

# Chapter Three

## COURTSHIP AND NESTING BIOLOGY

*So I am camouflaged and lying flat and still on my back on the ground under and alongside the plucking post log that, with much effort, I have lowered close to the ground. My plan is that when the adult male from the nearby nest lands on the log to transfer food to his mate I can jump up and scare him into my mist net, set just to the other side of the log. Gosh, I hope this works. He's wearing a red leg band with a unique alpha-numeric code on his left leg, indicating I banded him as an adult. But I have been unable to recapture him this year because he's 'trap shy' from having been caught in previous years with use of the same decoy owl, and I'm guessing he recognizes it unfavorably. Either way, he won't attack my trapping owl, and I really need to get this hawk so that I can draw blood for our new paternity study in Stevens Point, which may allow me to identify which offspring he sired and maybe even which female(s) he has courted in our urban study population. I sense a whir of air, and in an instant he's inches above me, having just landed with a lifeless robin - I reflexively lunge and yell at the same time to 'scare' him, and he flushes right into my net! Then a speck of his blood is obtained for his DNA...YES!!! I'm guessing it'll be harder to trick him into a capture in the future, and so I grip him for a few extra seconds, admiring his regal look before releasing him, as I figure it'll be (and it was) the last time I hold this long-lived 'stud,' as he's replaced the next year with the new kid in town.*

## OVERVIEW AND NEST BUILDING

Undeniably, the best-studied aspect of raptor ecology is nesting biology. This is likely because, as with most birds, socially monogamous Cooper's Hawks become predictably present daily at or near a nest during the same months each year. During this time, the vocalizations and persistent presence of the pair in nest building, food deliveries by adults to young, and defense of the nest site from predators or territorial

rivals render the birds more detectable. In fact, and as we shall see, seemingly collaborative efforts by a nesting male and female reflect individual strategies that sometimes are in conflict. Thus, they must strike compromises to marshal the main task of their existence: to produce young who in turn will join future breeding generations. In fact, and as naturalist Charles Darwin pitched, the ultimate goal for an individual is to produce, or in effect contribute more young into a population versus others of the same species. Competition among counterparts is a main driving force for the behaviors exhibited by social partners. The basis for these behavioral or evolved adaptations is that they are, in part, expressions of copies of genes that they obtained from their parents. So, offspring typically exhibit many behaviors inherited from their parents, enhancing their own viability and competitive success when they begin breeding.

Let's first overview some facts about Cooper's Hawk nests, nesting events and the duration of such events, to provide some context for the more specific details to follow about courtship, vocalizations, and paternity issues. Cooper's Hawks generally produce a single brood each year, and several of their breeding events come in 'fours.' Adults take about three to four weeks to build the nest in spring (though some nest-building occurs in the non-breeding season), about 34 days to incubate eggs, and about four more weeks to feed and care for pre-flight young. It's mostly the females who incubate and tend to the young at the nest. Both adults will deliver food to young for several weeks after they leave the nest, or fledge, but females eventually leave dependent fledglings after they are out of the nest for two to three weeks, and adult females become less associated with the immediate nest site and the breeding territory. Males, on the other hand, provide the bulk of food to fledglings while they are gaining independence, but over time they provide less and less food to the offspring. So the young must eventually hunt on their own. Fledged young will often follow and imitate each other's behaviors, and hence they hunt together (and rarely share food). Often they're grouped within several meters of each other during this post-fledging period, which lasts about four to six weeks. Infrequently, and unlike many non-raptors, the Cooper's Hawk and other birds of prey continue to use the nest for loafing, sleeping, and feeding during the post-fledging period (Boal 1997, Meng and Rosenfield 1988, Nicewander and Rosenfield 2006). Altogether, the breeding period lasts about four to five months, typically beginning in mid-to-late March and lasting through July in Wisconsin (this period can be extended by a few pairs in a population who re-nest after a failure during the egg stage such that active nests occur in August). Interestingly, this schedule is generally similar to other populations of Cooper's Hawks throughout North America (Rosenfield and Bielefeldt 1993a, Millsap *et al.* 2013).



