Method for Transporting Incubated Giant Canada Goose Eggs

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Abstract: We transported 2,220 giant Canada goose (*Branta canadensis maxima*) eggs by small aircraft from Cornwall, Ontario, Canada, to El Reno, Oklahoma, from 1986 through 1989. Stages of incubation ranged from 3 to 27 days. Eggs were covered with goose down and shipped in domestic turkey egg transport containers made of corrugated cardboard. Two techniques were used to maintain temperatures between 24 and 38 C. In 1986 and 1989, no attempt was made to heat the eggs other than from the aircraft cabin temperature. In 1987 and 1988, we used supplemental heat in an attempt to maintain egg temperature around 38 C. Because hatching success was greater for eggs that did not receive supplemental heat ($P < 0.05$), we do not recommend heating of egg containers during transit.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 44:351–355

The Oklahoma Department of Wildlife Conservation (ODWC) initiated the Gosling/Cooperator Project in 1986 to produce stock for propagation. Giant Canada goose eggs from Cornwall, Ontario, Canada, were hatched at the ODWC's El Reno Game Farm. Ten-day-old goslings were distributed to selected cooperators for rearing and release on small impoundments when fledged. This project is an expansion of Oklahoma's Giant Canada Goose Establishment Program, which has translocated over 10,200 sub-adult, adult, and juvenile geese to Oklahoma from northern states and Canada since 1980. The Gosling/Cooperator Project was conducted through agreements with the Oklahoma Department of Wildlife Conservation, the

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Canadian Wildlife Service, and the Ontario, Canada, Ministry of Natural Resources (OMNR). The objectives were: (1) to reduce the expansion rate of the summer population of Canada geese within the Cornwall District in Ontario along the St. Lawrence River, and (2) to produce stock to enhance Oklahoma's Giant Canada Goose Establishment Program.

Restoration of waterfowl and other precocial birds can be enhanced by collecting fertile eggs from brooding birds and transplanting them to surrogate birds or hatcheries. Incubated and unincubated whooping crane (*Grus americana*) and sandhill crane (*G. canadensis*) eggs have been successfully transported to and from the Patuxent wildlife Research Center, Laurel, Maryland, for research and propagation (Erickson 1981). Incubated trumpeter swan (*Cygnus buccinator*) eggs have been transported from Alaska to Forest Lake, Minnesota, for restoration projects (Henderson 1988). Incubated giant Canada goose and gadwall (*Anas strepera*) eggs have been collected in Ontario and Quebec, Canada, and transported to Nova Scotia, Canada, with success (B. Vissers, Nova Scotia Dep. Lands and For., pers. commun., 1989). We report on the results of collecting and transporting giant Canada goose eggs from Cornwall, Ontario, Canada, to El Reno, Oklahoma, from 1986 to 1989.

We acknowledge the help and cooperation of R. Brothers, G. Keller, and other ODWC and OMNR personnel. We thank E. Johnston for the use of his incubator during egg collection. This project was supported by Oklahoma's Federal Aid in Wildlife Restoration Project W–143-D and the Oklahoma Waterfowl Hunting Stamp. D. Leslie, Jr., H. Namminga, B. Stiver, S. Aldrich, S. Forsythe, E. McGregor, and M. Eckersley provided valuable comments on the manuscript.

Methods

We collected 2,220 giant Canada goose eggs in April 1986–89 (1986, N = 604; 1987, N = 442; 1988, N = 555; 1989, N = 619). The eggs ranged from 3 to 27 days into incubation, but the majority had been incubated >17 days.

Eggs were collected from the islands and north shore of the St. Lawrence River, Canada. One egg was left in each nest to discourage renesting. Eggs were placed in styrofoam coolers and down taken from the nest was arranged around each egg to prevent egg cooling and breakage. Egg gathering was conducted in the morning and afternoon, and collected eggs were taken to an incubator both at mid-day and late in the afternoon. Incubator temperature was set at 37.5 C. We collected eggs within a 2-day period each year. After the last eggs were collected, all were artificially incubated overnight for another 12–14 hours before they were transported to Oklahoma.

Eggs were packed in domestic turkey egg transport containers made of corrugated cardboard (Anderson Box Company, 425 Old Wire Road, Springdale, AR 72764) for shipment. The containers measured 29.5 × 33 × 59.5 cm. Four 2.5-cm diameter holes were cut out randomly on each long-side of the container for ventilation. Three levels of egg trays were packed with 20 eggs per level; 60 eggs could be placed in each container. Each level of eggs was covered with down that had been stored at 24 C. Eggs were placed in the egg tray with the most pointed end facing down and the air cell up. Shipment techniques followed those recommended by the Nova Scotia Department of Lands and Forests (E. Pace, Shubenacadie Wildlife Park, pers. commun., 1979).

