Observations on Nesting Sharp-shinned Hawks in Greenville County, South Carolina

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The Sharp-shinned Hawk (*Accipiter striatus*) is currently classified in South Carolina as a rare summer breeder or vagrant (Post and Gauthreaux 1989). Breeding was first documented in the state on 14 May 1937 in Beaufort County by DeCamps (1944). Since 1937, spring and summer sightings of this bird have persisted throughout the state, but few other breeding reports have been documented. Pitts saw individual birds at Caesars Head State Park, Greenville County, South Carolina on 28 June 1987 and 12 June 1988.

In 1991 an active Sharp-shinned Hawk nest was reported in Williamsburg County, S. C. on 9 May (S. Rogers, pers. comm.). Fledged young out of the nest were later reported on 11 July near Kershaw, Lancaster County (L. Glover, pers. comm.). On 27 April 1991, Pitts heard and saw a calling male Sharp-shinned Hawk at Caesars Head State Park and he saw adults building a nest at the same location on 28 April. This report documents observations of that nest by Mitchell and Pitts during the 1991 breeding season.

The nest was easily observed from the ground. Using 10 x 40 binoculars and a spotting telescope, a total of 71 hours were spent observing the nest, with nest building observed for 12 hours; incubation for 37 hours; and brooding 25 hours.

NEST SITE

The nest site was located at Caesars Head State Park, Greenville County, S. C. at an elevation of about 924 m. This was about 2.9 km W of the park headquarters and 640 m from the South Carolina/North Carolina border.

The nest was placed about 14 m high on a three prong fork of a large White Pine (*Pinus strobus*). It was situated against the main trunk and substantially built of twigs and small branches. The nest tree was located about 30 m from a small grove of large White Pines and 21 m from a dirt road. It was also located 36 m from a small clearing of the forest that was 12 m by 18 m. The nest was large and bulky. Materials used for the inner lining of the nest are not known.

Bent (1937) stated that in southeastern Massachusetts, the standard nesting site is usually located in a dense grove of medium-sized White Pines (17 of 18 records in White Pine stands). W.J. Brown (cited in Bent 1937) stated that many Montreal nests are found at the edge of any clearing or opening in the middle of the woods. The South Carolina nest described here was found in a similar situation.

The nesting area was heavily wooded with a mixed stand of hardwoods and pines. The dominant canopy trees included White Pine, Tulip Tree (*Liriodendron tulipifera*), Red Maple (*Acer rubrum*), Black Locust (*Robinia pseudo-acacia*), Pitch Pine (*Pinus rigida*), Virginia Pine (*P. virginiana*), Scarlet Oak (*Quercus coccinea*), Rock Chestnut Oak (*Q. prinus*), White Oak (*Q. alba*) and Black Gum (*Nyssa sylvatica*).

The understory was fairly dense and consisted mostly of Huckleberry (*Gaylussacia ursina*), Mountain Laurel (*Kalmia latifolia*), White Pine, Holly (*Ilex opaca*), blueberry (*Vaccinium* sp.), Red Maple, Sourwood (*Oxydendrum arboreum*), Flowering Dogwood (*Cornus florida*), Umbrella magnolia (*Magnolia fraseri*), Sassafras (*Sassafras albidum*), hickory (*Carya* sp.), and Chinquapin (*Castanea pumila*).

COURTSHIP AND NEST BUILDING

The adult male, distinguished from the female by his smaller size, was present in the nesting area during the nest building period and was quite vocal. His most frequent call was a shrill, falcon-like "kek-kek-kek-kek". This call was heard whenever the nesting area was approached. This, or a similar call, was also given by the male when the pair interacted during nest building activities. The female also called, but less frequently. Her call was similar to the male's but was less shrill and more suppressed. Pitts heard one bird give a series of "squealing" calls on 5 May.

The male called most frequently from the understory of the nearby pine grove at a place that later became the "feeding area". When the male was approached by a human observer, he normally flew a short distance away and perched facing the intruder while shaking his tail. Both Mitchell and Pitts saw this tail-shaking behavior.

Copulation was observed by Heyward Douglass and Pitts about 40 m from the nest tree on the morning of 4 May. The female flew directly to the male, and he quickly mounted her. Mating lasted for about 10 sec and was accompanied by much wing flapping and calling by both birds. The female immediately flew off, and the male remained perched facing us and shaking his tail. Palmer (1988) stated that "tail flagging" behavior of the male is sometimes associated with "territorial or pair-bonding activities".

