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Comparison of the egg flotation and egg candling techniques for estimating incubation day of Canada Goose nests

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ABSTRACT. Both egg flotation and egg candling have been used to estimate incubation day (often termed nest age) in nesting birds, but little is known about the relative accuracy of these two techniques. We used both egg flotation and egg candling to estimate incubation day for Canada Geese (*Branta canadensis interior*) nesting near Cape Churchill, Manitoba, from 2000 to 2007. We modeled variation in the difference between estimates of incubation day using each technique as a function of true incubation day, as well as, variation in error rates with each technique as a function of the true incubation day. We also evaluated the effect of error in the estimated incubation day on estimates of daily survival rate (DSR) and nest success using simulations. The mean difference between concurrent estimates of incubation day based on egg flotation minus egg candling at the same nest was 0.85 ± 0.06 (SE) days. The positive difference in favor of egg flotation and the magnitude of the difference in estimates of incubation day did not vary as a function of true incubation day. Overall, both egg flotation and egg candling overestimated incubation day early in incubation and underestimated incubation day later in incubation. The average difference between true hatch date and estimated hatch date did not differ from zero ($\bar{x} = 0.35 \pm 0.25$ days) for egg flotation, but egg candling overestimated true hatch date by about 1 d (true – estimated; $\bar{x} = -0.94 \pm 0.25$ days). Our simulations suggested that error associated with estimating the incubation day of nests and subsequently exposure days using either egg candling or egg flotation would have minimal effects on estimates of DSR and nest success. Although egg flotation was slightly less biased, both methods provided comparable and accurate estimates of incubation day and subsequent estimates of hatch date and nest success throughout the entire incubation period.

SINOPSIS. **Una comparación de la flotación de huevos y el uso del mirar a trasluz para la estimación del día de incubación en nidos de *Branta canadensis interior***

El uso de la flotación de huevos y el uso del mirar a trasluz han sido usadas para estimar el día de incubación (algunas veces llamado la edad del nido) pero poco se conoce sobre la precisión relativa de estos dos métodos. Utilizamos la flotación de huevos y también el mirar a trasluz para estimar el día de incubación para *Branta canadensis interior* cuales nidificaron cerca del Cabo de Churchill, Manitoba, entre el 2000 y el 2007. Modelamos la variación en la diferencia entre las estimaciones del día de incubación usando cada método como una función del día de incubación verdadero así como la variación en las tasas de error con cada método como una función del día de incubación verdadero. También evaluamos el efecto del error en la estimación del día de incubación sobre las estimaciones de la tasa de sobrevivencia diaria (TSD) y éxito del nido mediante el uso de simulaciones. El promedio de la diferencia entre estimaciones concurrentes del día de incubación basadas en la flotación del huevo menos la del mirar a trasluz en el mismo nido fue de 0.85 ± 0.06 (SE) días. La diferencia positiva a favor de la flotación de los huevos y la magnitud de la diferencia en las estimaciones del día de incubación no variaron como una función del día de incubación verdadero. En general, los dos métodos sobreestimaron el día de incubación durante las fases tempranas de la incubación y lo subestimaron mas tarde durante la incubación. El promedio de la diferencia entre el día de eclosión verdadero y el día de eclosión estimado no varia de cero ($\bar{x} = 0.35 \pm 0.25$ días) para el método de flotación de huevos pero el uso del mirar a trasluz sobreestimo el día de eclosión verdadero por aproximadamente un día (verdadero – estimado; $\bar{x} = -0.94 \pm 0.25$ días). Nuestras simulaciones sugieren que el error asociado con la estimación del día de incubación de nidos y subsecuentemente los días expuestos usando cualquiera de los dos métodos tendría un efecto mínimo sobre las estimaciones del TSD y el éxito del nido. Aunque la flotación de huevos tuvo un poco menos de errores, los dos métodos proveen estimaciones comparables y precisas del día de incubación y de las subsecuentes estimaciones del día de eclosión y éxito de nido a través de todo el periodo de incubación.

