

NESTING PHENOLOGY, SITE FIDELITY, AND DEFENSE BEHAVIOR OF NORTHERN GOSHAWKS IN NEW YORK AND NEW JERSEY

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ABSTRACT.—Eleven Northern Goshawks (*Accipiter gentilis*) were detected on territory during midwinter suggesting that most nesting pairs are permanent residents along the New York-New Jersey border. The onset of incubation occurred primarily (80%) during the second through fourth weeks in April at 20 nests monitored. Only two of 35 nesting attempts were made by immature-plumaged females and all breeding males observed were in adult plumage. Goshawks built from one to five nests in the nesting area and an occupancy of 18 sites averaged 3.8 years. Nest defense was scored at 20 nests but no significant correlation between aggression and habituation to human habitation was apparent. Extreme aggressive attacks on ground observers occurred only during single observer visits. Aggressive attacks by the female were most intense during the early nestling stage. Males participated on only 18% of nest defense encounters and were usually less aggressive.

Época reproductiva, fidelidad al nido, y conducta de defensa en el Gavilán Azor, en Nueva York y Nueva Jersey

EXTRACTO.—Once Gavilanes Azor (*Accipiter gentilis*) fueron detectados en su territorio durante la mitad del invierno, lo que sugiere que la mayoría de las parejas reproductoras son residentes permanentes a lo largo de la frontera entre Nueva York y Nueva Jersey. En 20 nidos observados, los inicios de la incubación ocurrió primariamente (80%) desde la segunda a la cuarta semana de abril. Solo dos de los 35 intentos de nidificar fueron hechos por hembras con el plumaje que es típico de aves aún inmaduras, mientras que todos los gavilanes machos observados estaban ya en su plumaje de adultos. Los gavilanes construyeron de uno a cinco nidos en el área de reproducción y la ocupación en 18 sitios promedió 3.8 años. La intensidad de defensa del nido fue registrada en 20 nidos. No hubo aparente correlación entre la agresión y la habituación a zonas pobladas por personas. Ataques de agresión extrema, a quien hace la observación desde el suelo, ocurrió sólo durante visitas de observación individuales. Los ataques agresivos por las hembras fueron más intensos durante el período de las crías en el nido. Los machos participaron en sólo 18% de los encuentros de defensa del nido y fueron usualmente menos agresivos.

[Traducción de Eudoxio Paredes-Ruiz]

There are few accounts on the nesting behavior of Northern Goshawks (*Accipiter gentilis*) in North America. Sutton (1925), Bent (1937), Bailey and Niedrach (1938), Todd (1940), Schnell (1958), and Bartelt (1977) provided qualitative accounts of nesting behavior. Allen (1978) observed prey deliveries and development of young from a blind at two nests in the Adirondack Mountains of New York. Hennessey (1978) reported increased "aggression" by adult goshawks toward human intruders from March through August in Utah. Lee (1981) observed two nests in Utah and speculated on relationships between human activity, nest defense, and habituation

by goshawks to disturbance. Reynolds and Wight (1978) reported information on nest site tenacity and nesting phenology of goshawks in Oregon.

Since the mid-1970s, we have studied the nesting ecology of Northern Goshawks in northern New Jersey and southeastern New York. Most of this research has focused on population status, habitat selection, and nest site characteristics (Speiser and Bosakowski 1984, 1987, 1989, Bosakowski 1990). Here, we present some details of goshawk nesting biology and behavior in the northeastern United States where little information has been previously reported.

STUDY AREA AND METHODS

Goshawks were studied at nest sites in northern New Jersey (Morris, Passaic, and Sussex Counties) and south-eastern New York (Orange County). This area is comprised of rolling hills and valleys (41 north latitude) with nests ranging between 250–400 m in elevation. The study area was extensively forested excepting occasional suburban housing developments, reservoirs, and rights-of-way. Forest composition and physiognomy have been previously described in detail (Speiser and Bosakowski 1987).

Observations of incubating or protesting goshawks were made at nest sites found from 1977–89. A “nest site” is defined as an active nest and the forest area immediately surrounding the nest. A “traditional nest site” is defined as a nest which is used for at least two nesting seasons. A “nest area” is defined as a traditional nesting area which contained one or more nests and was used over a period of several nesting seasons, presumably by the same male and/or female. Reynolds and Wight (1978) estimated goshawk nest areas as 8–10 ha in extent.