Nest construction was seen by Pitts on 28 April and 4 May. The female did most of the work, but both adults were seen making alternate trips to the nest on 4 May. Both birds were present during nest building. Nest material was gathered near the nest tree. The female usually gathered the nest material in the vicinity of the nearby male, who called frequently. The female called occasionally. Each trip to the nest was brief, usually lasting from 10–15 sec. and never longer than 30 sec.

Pitts saw the female gathering nest material on 28 April. She moved through the understory, dropping down to the ground to snatch small branches with her talons, and then flew directly to the nest. On each approach she flew in low, banked sharply at the main tree trunk and swooped up to the nest. The adults spent active periods of nest building, followed by longer intervals away from the nest. On 4 May, Pitts saw the adults make 8 visits within 5 min. Nest building was observed from mid-morning to early afternoon.

Blue Jays (*Cyanocitta cristata*) were active and vocal in the area during the nest building period. During a pause in nest construction on 4 May, Pitts saw 4 Blue Jays fly into the nest tree. One of the hawks, thought to be the female, flew to the nest tree, scattered the Blue Jays and pursued one. The bird's manner of approach was similar to that used when bringing nesting material.

INCUBATION PERIOD

Mitchell saw an adult, presumably the female, perched on the rim of the nest on 9 May. The bird did not appear to be incubating. On 13 May she saw the female in the nest, apparently incubating eggs. Palmer (1988) stated that eggs are usually laid on alternate days, and that incubation does not begin until after the third egg is laid or the clutch is complete. Mitchell's observations indicate that incubation probably began sometime between 10 and 13 May. The total number of eggs laid was not determined.

Shortly after incubation began, the "kek-kek-kek" call of the male, which was frequently given during the nest building period, was no longer heard. On 6 June, Mitchell played a tape recording of a Sharp-shinned Hawk call but got no response. Bent (1937) stated that incubation is shared by both sexes and Palmer (1988) stated that the male incubates occasionally. However, our observations indicated that the female spent the most time on the nest and that the male generally stayed away from the nesting area. There was no evidence that the male spent any time on the nest.

During the incubation period, Mitchell saw the male at the nest tree on three occasions. On 13 May the male flew in apparently to drive away an American Crow (*Corvus brachyrhynchos*) that had entered the nest tree. The crow left, and the male flew off shortly thereafter. He gave the "kek-kek-kek" call that was probably an alarm response to the crow. During this time the female remained on the nest. On two other occasions (22 and 30 May) the male flew back to the nest with the female from the feeding area. On both occasions the male stayed only briefly; after she settled in, he flew off.

Once incubation began, the male spent most of his time away from the nest. When he did arrive, he usually brought food and gave a soft "ki-ki-ki" call. This call, which we termed as the "feeding call", was less shrill and more subdued than the "kek-kek-kek" call given by the male earlier (during the nest building period). The male usually flew to a small area of the forest near the nest known as the "feeding area". (The feeding area will be described in more detail later.)

When the male arrived and called, the female would slip off the nest and fly to the feeding area. Occasionally she would leave the nest immediately, but at other times it took more coaxing on the male's part. This reluctance to leave the nest might have been attributed to the female's nervousness about our presence. When she joined the male, both birds actively moved through the understory of the "feeding area", jumping about from branch to branch. On 5 June, Mitchell saw the female chase the male in the "feeding area" while he carried food.

Mitchell and Pitts both noted that the male usually ate a portion of the food before transferring the remainder to the female. After she ate, she normally remained in the "feeding area" for a short time, preening and tail wagging, before flying back to the nest. The male usually stayed nearby until she had finished eating and departed. On the average the female usually stayed away from the nest for about 5 to 10 min.

The incubating female frequently seemed "restless" in the nest, shifting positions and preening often. On most occasions her long tail was visible over the rim. She could not be seen at other times. On 30 May Mitchell saw the fe-

male fly from the nest with a large feather in her bill. Other cast-off hawk feathers were also found in the nesting and feeding area. Bent (1937) and Palmer (1888) stated that the female molts during the incubation period. The female sometimes seemed nervous due to our presence but never left the nest when we approached.