Key words: *Branta canadensis*, Canada Goose, egg candling, egg flotation, incubation day

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Accurately determining the incubation day of nests (i.e., the number of days since incubation was initiated and frequently, although misleadingly, referred to as nest age) is often necessary to estimate vital rates, such as the probability of a nest surviving an incubation interval. Primary methods used to estimate nest survival rely on exposure days, or the number of days a nest is under observation while also being at risk to fail (Mayfield 1975, Dinsmore et al. 2002). When nests are not visited daily and hatch date cannot be observed directly, the number of exposure days for nests where eggs hatch must be estimated based on the incubation day of a nest when discovered and the average number of days in the incubation period. Reliable techniques for determining incubation day are therefore necessary for estimating exposure days and subsequently estimating demographic parameters such as daily survival rates of nests, reproductive success, and nest parasitism rates. Accurate estimates of incubation day can produce accurate predictions of hatch dates needed to plan field activities, such as capturing adults at their nests just prior to hatching to attach radio transmitters (Nack and Andersen 2004) or measure body condition (Moser and Rusch 1988), or tagging precocial young prior to their leaving the nest (Walter 1996).

Two ways to estimate incubation day are egg flotation (Westerkov 1950, Walter and Rusch 1997, Mabee et al. 2006) and egg candling (Westerkov 1950, Weller 1956, Klett et al. 1986, Young 1988). However, little is known about their relative accuracy (i.e., bias and precision; but see Westerkov 1950, Weller 1956), and how errors in estimates derived using these methods might influence estimates of daily survival rate (DSR) and nest success. Because it may be more convenient to use one or the other of these methods, depending on local circumstances (e.g., availability of water to float eggs), knowing the relative accuracy of egg candling and egg flotation would also facilitate more direct comparisons of nest survival estimates across studies.

We used both egg flotation and egg candling to estimate incubation day of Canada Goose (*Branta canadensis interior*) nests. Walter and Rusch (1997) studied the same population of geese and found that egg flotation provided accurate estimates of incubation day (or nest age), but did not assess egg candling or the effects that error in estimating incubation day would have on estimates of DSR and nest success. We evaluated both techniques. First, we assessed the relative accuracy of egg candling and egg flotation to estimate incubation day based on differences in the estimated and true hatch date. Second, we compared differences in estimates of incubation day for nests at discovery when using both egg flotation and egg candling concurrently at the same nest and evaluated changes in the directional relationship and magnitude of these differences as a function of true incubation day. Third, we assessed variation in the magnitude of the errors when using each technique as a function of the true incubation day. Finally, we conducted simulations to evaluate the effect inaccurate estimates of incubation day (based on the observed distribution of error rates for egg candling and egg flotation) and subsequently exposure days have on estimates of DSR and nest success.

METHODS

Study area. We conducted our study in Wapusk National Park (11,475 km^2) in northern Manitoba, Canada. Located within the broader Hudson Bay Lowlands ecosystem, our coastal tundra study site consisted of sedge meadows, beach ridges, coastal salt marshes, numerous small ephemeral pools, and scattered shallow permanent lakes (Didiuk and Rusch 1979, Walter 1999). The Nestor One study area (~48 km^2; 58° 34′N, 93° 11′W) near Cape Churchill, Manitoba, has been the location of Canada Goose breeding ground surveys since 1976. In 2005 and 2006, we also surveyed for goose nests at Broad River (~10 km^2; 58° 07′N, 92° 51′W), located about 60 km southeast of Nestor One along the Hudson Bay coast.

Incubation day, estimated hatch date, and nest observations. We located Canada Goose nests by systematically walking through each study area (Nestor One, 2000–2007; Broad River, 2005–2006) with multiple (4–6) observers spaced at distances of 50–250 m, depending on terrain and nest density. At each nest, we floated and candled the oldest (i.e., dirtiest) and youngest (i.e., cleanest) eggs. For egg flotation, we placed eggs in water that was deeper and wider than the length of the egg (~10 cm), and considered eggs to be in one of six stages based on the extent of floating and the angle the egg floated in water (Westerkov 1950, Walter and Rusch 1997). We estimated the incubation day at discovery as: average egg stage × 4.67 – 2.33 (Walter and Rusch 1997). This calculation assumed that each flotation stage represented one-sixth (4.67 d) of 28 total incubation days. Because we could not know the exact incubation day in each flotation stage, we also assumed that eggs were half-way through the current stage, and thus we subtracted 2.33 d (Walter and Rusch 1997). For egg candling, we used 15–20 cm vinyl candling tubes and an image from Weller (1956) to assign eggs to one of seven age categories representing approximately 4-d intervals. We considered the average age of the two candle-aged eggs to be the estimated incubation day at discovery. We estimated the hatch date for each nest by assuming all nests had 28 total incubation days (Walter 1999). We removed nonviable eggs (e.g., infertile, dead, or laid by a nest parasite) from consideration to prevent bias.

