Gray Catbird *Dumetella carolinensis*

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EXECUTIVE SUMMARY

Preferred breeding habitat: In early successional shrub thickets or vine tangles, including forest edges and clearings, roadsides, fencerows, old fields, riparian and swamp habitats, and some residential areas.

Nest placement: In the middle of a living shrub, on a horizontal supporting branch close to the main trunk, and well hidden by surrounding branches and foliage, at an average height of 1.5 m.

Mean clutch size and fledging brood size (±SD)**:**

- Non-parasitized nests: clutch 3.70 (SD = 0.78); brood 3.01 (SD = 1.11)

Number of broods per season: Two to three.

Annual adult survival rates: Uncertain. Assumed male and female: 63.4%.

Requirements for population stability ($\lambda \geq 1$)**:**

- Approximately ≥ 2.4 own young/female/season

Nest mortality and parasitism rates in relation to landscape context:

- No relationships between daily nest predation rate and landscape context detected
- Insufficient data to relate nest parasitism rate to landscape context

The importance of spatial scale to the relationship between nesting success and landscape context: No relationships detected

General conclusions:

- Nest parasitism has little effect on reproductive success
- Lambda is positively correlated with the degree of forest fragmentation, particularly at landscape scales, but this may be a statistical artefact

Management guidelines:

- As a common, widely distributed species occupying early successional habitats, the Gray Catbird has generally benefited from anthropogenic forest fragmentation and a variety of silvicultural practices. In addition, it is largely unaffected by cowbird parasitism, and there is no indication that nest predation rates are subject to edge effects. At a continental scale, therefore, no active management is considered necessary. However, evidence of recent population declines in the southeastern United States warrants monitoring (Cimprich & Moore 1995).
- Because this species winters in coastal areas within the United States, which are areas of rapidly increasing suburban development, the potential for impacts on their wintering grounds is great (Cimprich & Moore 1995). The conservation of dense, shrubby habitats, often near water and in areas with broadleaf evergreen cover in the coastal wintering range, is therefore important for wintering populations.
- Given the Gray Catbird's sensitivity to moderate to high levels of grazing and browsing, management actions that reduce grazing/browsing pressure will benefit Gray Catbird populations, particularly in riparian habitats in the western United States.

DETAILED and BACKGROUND INFORMATION

Distribution and habitat preference

A Neotropical migrant, the Gray Catbird occupies a breeding range through much of North America, and winters along the Atlantic and Gulf Coasts of the United States, and the Atlantic slope of Mexico south to central Panama and the western Caribbean. The breeding range extends from the Atlantic coast of northern Florida, westwards along the Gulf Coast (excluding immediate coast) to eastern Texas, and northwards to southern Canada, from the Atlantic coast in the east, to eastern Kansas, Oklahoma (except extreme southwest), northern New Mexico, northeastern edge of Arizona, northwestern and eastern Utah, eastern Oregon, and eastern Washington (Cimprich & Moore 1995).

On the breeding range, it is found in early successional habitats with dense shrubs or vine tangles, including forest edges and clearings, roadsides, fencerows, old fields, riparian and swamp habitats, and some residential areas. Breeding density increases linearly with shrub density (Lent 1990, Berger et al. 2001), and it is most abundant in shrub-sapling successional habitats. During winter, it similarly favors dense, shrubby habitats, often near water and in areas with broadleaf evergreen cover in the United States (Cimprich & Moore 1995). Although it may be present in forest, it is not abundant. Density was negatively correlated with woodland area in fragmented riparian forest in Ohio (Groom & Grubb 2002). There is no information to suggest that the habitat requirements of juveniles post-independence differ from the breeding habitat requirements.

The average territory size is 0.32 ha in southern Ontario (Darley et al. 1971). Breeding density 9.9-25.7 pairs/ha over 3 years in lake-edge habitat in Manitoba (Harcus 1973), 7.4 pairs/ha in shrub-dominated habitat in Michigan (Nickell 1965), 1.0 pairs/ha in 6-8-year-old and 0.5 pairs/ha in 2-4-year-old aspen (*Populus*) stands (Yahner 1991), and 0.3 pairs/ha in floodplain forest/wet scrub, but 0.1 pairs/ha in upland scrub and forest edge in Georgia (Cromwell 1962).

Nest site characteristics

The open-cup nest is generally placed in the middle of a living shrub, on a horizontal supporting branch close to the main trunk, and well hidden by surrounding branches and foliage. Average nest height is 1.5 m (Cimprich & Moore 1995).

BREEDING PRODUCTIVITY

Laying seasons

Earliest and latest nests in the BBIRD database were initiated on 5 May and 20 July respectively. The timing and length of the laying season appeared to vary with latitude (see Figure 1). The peak in nest initiation at latitudes 35-40°N (14-20 May) occurred two weeks earlier than at latitudes 40-45°N (28 May – 3 June), and 3-4 weeks earlier than at latitudes 45-50°N (4-17 June). Published data suggest similar latitudinal variation in the start of breeding: mid-April through mid-May in the southeastern United States (Charles 1954), mid-May through early June from Iowa to New York (), and late May through

mid-June in Ontario, Manitoba and British Columbia (Harcus 1973, Scott et al. 1988). Although data are limited, the length of the laying season may be shorter at latitudes 45-50°N, than in more southern regions (Figure 1). The overall length of the laying season was estimated at 62 days at latitudes 40-45°N, the only latitudinal band for which we had sufficient data.