All observations were made by observing nests, goshawks, and their young with binoculars from the ground without blinds. The nest tree was not climbed at any nest site. A total of 35 nesting attempts were studied from 20 different nest areas. The onset of incubation was monitored by repeated visits to nest sites during 20 nest attempts. At 18 nest areas, signs of nesting activity (i.e., greenery, incubating or protesting birds, young) were monitored from initiation of the first nest to final abandonment of nest areas to determine the duration of “nest site fidelity.” Aggression to a single human intruder was ranked at 16 different nest sites as: high (actual strike or diving within striking distance), medium (diving outside of striking range), and low (flyovers and/or protesting only). Reactions were summarized from one or more visits by a single observer during visits when nestlings were estimated to be between 2–3 wk of age.

RESULTS AND DISCUSSION

Nesting Phenology. In our region, most goshawks appear to be permanent residents. Mid-winter observations of goshawks were made at or near several traditional nest sites ($N = 6$) and others were lured-in near nest sites with broadcasts or imitations of various raptor calls ($N = 5$). The majority of breeding goshawks probably begin regular visits to the nest site in late February as we usually observed fresh greenery and newly added sticks on the nest by mid-March. In one exceptional case, during an unusually mild winter, a new, almost completed nest with a protesting adult (sex undetermined) was discovered on 1 January 1990. This nest was defended vigorously in late May and was located about 300 m from the previous year’s nest which was successful.

Observations of incubating goshawks were made at 20 closely monitored nests. Along with back-dat-

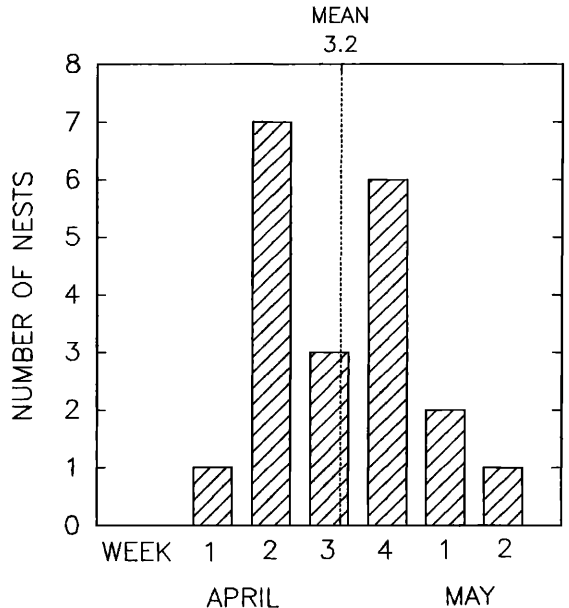


Figure 1. Onset of incubation at 20 Northern Goshawk nests found along the New Jersey-New York Border.

ing from the age of young, we estimated that incubation commenced primarily (80%) during the second through fourth week in April with a mean of 23 April (Fig. 1). Henny et al. (1985) reported a similar mean date (24 April) for clutch completion in eastern Oregon at elevations ranging from 500–1600 m. However, Reynolds and Wight (1978) reported a later mean date (6 May) for goshawks initiating incubation in Oregon which was apparently a result of higher elevation 1430–2130 m.

Of 35 nesting attempts studied in total, we observed only two females breeding in immature plumage and all males observed ($N = 18$) were in adult plumage. Similar frequencies of nesting by immature-plumaged females have been reported in the literature, but immature males have not been reported to attempt breeding (Henny et al. 1985, Palmer 1988).

Nest Site Fidelity. Nest areas were occupied from one to eight years with an average occupancy of 3.83 (SD = 3.05) years. Reynolds and Wight (1978) reported occupancy of nest areas only up to five years for goshawks nesting in Oregon. A nest area in Washington has been continuously occupied for at least 10 years (D. Bates, R. Speiser, T. Bosakowski, pers. observation).

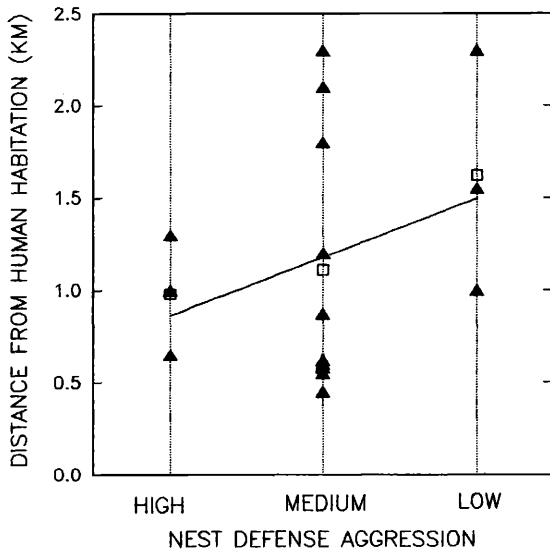


Figure 2. Nest defense aggression rank at 16 Northern Goshawk nests versus distance to human habitation. Squares represent mean for each rank. The least squares correlation was extremely weak ($r = 0.005$) and was not significant by ANOVA ($P = 0.788$).