At Nestor One in 2005 and 2006, we observed nests at 4- to 6-d intervals throughout incubation and at 1- to 3-d intervals close to the estimated hatch date. To minimize disturbance, we candled or floated eggs only during the first visit, covered the eggs with down after any visit to the nest, and remained >200 m from nests during subsequent observations. We considered nests active if a female was on or near (< 2 m) the nest. If a female was not on the nest, but observed in the vicinity, we returned on a subsequent day to determine if the nest was active. If, on that visit, no goose was observed, we checked the nest to determine if it was active (warm, intact eggs), successful (eggs hatched as indicated by the presence of large shell fragments and intact membranes), abandoned (cold intact eggs), or failed (empty nest or small shell fragments; Walter 1999, Anthony et al. 2004).

Data analysis. We used data from 2000 to 2007 to examine differences between the egg flotation and egg candling estimates of incubation day (float – candle) for the same nest. A 95% confidence interval (CI) of this difference that did not overlap zero was considered significant.

Using data from Nestor One in 2005 and 2006, we evaluated the difference between the estimated hatch date based on estimates of incubation day using egg flotation or egg candling and the true hatch date. We used three categories of nests: (1) successful nests terminated prior to the estimated hatch date—an overestimate of hatch date and thus underestimate of incubation day (Fig. 1A), (2) successful nests active after the estimated hatch date—an underestimate of the hatch date and thus overestimate of incubation day (Fig. 1B), and (3) successful nests active 1 d before the estimated hatch date and terminated on the hatch date or active on the estimated hatch date and terminated 1 d

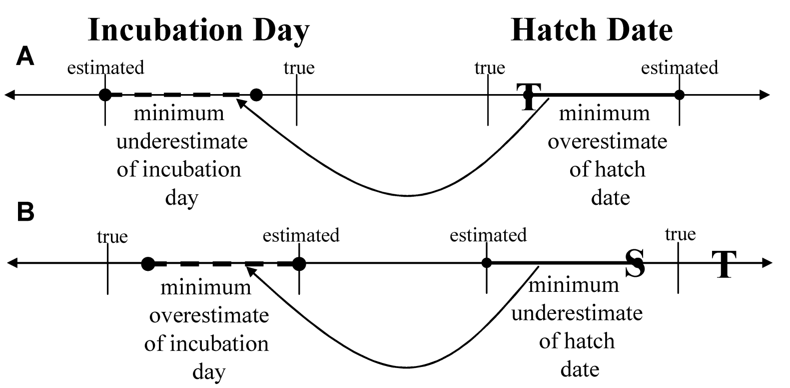

Fig. 1. Schematic representing how the minimum difference (dashed lines) between the estimated incubation day and true incubation day was directly estimated from the minimum difference (bold lines) between the estimated hatch date and true hatch date for Canada Geese when incubation day was (A) underestimated and (B) overestimated. T was the date the nest was terminated, S was the last day a nest was observed as active, and the double-arrow horizontal lines represented a time continuum in days during the incubation period. The relationship between the error in estimates of hatch date and error in estimates of incubation day are indicated by the curved single-arrow lines.

later—estimated hatch date and incubation day were considered correct for these nests. We excluded nests that failed or had unknown hatch dates from analyses.