*Adult female Cooper's Hawk with 14-day-old young. Young are essentially all white with down feathers up until this age when tips of growing darker feathers begin to show. Note feces or 'white-wash' of young whose squirts of their waste land on nest rim, tree branches, leaves, and the ground. Thus the nest's interior is kept relatively clean and it thus may, for example, be less likely to attract parasitic insects.  
Photo by Robert Rosenfield.*



*Left & Bottom Left: Adult female arriving with starling prey for less than 1-week-old-young. It is the female that primarily tends the nest, feeding and brooding the young. Photos by Thomas Muir.*



*Above: Weak and hungry 3-day old young apparently reacting to my movements at the nest by opening their mouths for food. Notice white egg-tooth on top end of bills. An egg-tooth facilitates breaking an egg-shell at hatching and usually disappear when young reach 10 days of age. There too is a leg of a woodpecker prey item on nest rim. Photo by Robert Rosenfield.*



*Incubating adult female Cooper's Hawk on typical Wisconsin nest that abuts main stem of conifer tree and which nest is about 50 cm (20 inches) wide and 25 cm (10 inches) deep. This female bred for seven consecutive years on the same territory and would not leave the nest when a researcher climbed to count eggs (one partially visible on her left) and later to band young. Thus we could hand-grab her for marking, etc. Here she, as with many incubating hens, is hunkered down low in a possible attempt to conceal her presence to me. Photo by Robert Rosenfield.*



*Completed clutch of 5, typically pale bluish eggs at a nest in a white pine tree in Wisconsin. Note abundant red pine bark flakes that line inside of nest and downy white feathers on nest rim from adult female's underside as her brood patch forms to expose skin to enhance transmission of heat to eggs. Bark flakes from trees are typically added during egg-laying and occasionally throughout the 34-day incubation period. The female typically begins incubation after the first 3 eggs are laid. Thus with same duration of incubation time to hatching for each egg, the first three eggs hatch on same day, 4th and 5th eggs about 1 and even up to 3 days later, respectively. Such asynchronous hatching results in later-hatched young being noticeably smaller than their older siblings. Photo by Robert Rosenfield.*



*An adult female (right) has just arrived at her nest to resume her duties as primary nest attendant. Males typically incubate eggs or broods of very small young only for short time periods of about 10-15 minutes when their female mates are away from a nest to feed on delivered prey, defecate, and/or bathe. Note that this male has a brown cheek rather than the gray face of most males. Photo by Thomas Muir.*



Returning to the start of the nesting season in spring, we have estimated that male Cooper's Hawks do about 70% of the twig collection for nests. Twigs are delivered one at a time to a nest during building. Females occasionally land on nests under construction without any building material and thus may be simply 'inspecting' its progress (Meng and Rosenfield 1988, Rosenfield *et al.* 1991a). It is rare for both birds to be on the nest at the same time during its construction.

Nests typically about the main tree stem, are usually within the cover of the lower reaches of tree canopy, and average about 14 meters (45 feet) above ground in Wisconsin (Trexel *et al.* 1999). Nest height typically is at about 60% of total tree height, a proportion that appears to apply to many other Cooper's Hawk breeding populations throughout North America, irrespective of the tree species used for nesting (see below, Bosakowski *et al.* 1992, and Rosenfield *et al.* 2002a). The nest is a relatively large structure about 50 centimeters (20 inches) in diameter and 25 centimeters (10 inches) deep. Cooper's Hawks typically build a new nest - in fact they build several - each year on a territory (see Chapter 4). Nests are often not started from scratch in Wisconsin. In fact, about 40% to 60% of nests each year are built on pre-existing structures such as squirrel or old Cooper's Hawk nests (R.N. Rosenfield, unpubl. data). Millsap *et al.* (2013) reported 21% reuse of the previous year's nest in Florida.

