001). Survival of both King Eider and White-winged Scoter ducklings was extremely low ($\leq 0.10$) due to predation by gulls (Larus spp.), but there was no evidence that gulls specifically targeted marked ducklings (Traylor and Alisauskas 2006; Mehl and Alisauskas 2007). The percentage of marked White-winged Scoter ducklings did not change from < 2 d of age (46% of 385 ducklings observed) to ~28 d after hatch (39% of 72 ducklings observed), suggesting minimal effect of markers on survival and little potential for tag loss ($\chi^2 = 1.3, P = 0.25$). However, two 28-d-old scoter ducklings were sighted with plasticine-filled leg bands only, indicating some nape-tag loss. White-winged Scoter ducklings retained their markers for up to 60 d, and four Ruddy Duck ducklings retained their markers for at least 43 d.

**DISCUSSION**

Nape tags provided us an effective and affordable means of marking large numbers of coots and ducklings under a variety of field conditions, and based on our experiences we suspect they would also be effective for marking hatchling loons, grebes, goslings and gallinaceous birds. Nape tags were retained long enough to meet our single-season study objectives, although some loss of information occurred in coot broods when two or more chicks per brood lost markers. In two of our studies we observed lower rates of tag loss when tags were applied by a single experienced observer, indicating the importance of training and experience. To obtain unbiased estimates of survival using nape tags, we recommend that investigators concurrently assess rates of marker loss.

We observed no concerns related to animal welfare. Chicks typically exhibited little or no reaction to being marked, and marking appeared to cause less discomfort than other commonly-used marking methods that we have used including web-clipping (Eichhorst 1986) and web-tagging (Alliston 1975).
A few coot chicks got their bills caught in their markers, but managed to free themselves later; they may have been marked too low on the neck. We were concerned about potential impacts of marker colors with coot chicks given their colorful ornamentation and previous demonstration of parental preferences for such ornamentation (Lyon et al. 1994); however, we found no difference in rates of feeding, tousling, or survival among coot chicks marked with different color combinations.

Bead colors that offered the best visibility under varying light conditions included yellow and white, whereas brown beads had lower visibility. Visibility was only assessed on coot chicks, but ducklings had dark natal plumages and we expect similar results. Our studies needed enough color combinations to uniquely identify up to 130 different chicks per wetland, which required a minimum of eleven different colors using one or two bead combinations. For some of our studies, rapid identification of individual chicks was important (Lyon et al. 1994; Shizuka and Lyon 2010) and, in such cases, the vibrant florescent colors of some Perler beads (orange, pink and green) were especially helpful. Future investigators might consider using corrosion-resistant stainless steel pins, which were not readily available when we began our studies. We also suspect that there is little benefit from using ethanol or topical antibiotics on insertion sites, and recommend that future investigators discuss this issue with their animal care committees.

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LITERATURE CITED