Although we visited nests at 4- to 6-d intervals in 2005 and 2006, and more frequently (1- to 3-d intervals) at or just before the estimated hatch date, we were often unable to determine an exact hatch date. We calculated the minimum underestimate of incubation day (i.e., overestimate of hatch date) as the difference between the date of the final nest observation (nest categorized as successful) prior to the estimated hatch date (T; see Fig. 1A) and the estimated hatch date. We calculated the minimum overestimate of incubation day (i.e., underestimate of hatch date) as the difference between the date of the final nest observation as active after the estimated hatch date (S; see Fig. 1B) and the estimated hatch date. We calculated these values based on incubation day estimates from both floated and candled eggs. The distribution of the minimum underestimates and overestimates of the hatch date based on egg flotation and egg candling represented the minimum overall error in estimating incubation day for each method. This distribution incorporated values when the estimated hatch date was correct (i.e., difference = 0). We compared the distributions of error in estimates of incubation day for egg flotation and egg candling to evaluate their relative accuracy (bias and precision). We considered an estimate of incubation day biased if the 95% CI of the mean of the distribution of the differences between the estimated hatch date and the true hatch date did not overlap zero. We compared variability in the distribution of differences using the sample variance (σ) and overall accuracy of the estimates using the mean squared error (*MSE*; Williams et al. 2001).

For nests where we estimated the true hatch date based on regular observations (Nestor One, 2005–2006) and estimated incubation day using both egg flotation and egg candling, we employed linear regression to assess whether the direction (i.e., positive or negative) of relationship in the difference of the estimated incubation day at discovery (float – candle) changed based on the true incubation day of the nest, and whether the magnitude of the absolute difference in the estimated incubation day at discovery changed based on the true incubation day of the nest at discovery. We calculated the true incubation day at discovery using the true hatch date and an assumed 28-d incubation period (true incubation day at discovery = 28 – [true hatch date – date of discovery]).

Finally, we employed linear regression to model the difference in the estimated incubation day at discovery and the true incubation day at discovery (estimated – true) when using egg flotation or egg candling as a function of the true incubation day at discovery. We assessed whether the direction of error in the estimated incubation day based on either egg flotation or egg candling changed over the course of incubation. We used the Statistical Analysis System (SAS Institute 2007) and EXCEL (Microsoft © 2003) for data analyses.

Simulations. We used R v. 2.5.1 (©2007 The R foundation for Statistical Computing) to conduct Monte Carlo simulations (Manly 2001) to assess the influence that errors in estimating the incubation day, and subsequently exposure days, had on estimates of DSR and nest success (Mayfield 1975). We generated three groups (HIGH, MID, and LOW) of 100 nests, with each nest in each group randomly assigned a fate (1 = successful, 0 = failed) based on a random binomial trial with probabilities of success of 0.87 (HIGH), 0.63 (MID), and 0.19 (LOW). These probabilities represented the 2.5th, 50th, and 97.5th percentiles of the ranked values of Canada Goose nest success based on 32 yr of data at Nestor One (D. E. Andersen, unpubl. data). We randomly assigned incubation days at discovery to each nest in each group using a normal distribution with a mean ($\bar{x}$) of 9.32 and standard deviation (SD) of 3.81 that we based on incubation day at discovery data from 2006 at Nestor One. We treated randomly assigned incubation days as true incubation days, and calculated true exposure days as 28—true incubation day. We multiplied exposure days for failed nests by 0.5 to account for uncertainty about when in an interval a nest failed (Mayfield 1975, Johnson 1979).

We conducted 1000 iterations of the initial incubation day data in each group and in each iteration varied the true incubation day randomly using a normal distribution to incorporate the error in estimating incubation day when using egg candling and egg flotation. We used a normal distribution with $\bar{x} = -0.94$ and SD = 2.34, and a normal distribution with $\bar{x} = 0.35$ and SD = 2.49 to add error in estimates of incubation day based on observed distributions of errors in estimates of hatch date using egg candling and egg flotation, respectively (see Results). In each iteration, we calculated DSR (DSR = 1 − [total number failed nests / total number of exposure days]) and nest success (nest success = DSR^i; i = average total number of days in incubation = 28), and compared the simulated distribution of 1000 DSR and nest success values with the true values based on the true incubation days. Although there is likely some variation around the 28-d incubation period, such random variation would not substantially affect comparisons. We plotted the mean, and the 25th and 975th ranked values of the 1000 iterations to represent a 95% CI (percentile method; Efron and Tibshirani 1993). We considered a true DSR or nest success estimate occurring outside of the 95% CI of the simulated data with incubation day estimation error as significantly different. We calculated 95% CI for the true nest success based on Johnson (1979).