In one fortuitous instance, a courting pair stopped building on a nest about 50 meters (150 feet) from my ground blind, and the female, with the male flying close

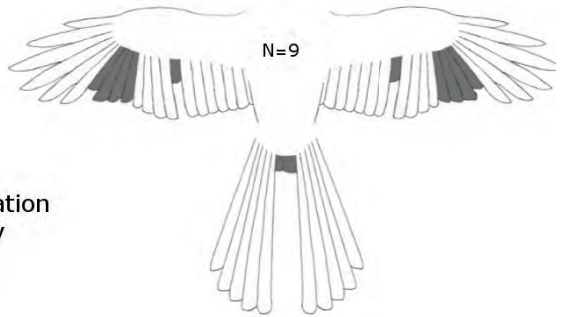
*Right: Adult Cooper's Hawks have to molt, that is drop and replace worn out old feathers each year. But, breeding activities, including different nest duties by the sexes, likely influence the molt process. These images representing captured gray birds at least 2-years-old, or after-second-year (ASY) breeders, depict in a generalized pattern the molting process in flight feathers of the wing and tail of Cooper's Hawks in Wisconsin (white, old feathers, gray, new flight feathers). Neither sex begins molt during the pre-incubation period. Although unknown, perhaps at this time both sexes avoid molting in part because they need all their plumage to signal to possible mates their individual integrity in courtship display and flight efficiency (in fact both males and females in Wisconsin choose their mates; see Chapter 5). Notably, molt gaps in the wing reduces aerodynamic flight performance in birds (Hedenström and Sunada 1999). Breeding males and females begin molt during the mid-incubation period (about mid-May). By contrast, in some other raptors, including the ecologically similar Eurasian Sparrowhawk (*A. nisus*), males begin molt later during egg-hatching and the early nestling period (Newton 1986, Steenhof and McKinley 2006). However, as in other raptors, molt in female Cooper's Hawks occurs to a greater extent, in fact, involving about twice as many total flight feathers as the male Cooper's Hawk in each of the incubation and nestling stages. Further, the male restricts its molt to the 'primaries', which feather group is the outermost 10 feathers of the wing. The difference in extent in molt between the sexes probably occurs because females do not have to route as much energy to flying as they principally tend eggs and young at a relatively small area around the nest. Thus unlike males, who are energetically and aerodynamically tasked with hunting and carrying prey throughout a territory due to their primary role as food provider, females can direct more of their energy toward molting during the incubation and nestling stages.*

**ASY MALES**

**ASY FEMALES**



**Pre-incubation  
April**



**Incubation  
May**



**Nestling  
June**





*On average perhaps the highest Cooper's Hawk nests occur in tall conifers of the Pacific Northwest. Here the author is ascending to a nest just over 31 meters (102 feet) in a Douglas-fir tree in Victoria, British Columbia. Canadian researchers Andy and Irene Stewart often cannot readily find study nests in this city because they are so difficult to see from the ground so they resort to early morning observations of nest-building hawks whose activities reveal nest locations.*

*Photos courtesy of Eric Wagner.*

behind her, flew over and onto a squirrel nest in a tree just above my hide. The male did not land at the nest and perched in another tree. The female then started to 'shuff-le' about the structure while lying on her chest (I note that she was not holding any twigs when she arrived at the nest). Her actions on the nest over about 30 seconds were so forceful that she knocked several leaves from the structure, which landed on me. She then flew off and perched nearby. Then her mate flew to neighboring trees, where he broke sticks one at a time (at least 13 in total), which were used for nest-building on the squirrel's nest. The female eventually flew off, and the male almost immediately followed her out of my view. These events were probably the beginning of nest building on that structure, because later that day, when the pair was off-site, I climbed to and counted only 13 fresh sticks on that squirrel nest. My impression at the time was that her movements on the nest were simply to assess its structural integrity, but she also could have been checking whether the nest was occupied by squirrels (a possible egg predator). It was not. It also seemed to me that her actions influenced or prompted the male to build there. Nevertheless, I did not see the pair use this nest further that year. Without providing evidence, Meng (1951) indicated that the male Cooper's Hawk selects the nest tree in New York,

while Moore and Henny (1984) assumed that the female does this task in Oregon. I have no evidence to indicate, generally, which sex chooses the nest tree.