Aggressive behavior was noted on 8 June. Pitts was in the feeding area when the male arrived with food. He called 8 times, but the female could not be seen. Pitts watched the male for about 10 min as he plucked and fed on a small bird. The male occasionally glanced at Pitts "but did not seem too concerned". The female appeared suddenly and swooped at Pitts. She then flew up to a nearby branch, faced Pitts and called an agitated "kek-kek-kek", and then swooped again. Some Blue Jays called from near the nest tree, and she immediately flew in that direction. The male left in the opposite direction, still carrying partially eaten food.

On 10 June the female also swooped towards Mitchell on her way to the feeding area. She made one pass and veered away towards the calling male. This was the only other incident of aggressive behavior noted. However, the "kek-kek-kek" alarm call was given by both birds on several occasions when they were disturbed in the "feeding area".

YOUNG REARING AND DEVELOPMENT

Bent (1937) stated that "when first hatched, the nestling is scantily covered with short white down". Fluffs of white down were first seen on the nest rim by Pitts on 9 June. Bent (1937) stated that the incubation period lasts for about three weeks; "perhaps 21 to 24 days". Palmer (1988) estimated that the incubation period lasts for about 30 to 32 days. Assuming that Palmer is correct and that incubation began sometime between 10 and 13 May, 9 June would be close to the time of hatching.

After hatching the male continued to catch food and bring it to the feeding area with increasing regularity. He announced his arrival with the "ki-ki-ki" feeding call, drawing the female off the nest. Mitchell first saw young actually being fed in the nest on 18 June. At other times an adult dropped food off in the nest and immediately returned to the feeding area with actual feeding not observed. Both adults were vocal in the feeding area.

The male made regular visits to the nest following hatching but it was never clearly determined whether he actually fed the young. The male accompanied the female back to the nest from the feeding area on several occasions. On 13 June Pitts saw the male fly over the nest tree twice, giving a squeal-like "skeeee skeeee skeeee" call. He flew to the nest briefly that same morning while the female was brooding but did not bring food. Mitchell also heard a "squealing" call from the feeding area on 5 July.

The female continued to brood throughout the month of June but became increasingly restless on the nest. She preened constantly, frequently shifted positions, and perched on the rim more often. On 13 June Mitchell saw the female re-arranging twigs in the nest. She frequently seemed busy and sometimes nervous about our presence.

The female was last seen brooding by Mitchell on 28 June. Mitchell found the nest unattended on 1 July and on consecutive days. Snyder and Wiley

(cited in Palmer 1988 on two Sharp-shinned Hawk nests in Arizona) stated that "to mid-nestling stage, nearly all food eaten by the pair and offspring was captured by the male, then the female begins to hunt extensively and continues throughout the breeding period".

The end of the brooding period also marked the cessation of the male's feeding call, except for calls heard on 2 and 11 July. The feeding area was used considerably less often following the brooding period. Very little fresh whitewash was found in the feeding area after 1 July.

Mitchell saw 3 of the 4 young aggressively take food from the adult on 1 July. On that day the young were alert, active and mobile, perching precariously on the nest rim and flapping their wings. They still had a considerable amount of down on their bodies.

On 5 July the young were increasingly alert, climbing over each other, flapping their wings and actively chasing flies buzzing around the nest. On 5 July Mitchell also noticed a size disparity and differences in the degree of feathering between nestlings. The most advanced nestling had dark wing tips, a longer tail and dark feathers developing between the bill and eyes.

Palmer (1988) stated that disparity in size between sexes is apparent from very early in nest life, and that the male becomes feathered at an earlier age than the female, although the female tends to be larger. This size disparity was apparent to Mitchell and Pitts.

Mitchell saw the nestlings pick and chew on twigs of the nest on several occasions. As they grew and became more active, the nest's condition became worse. On 7 July the young were much more coordinated, hopping along the nest rim and tearing at food brought in by the adult. Mitchell noted that the down feathers were quickly being replaced by the juvenal plumage. The primaries and tail had sprouted, and the breast was streaked with dark feathers. The young actively preened that day, removing much of the white down still present.

Also on 7 July Mitchell first saw one of the nestlings venture from the nest. This nestling twice jumped on the main branch supporting the nest, but quickly returned to the nest each time. On that same date Mitchell also heard the young give a "peeping" call when an adult brought food to the nest.

By 11 July the young were capable of feeding themselves in the nest, and much of the down had been replaced by juvenal plumage. The remaining down was of a buffy, tan color, and the nestlings continued to preen actively. On 14 July Mitchell observed that the nest was loosely arranged, and, in some places, falling apart. The young actively jumped in and out of the nest. The young called more vigorously on that day when an adult brought in food.