RESULTS

We estimated the incubation day of 1515 nests at Nestor One and the Broad River using both egg flotation and egg candling. The mean difference between these paired estimates (float age – candle age) was 0.85 days (SE = 0.06; 95% CI = 0.73 – 0.97).

In 2005 and 2006, we made 1239 observations of 331 nests at Nestor One. Based on the difference between the observed and estimated hatch dates using egg flotation (N = 101), we underestimated the incubation day at discovery for 25 (22.8%) nests, overestimated the incubation day at discovery for 42 (41.6%) nests, and correctly estimated the incubation day at discovery for 34 (33.6%) nests. Using egg candling (N = 89), we underestimated the incubation day at discovery for 49 (55.1%) nests, overestimated the incubation day at discovery for 19 (21.3%) nests, and correctly estimated the incubation day at discovery for 21 (23.6%) nests. The mean minimum difference between the true hatch date and the estimated hatch date (true – estimated) was 0.35 (SE = 0.25 d; Range: −9.66–9.68; N = 101) for estimates of hatch date based on egg flotation and −0.94 (SE = 0.25; Range: −8.00–6.50; N = 89) when based on egg candling. The 95% CI for the mean of true minus estimated hatch dates overlapped zero for egg flotation but not for egg candling. The variance of the difference was only slightly larger for egg flotation (σ = 6.20) than for egg candling (σ = 5.48), and overall accuracy as measured by the MSE was nearly identical; MSE = 6.37 for egg candling and MSE = 6.33 for egg flotation.

Regression analyses suggested that the sign (Fig. 2A) and magnitude (Fig. 2B) of the difference between estimated incubation day using egg flotation and egg candling did not change as a function of the true incubation day in 2005 and 2006. However, the difference between the estimated and true incubation day decreased significantly as a function of true incubation day for both egg flotation and egg candling (Fig. 3A and B). Both methods overestimated incubation day early in incubation, and underestimated incubation day late in incubation; indicated by the best-fit least-squares regression line that crossed over the x-axis at difference = 0. Based on least-squares regression, egg flotation (difference = 2.87–0.23 × true incubation day) tended to overestimate incubation day until the true incubation day was nearly 13, whereas egg candling (difference = 1.93–0.27 × true incubation day) overestimated incubation day until true incubation day 7 and on average underestimated incubation day thereafter.

Our simulations indicated a small positive bias in estimates of DSR and nest success in all groups when incubation day was estimated using egg candling (Table 1). Typically, egg candling underestimated incubation day and thus overestimated the number of exposure days, resulting in inflated estimates of DSR and nest success. In egg flotation simulations, we observed a slight underestimate of DSR and nest success in all three simulation groups (Table 1). Egg flotation tended to overestimate the incubation day, resulting in underestimation of exposure days, and subsequently deflated estimates of DSR and nest success. However, the true values of DSR and nest success were captured in the 95% CI when using either egg candling or egg flotation errors in the simulations (Table 1).

DISCUSSION

We observed little bias in the difference between the estimated hatch date based on estimates of incubation day using egg flotation and observed hatch date. Egg candling consistently