The egg transport containers were placed in a preheated (approximately 24 C) vehicle for transport to the airport. From 1986 to 1988, a 6-passenger twin engine aircraft (Beechcraft Baron BE58) with rear cargo doors was used to transport eggs to Oklahoma. In 1989 an 8-passenger twin engine aircraft (Piper Navajo Chieftain PA–31–350) with rear cargo doors was used. The back seats were removed and the remaining seating arrangement allowed for the pilot and up to 4 passengers. The trip from Ontario to Oklahoma averaged 13 hours, which included U.S. Customs inspection and fuel stops.

We used 2 techniques in an effort to maintain ambient temperature between 24 and 38 C around egg containers in the aircraft. In 1987 and 1988, using a technique referred to as "supplemental heat," we separated egg containers from the pilot and passengers with cardboard partitioning in the aircraft cabin and ran a heat duct to this area. The ambient temperatures in the partitioned area of the cabin was difficult to control and measure. Based on the elevated temperature of some eggs when unpacking, we believe that some portions of the partitioned area reached >40 C. In 1986 and 1989, we did not partition the aircraft cabin or provide supplemental heat to the containers, and the ambient temperatures in the cabin ranged from 24 to 29 C but varied depending on the location of heating system vents. Egg containers were covered with standard moving blankets when the aircraft doors were opened during fuel and inspection stops. Space limitations in the aircraft prohibited monitoring temperatures within the egg containers.

Chi-square analysis was used to determine hatching success of fertile eggs between techniques.

Results and Discussion

In 1987 and 1988, 327 of 364 (90%) and 368 of 461 (80%) fertile eggs hatched, respectively (Table 1). Egg fertility was determined by candling each egg after 10 days in the incubator (Grow 1972).

We believe that lack of space in the partitioned area of the cabin reduced circulation and concentrated the supplemental heat around some of the containers, which increased embryo mortality and reduced hatching success.

In 1986 and 1989, 511 of 523 (98%) and 496 of 523 (95%) fertile eggs hatched, respectively (Table 1). Although the ambient temperature around egg containers using the open cabin technique was lower than when using the supplemental heat technique, the open cabin technique had higher hatching success ($\chi^2 = 81.2$, $P < 0.05$). This was apparently due to thermal stratification from reduced circulation in the partitioned cabin.

Mean hatching success of fertile eggs during 4 years of transporting incubated giant Canada goose eggs from Ontario to Oklahoma was 91% (1,702 of 1,871,

Table 1. Hatching success of fertile Canada goose eggs transported from Cornwall, Ontario, Canada, to El Reno, Oklahoma, 1986–89.

Year	*N* eggs transported	*N* fertile eggs	Success of fertile eggs *N*	Success of fertile eggs %
1986	604	523	511	98
1987	442	364	327	90
1988	555	461	368	80
1989	619	523	496	95
Total	2,220	1,871	1,702	
Mean	555	468	426	91

Table 1). Our overall level of hatching success was higher than the 84.5% reported for a captive flock of giant Canada goose eggs at Northern Prairie Wildlife Research Center during 1972–1980 (Lee et al. 1984). Hatching success resulting from the open cabin technique was similar to that reported by Cooper (1978) for a free flying, migratory population of giant Canada geese at Marshy Point, Manitoba, Canada (97% for first nests). Brakhage (1965) reported a lower hatching success of 78% for the Trimble, Missouri, giant Canada goose flock. An average hatching success of 90% for giant Canada geese that had been re-established in southeastern Michigan was reported by Kaminski et al. (1979). The Nova Scotia Department of Lands and Forests transported 355 giant Canada goose eggs from Ontario to Shubenacadie, Canada, by aircraft in 1984 and reported a hatching success of 90% (B. Vissers, Nova Scotia Dep. Lands and For., pers. commun., 1989).

Giant Canada goose eggs from incubated nests appear to be tolerant of reduced temperatures for several hours. Erickson (1981) reported that eggs several days into the incubation period of some species are capable of generating sufficient warmth to maintain acceptable temperatures in insulated containers.

We recommend the open cabin technique used in 1986 and 1989 to reduce problems associated with high temperatures due apparently to thermal stratification from poor circulation of supplemental heat. The high success of this method, given the relative lack of control over the temperatures, should make it attractive to managers and researchers when transporting large numbers of eggs. Our method of transporting incubated Canada goose eggs may be successful when applied to eggs of other avian species.

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