Cooper's Hawks nest in a very wide array of tree species across the continent in both rural and urban settings. For example, they use white pine (*Pinus strobus*) in Massachusetts and Wisconsin; American beech (*Fagus grandifolia*) in New York and Florida; various oaks (*Quercus* spp.) in California, Florida, Maryland, Iowa, and Wisconsin; Douglas-fir (*Pseudotsuga menziesii*) in Oregon, Washington and British Columbia; and green ash (*Fraxinus pennsylvanica*), trembling aspen (*Populus tremuloides*) and even Rocky Mountain juniper (*Juniperus scopulorum*) in North Dakota (Rosenfield and Bielefeldt 1993a, Rosenfield *et al.* 2002a, Millsap *et al.* 2013). There is evidence that Cooper's Hawks prefer nesting in white pine in Wisconsin and that pine plantations are important habitat for breeding Cooper's Hawks throughout the Midwestern U.S. (Rosenfield *et al.* 1991b, 2000, see Chapter 4). Unlike other raptors that will use man-made structures for nests (e.g., buildings and billboards by Red-tailed Hawks [*Buteo jamaicensis*], smokestacks and bridges by Peregrine Falcons [*Falco peregrinus*]; Bird *et al.* 1996) urban nesting Cooper's Hawks apparently are averse to using anything other than trees (Stout and Rosenfield 2010).

Several of the breeding activities and pre-incubation events already mentioned are common in many other raptors, but one recent, surprising discovery shows the Cooper's Hawk to be markedly unlike all other birds of prey studied to date. Most raptors are socially and genetically monogamous, with only occasional trysts that result in nests with young sired by at least two different males. This latter phenomenon is known as extra-pair paternity, or EPP. Cooper's Hawks, however, are highly unfaithful to their social partners. In fact, their mating system seems more like that of songbirds, a group of sparrow-sized birds renowned for their sexual promiscuity despite their social monogamy. EPP seems particularly detrimental to the fitness (meaning, ability to produce young that would in turn become breeders) of the resident male who, in Wisconsin, invests all of the reproductive periods of his life into one territory where, theoretically, he should be raising his own young. This site investment is accentuated by the fact that males, not females, establish breeding territories; invest more than females do in reproductive efforts via nest building and anti-predator behavior before the eggs are fertilized; and are principally responsible for procuring prey for themselves, their mates, and their young right through to independence after fledgling (Rosenfield and Bielefeldt 1991a,b, 1993a). There clearly is a marked difference between the sexes in reproductive investments in a nesting effort. And although males in Wisconsin make lifetime or career decisions as to which site (territory) they will breed in, some females switch sites and, over the years, divorce mates (Rosenfield and Bielefeldt 1996). The factors that dictate mating



dynamics of the sexes can be difficult to identify, but some insights will be discussed in Chapter 5. Nevertheless, successful nesting at any nest site requires cooperation between the sexes. This begins with courtship.

## COURTING

Courtship includes interactions between the sexes that involve pairing and other behaviors that should lead to production of eggs and young. Unfortunately, there is little (especially quantitative) information on the specific behaviors that lead to pairing. Aerial displays, either in tandem or singly, are a common and seemingly important behavior that may facilitate pairing in raptors (Olsen 1995). In spring, and less frequently in fall, male Cooper's Hawks (and females less so), exhibit a pronounced or exaggerated deep wingbeat during a slow, somewhat undulating and rocking flight above treetops (sometimes as high as 100 meters [300 feet] above the ground). That makes the birds appear, at least to my eye, very light or buoyant in flight. Their under-tail, brilliant white covert feathers tend to be flared in such flights, and we have heard males occasionally give *kik* calls during these displays. This apparent and early courtship display, which may initiate or facilitate pairing, is similar to the buoyant wing flapping of Common Nighthawks (*Chordeiles minor*).