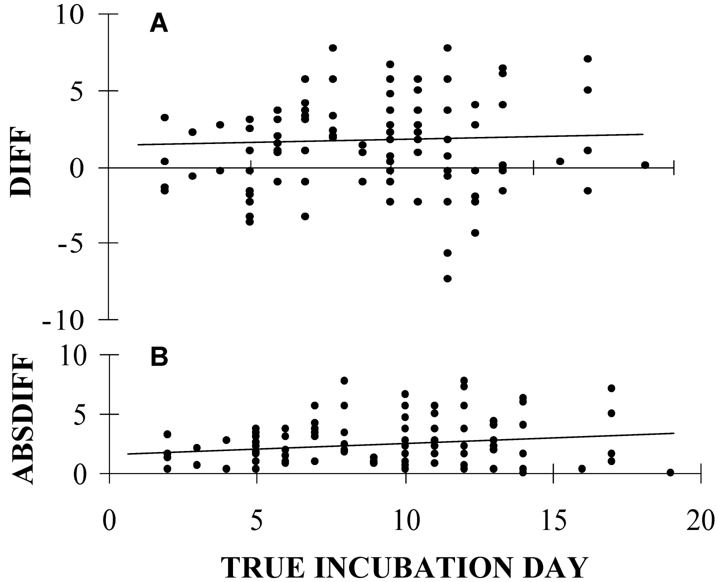

Fig. 2. True incubation day versus (A) the difference between the estimate of incubation day based on egg flotation and egg candling (DIFF; $R^2 = 0.004$, $F_{1,135} = 0.5$, $P = 0.47$), and (B) the absolute difference between the estimate of incubation day based on egg flotation and egg candling (ABS DIFF; $R^2 = 0.006$, $F_{1,135} = 0.8$, $P = 0.37$) for Canada Goose nests near Cape Churchill, Manitoba, 2005–2006.

underestimated incubation day and subsequently overestimated hatch date by about 1 d. However, the precision of estimated hatch date using egg candling was similar to that using egg flotation and the overall accuracy of each technique was nearly identical. Across all true incubation days, the difference between the estimate of incubation day based on egg flotation and the estimate of incubation day based on egg candling was consistent, suggesting that these techniques could be employed and compared at any stage of incubation with similar results. In addition, both egg flotation and egg candling overestimated the incubation day early in incubation and underestimated the incubation day later in incubation.

Our simulations suggested that egg candling error may result in small overestimates of DSR and nest success. However, in all simulations, the difference between true nest success and

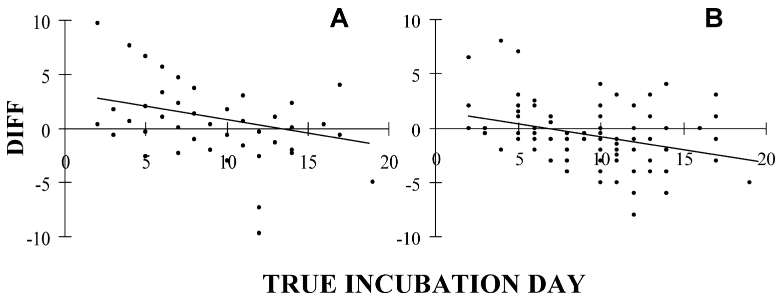

Fig. 3. True incubation day versus (A) the difference (DIFF) between the estimated incubation day using egg flotation and the true incubation day ($R^2 = 0.13$, $F_{1,135} = 16.6$, $P < 0.001$), and (B) the difference between the estimated incubation day using egg candling and the true incubation day ($R^2 = 0.11$, $F_{1,135} = 20.9$, $P < 0.001$).

Table 1. Simulation estimates of mean (95% CI) daily survival rate (DSR) and mean (95% CI) nest success when adding error to incubation day estimates based on error associated with egg flotation and egg candling for Canada Goose nests near Cape Churchill, Manitoba. True DSR and nest success were derived without incorporating error. We generated the random binomial of successful or failed nests in simulations based on LOW probability of survival (0.19), MID probability of survival (0.63), and HIGH probability of survival (0.87) based on 32 yr of annual estimates of nest success.

	Egg flotation	Egg candling	True
DSR			
LOW	0.93 (0.90–0.94)	0.93 (0.91–0.94)	0.93 (0.91–0.94)
MID	0.97 (0.96–0.98)	0.97 (0.97–0.98)	0.97 (0.96–0.98)
HIGH	0.99 (0.98–0.99)	0.99 (0.98–0.99)	0.99 (0.98–1.00)
Nest success			
LOW	0.12 (0.05–0.19)	0.14 (0.07–0.20)	0.13 (0.08–0.20)
MID	0.48 (0.36–0.57)	0.51 (0.41–0.58)	0.48 (0.38–0.61)
HIGH	0.78 (0.71–0.82)	0.79 (0.74–0.83)	0.78 (0.69–0.89)