During their occupancy, goshawks built and/or nested in one to five nests in the nest areas investigated in the study area. Each year, goshawks often used different nests in their nest area regardless of the nesting success or failure of the previous year. All nests, except one, were originally constructed by the nesting goshawks. The one exception was of unknown origin (probable goshawk nest) and was vacant for eight years prior to its use.

Once abandoned, traditional nest areas were not rapidly reoccupied for nesting. Only one reoccupation of a nest area in our region is known; this was following a period of seven years vacancy. These results support previous conclusions (Speiser and Bosakowski 1984, Bosakowski 1990) that the number of nesting pairs are below saturation levels and densities are considerably lower compared to other regions (see review by Reynolds 1983).

Nest Defense Behavior. The goshawk is a secretive forest raptor throughout the year, except during the breeding cycle, when adults respond aggressively to human intruders with loud vocalizations, aggressive fly-bys, and aerial attacks (Sutton 1925, Bent 1937, Todd 1940, Lee 1981, this study). During incubation we found that females usually sat

tight on the nest and rarely flushed even if the observer stood beneath the nest tree. At that time the male was secretive. However, during the early brood period (nestlings less than two weeks in age) the female became most aggressive and was occasionally supported by protesting vocalizations of the male who only participated in 18% of cases of nest defense. Schnell (1958) also noted that nest area defense was not characteristic of the male goshawk.

Nest defense usually began with protracted "cackle" alarm calls described as "cac, cac, cac" in Bent (1937). These calls were uttered by both adults if present. The cackling was quickly followed by repeated flyovers, then direct diving at the intruder primarily by the female. When young were more than three weeks old, adults rarely attacked an observer which was also noted by Julian (1971). At this time, the young were sometimes left unattended for up to a few hours. After the young fledged, aggression was greatly reduced to an occasional protest alarm call as the family unit quickly retreated away from the nest area.

The most aggressive aerial attacks were initiated by the female if an intruder came within about 100 m of the nest during the early nestling stage. Furthermore, attacks became more vigorous if an observer moved in the direction of the nest. We noticed that occasional solitary hikers on nearby trails (<60 m) were not usually attacked. Stopping and watching the nest from the same trail was not tolerated and usually provoked aggressive attacks. Ground observers were struck on only two occasions in this study, partially because we often flailed our arms and yelled, causing the bird to break its attack or retreat. In North America, ground observers have been occasionally struck by goshawks (Bent 1937, Lee 1981, this study), but the habit is not apparent in European goshawks (*A. g. gentilis*) presumably because they have long been persecuted (Newton 1979, R.E. Kenward, pers. comm.).

We also observed a direct relation between the magnitude of aggressive encounters and the number of observers in the party. Goshawks were noticeably less bold and aggressive when more than one observer was present. Visits to active nest sites have shown at least 15 extreme aggressive attacks during at least 80 single observer visits in comparison to no aggressive attacks during some 30 multiple observer visits (these numbers are estimates and refer strictly to attacks upon ground observers). Sutton (1925) also noted that a female goshawk became much more

bold and aggressive when other members of his party left him alone to study the nest. Hennessy (1978: 51) stated that "a large number of people would elicit a milder protest and less likelihood of an actual attack than fewer people." During our study, a minimum group size of two was always sufficient to prevent extremely aggressive attacks. In addition, adults tended to leave the nest area within a matter of minutes if a group of two or more people were present, but would continue protesting from a distance.

The possible relationship of distance to human habitation and the extent of aggressive nest defense behavior was also examined. However, no significant correlation was observed (Fig. 2). Thus, there is no clear indication that goshawks nesting closer to development have habituated to human disturbance (and have become less aggressive) or that less-aggressive goshawks will tolerate closer human habitations. In our study area, goshawks typically selected remote habitats, significantly farther from human habitation than random sites (Speiser and Bosakowski 1987), even though nest site selection always precedes the period of aggressive nest defense behavior. Lee (1981) believed that goshawks habituated to human disturbance, but this assumption was based on only two nests. Our data do not support such an hypothesis from a "normal" population of 20 nest sites that was not excessively disturbed during the nesting season (i.e., only two nests were on frequently used hiking trails). Thus, we suspect that nest defense by goshawks is a fairly inflexible response which is rarely modified by habituation to disturbance or proximity to human habitation.

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