Thus this behavior in Cooper's Hawks is called 'night-hawk flapping.' We have seen male and female Cooper's Hawks in simultaneous night-hawk flapping. It seems practical that a forest raptor would advertise his (her?) availability, territory vacancy and/or occupancy to potential mates or rivals more obviously in the open sky than in a more enclosed, darkened forest. I have twice seen a night-hawk flapping male being 'chased' by another male using direct and fast flapping, which to me suggested an impending attack (R.N. Rosenfield, pers. obs.). Unfortunately, I did not see the outcome of these chases. Male Cooper's Hawks will readily attack each other in contesting ownership of breeding territories, and there is evidence that these territorial interactions can have lethal outcomes (Millsap *et al.* 2013; see Chapter 4).

Indeed, I found two dead males, about a meter (3 feet) apart at the base of a nest tree with an incubating female present. Both males had several small puncture wounds about the upper chest. I speculate that they had fought a few days earlier (based on the equal 'freshness' of the carcasses) and inflicted lethal wounds to each other. Several days after finding these bodies, I climbed to the nest at this site and found cold eggs and no sign of the female, who had probably been obliged to desert the nest to hunt and feed herself, with no mate present to feed her. One of these dead birds included what was my oldest breeding male (9 years old) and a 1-year-old,

*Spring courtship includes flight displays in which white under-tail covert feathers are noticeably splayed as shown here in upper photo.*

*Photo by John Seibel*

*Dr. Steve Taft saw these two adult male Cooper's Hawks collide in mid-air and while gripping each other, fall to an ice-covered lake on the outskirts of Stevens Point, Wisconsin, in March, when courting seasonally commences. They remained 'talon-locked' for several minutes before releasing their grip on one another and flying off. Cooper's Hawks will physically attack and sometimes kill each other in territorial disputes (see Chapter 3).*

*Photo by Steve Taft.*



brown bird. This probable battle for the nesting site between a 'senior' and a 'teenager' occurred after a complete clutch of five eggs had been laid, so it seems territorial contests aren't restricted to the courtship period. (Similarly, Cooper's Hawks in Albuquerque, N.M., will build nests outside the spring courtship period, in the fall; B.A. Millsap, unpubl. data). In addition, a colleague of mine, zoologist Dr. Steve Taft, witnessed two adult Cooper's Hawks collide in mid-air, and, while locked in each other's grip, fall onto the snow on a frozen central Wisconsin lake in late March. For several minutes, the birds' talons appeared locked into each other's bodies, before they each let go and flew away. It was not apparent who 'won,' nor what extent of wounding was inflicted on either bird.

This hostile engagement during the courtship period probably reflected a conflict over territory. We have no observations of adults preying upon each other for food. But we did observe a subadult, 1-year-old female Cooper's Hawk take a very young (less than 1 week old) nestling from a nest in an apparently rare case of infanticide in Cooper's Hawks (Rosenfield and Papp 1988). This intruder took the young while the female was away from the nest and out of sight of the observer watching from a blind near the nest.

Courting generally appears to last several weeks each year in Cooper's Hawks and is an ecological dynamic that has been very poorly studied in wild birds of prey. This gap in our knowledge about raptor courtship is partly the result of logistical



*A bowing display that may signal a readiness to nest-build in Cooper's Hawks. We documented quick busts of bowing mostly at dawn just before nest building for the day began. Bowing resembled movements of birds when they place sticks into a nest. The display never lasted more than a minute, and males, the sex that does the majority of building, gave this display more than females. This posture also may facilitate pairing as we observed it mostly in new mates several weeks before eggs were laid. Drawing by Bryce Robinson.*