the mean of the simulated distribution of nest success based on egg candling data was less than five percentage points. Egg flotation resulted in a small underestimate of nest success, but the magnitude of the underestimate was consistently less than the magnitude of the overestimate based on egg candling. The distribution of simulated estimates of nest success based on egg candling data had only a slightly lower variance than the distribution of simulated estimates of nest success based on egg flotation data. Therefore, despite statistically significant results suggesting egg candling was biased, the biological consequences of this bias, as measured by DSR and nest success, appeared to be small. However, egg flotation may provide a more conservative and slightly less biased estimate of nest success than egg candling.

The distribution of the minimum difference between the estimated and true hatch date of nests based on egg flotation observed in our study (SD $=$ 2.49; Range: -9.66, 9.68) was nearly identical to that reported by Walter and Rusch (1997), who evaluated egg flotation to estimate incubation day at Nestor One between 1976 and 1995 (SD $=$ 2.94, Range: -9.00, 9.00). Their results, like ours, also suggested that egg flotation tended to generate a slight overestimate of incubation day, and thus an underestimate of hatch date. However, our simulations suggested that the subsequent underestimate of exposure days introduced only a small negative bias in estimates of DSR and nest success.

We also found that egg flotation overestimated the incubation day early in incubation ($<$13 d) and underestimated incubation day later in incubation. Walter and Rusch (1997) reported similar results. We found that egg candling followed a similar trend, but only overestimated incubation day until 7 d and on average underestimated incubation day thereafter. These trends could have implications for comparisons among years of a single study or among studies if there is large variation in the range of incubation days considered between years or studies (e.g., some years may have systematic overestimates of incubation day if nests were discovered early in incubation, but underestimates if discovered late in incubation). This should be considered when designing field studies and analyzing nest data. Our results also suggest that egg candling may be less biased than egg flotation early in incubation ($<$10 d), whereas egg flotation was less biased between 10 and 20 d. Therefore, if the approximate start of incubation was known, there may be an advantage to using one technique over the other depending on the incubation day.

Our data and those used in Walter and Rusch (1997) were collected by multiple observers. That results of these two studies are nearly identical suggests that egg flotation is a robust estimator of incubation day for Canada Geese despite the potential for large individual heterogeneity in observer abilities. That errors associated with egg candling were similar to errors associated with egg flotation was unexpected. Egg flotation categories are unambiguous and discrete, whereas visually comparing egg contents to a graphic representation of a continuum of egg development by candling is more subjective. However, because egg flotation was restricted to fewer categories representing a broader range of ages, observers may have been able to more precisely estimate incubation day via candling because incubation day could be estimated within a smaller range of days. In addition, because both methods were used by the same observer at the same nests, observers may have used results of one method to inform the other. We were unable to assess this possibility, but, based on discussions with other biologists and personal experience, egg flotation was more likely to influence the egg candling incubation-day estimate than vice versa. If egg flotation only influenced egg candling estimates, we would expect that, overall, information derived from egg flotation increased the egg candling estimates of incubation day. This occurred because egg flotation tended to overestimate incubation day, and egg candling underestimated incubation day. Therefore, estimates of incubation day using egg candling may have a larger negative bias than estimated in our analyses.

The ability to accurately determine the incubation day of nests is often important in studies of avian nesting ecology. In our study, both egg flotation and egg candling produced relatively unbiased estimates of incubation day, with similar variability and accuracy. Depending on research or management objectives, a slightly conservative estimate (i.e., underestimate) of nest success from egg flotation might be more desirable than an overestimate of nest success based on egg candling. Further, if research objectives require observing the nest just prior to hatch, egg flotation provides a more conservative approach. Given that the estimated hatch date would, on average, be underestimated, more regular nest observations just prior to the estimated hatch based on egg flotation would be more likely to capture the true hatch date. In addition, the timing of surveys during the incubation period should be considered when selecting a technique to estimate incubation day because egg candling may be less biased early in incubation and egg flotation may be less biased later in incubation. Overall, both egg flotation and egg candling appear to accurately estimate the incubation day of Canada Goose nests at discovery.

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