Palmer (1988) cited various sources as to the time nestlings became "branchers" and ventured from the nest: in Oregon, 21 to 24 days (R. Reynolds and Wight in Palmer 1988), and in Utah, 24 days for males and 27 days for females (J. Platt in Palmer). Mitchell found the nest empty on 17 July. On 18 July Mitchell saw and heard one fledgling call from the nest tree, but none were seen in the nest. Mitchell determined that four young successfully fledged from the nest.

The feeding area was used by the male as a place to deliver food to the female during the nesting period. It was located on the outer fringe of the White Pine grove, 75 m from the nest tree and 6 m from a dirt road. The feeding area contained a thick stand of second growth hardwoods including Red Maple, Tulip Tree, Rock Chestnut Oak and Black Locust. A large White Pine within the site was frequently used by the adults. The understory was fairly open but with a dense growth of Huckleberry in some places and scattered patches of Mountain Laurel.

The feeding area showed extensive use during the incubation and brooding period. A considerable amount of whitewash was present and feathers, bones, wing parts, feet from various songbirds and three pellets were collected from this area. Our observations indicate that most of the whitewash and pellets were from the female. After she quit brooding, fresh whitewash was not found.

Although the male generally spent most of his time away from the area, he occasionally hunted in the vicinity of the nest. On 7 June Pitts found the remains of a freshly killed Black-and-white Warbler (*Mniotilta varia*) in the dirt road near the feeding area. On 8 June Pitts saw the male dive into a flock of juvenile Eastern Phoebes (*Sayornis phoebe*) near the same location. Usually however, the male brought food into the feeding area already partially plucked.

The male brought food in at various times, but during the incubation period, he normally arrived every 2 to 4 hours. The time of his visits also varied following hatching but generally increased. He was observed arriving at a 55 min interval on 18 June and at a 21 min interval on 24 June. Following the brooding period, food was ordinarily brought in at intervals of 2 hrs or less.

Numerous songbirds were active in the nesting vicinity during the breeding period. Birds present in the area included Hairy Woodpecker (*Picoides villosus*), Eastern Phoebe, Blue Jay, American Crow, Carolina Chickadee (*Parus carolinensis*), Tufted Titmouse (*Parus bicolor*), Wood Thrush (*Hylocichla mustelina*), Solitary Vireo (*Vireo solitarius*), Red-eyed Vireo (*Vireo olivaceus*), Black-throated Blue Warbler (*Dendroica caerulescens*), Black-and-white Warbler, Worm-eating Warbler (*Helmitheros vermivorus*), Ovenbird (*Seiurus aurocapillus*), Hooded Warbler (*Wilsonia citrina*), Scarlet Tanager (*Piranga olivacea*), Northern Cardinal (*Cardinalis cardinalis*), and Rufous-sided Towhee (*Pipilo erythrophthalmus*). While Mitchell and Pitts were observing the nest on 13 June, songbird activity notably ceased when the male arrived at the feeding area.

Feathers and body parts of various fledged young and nestlings were recovered from the feeding area. The remains of nestlings were also found in two pellets. Palmer (1988) stated that the period of young rearing coincides with an abundance of nestling small birds and small mammals that can be easily captured.

A pellet collected in the feeding area by Mitchell on 18 June contained numerous remains of small arthropods. It was not determined whether the remains were from the digestive tract of consumed prey or were eaten by the hawk itself. While brooding, the female spent much time preening and poking around and possibly could have eaten some insects. Insects were seen crawling on and buzzing around the nest during and after the brooding period.

All documented food remains at this nest consisted of small birds. No mammal, reptile or amphibian remains were found in the feeding area. The remains from the following species of birds were recovered from the feeding area and positively identified: Yellow-bellied Sapsucker (*Sphyrapicus varius*) (old remains), Downy Woodpecker (*Picoides pubescens*), Eastern Phoebe, Tufted Titmouse, Carolina Wren (*Thryothorus ludovicianus*), Wood Thrush, Black-throated Blue Warbler, Black-and-white Warbler, Hooded Warbler, Scarlet Tanager, and Rufous-sided Towhee.

Four young successfully fledged from the nest. Palmer (1988) summarized Reynolds and Wight's study (1976) on the breeding success of this species. Their study indicated that 70–100% of hatched young survive to flight. Our observations indicate that the adults were fully capable of caring for their young and highly successful at capturing food. The adults also became accustomed to our presence and we feel our observations did not adversely influence their nesting activities.

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