The median date on which the Gray Catbird began laying in southern Ontario ranged from 17-29 May over 4 years, and the average length of the 12 longest individual laying seasons over 2 years was 47 days (Scott et al. 1988), supporting the suggestion of a possibly shorter laying season in the far north of its breeding range, although a direct comparison with the BBIRD-estimated laying season length is problematic, given that average individual laying season lengths will be shorter than the potential season.

Assumptions in calculations of breeding productivity

Eggs are laid at daily intervals (Cimprich & Moore 1995). The mean clutch size of unparasitized nests among BBIRD sites is 3.70 (SD = 0.78, n = 96). Mean clutch size varies with latitude and seasonally, with reported means ranging from 3.2 (n = 61) in Ohio (Slack 1973), to 4.1 in British Columbia (R.W. Campbell in Cimprich & Moore 1995). The mean incubation period has been reported as 12.9 days (range 12-14 days: Johnson & Best 1980), and 13 days at each of 4 nests in southern Michigan (Zimmerman 1963), and the nestling period as 10.5 days with a mode of 11 days (n = 17 birds) in Michigan (Zimmerman 1963). The re-nesting interval is 5.05 days (SD = 0.92, n = 41) after nest failure (Scott et al. 1987). The re-nesting interval after successful fledging is 7.6 days in Iowa (Johnson & Best 1980), 10.8 days (SD = 0.97, n = 5) in Michigan (Zimmerman 1963), and 15 days (n = 3) in Ontario (Scott et al. 1988), yielding a combined average of about 9 days (Scott et al. 1988). Two broods are attempted throughout most of the range, occasionally three in the southeastern United States (Cimprich & Moore 1995). In Ontario, 14% of females attempted 2 broods (Scott et al. 1987). In southern Michigan 5 of 7 pairs that successfully fledged young re-nested (Zimmerman 1963). To calculate breeding productivity, we used a 62-day laying season, a 27-day nesting period (3-day laying, 13-day incubation, 11-day nestling), and re-nesting intervals of 5 and 9 days after nest mortality and successful fledging respectively.

Assumptions in calculations of finite rate of population increase (λ)

Fidelity to the breeding territory, and thus the extent of breeding dispersal, is dependent on nesting success. In Ontario, 21% of males that lost a nest deserted their territory (Darley et al. 1971). Furthermore, the annual return rate was higher for birds that bred successfully the previous year (65.5% and 44.8% for males and females respectively, n = 29 and 29) than for birds that were unsuccessful the previous year (41.7% and 38.5%, n = 12 and 13: Darley et al. 1977). The extent of breeding dispersal among successful birds, and the influence of sex on dispersal probability, remain unknown, however.

In a mark-recapture study comparing adult survival and breeding productivity estimates between sites in the western (Kansas and Missouri) and eastern Midwest (Indiana and Kentucky), DeSante et al. (2001) report adult survival and productivity (proportion of young in the catch) estimates of 63.4% (SE = 5.1%) and 0.27 respectively

in the west, and 28.3% (SE = 4.1%) and 0.16 in the east. Given the poor productivity in the east, the eastern survival estimate is likely biased low by higher dispersal following nest failure. Other reports of the percent of adults returning to breeding sites between years varies from a low of 12% in New York (n = 106: Lent 1990) to a high of 40% in Iowa (n = 15: Johnson & Best 1980).

We assumed an annual adult female survival estimate of 63.4%, based on the upper estimate of DeSante et al. (2001), and a juvenile survival rate of 31.7% (50% of the adult survival rate estimate, following the hypothesis of Greenberg (1980) and Temple & Cary (1988) that juvenile survival is approximately 50% of adult survival among small, north-temperate passerines).

Effects of nest micro-habitat on probability of nest predation and parasitism

No data.

Effects of Brown-headed Cowbird nest parasitism on host reproductive success

There were insufficient BBIRD data from parasitized nests to evaluate the impact of parasitism. Although the Gray Catbird may incur up to 44% parasitism (Scott 1977), it quickly removes cowbird eggs from its nest, so observations of cowbird eggs being incubated are rare, and there are only six documented cases of cowbird nestlings being raised (Cimprich & Moore 1995). Removal of host eggs by the cowbird female accounted for the loss of 1.2% of Gray Catbird eggs at an Ohio site (Slack 1973). The cost of ejecting a cowbird egg is minor (0.0022 catbird fledglings/ejection), whereas the cost of accepting a cowbird chick is relatively high (0.79 catbird fledglings: Lorenzana & Sealy 2001). Because catbirds remove over 95% of cowbird eggs from their nests (Lorenzana & Sealy 2001), parasitism generally has little effect on catbird reproductive success.

Effects of landscape-level habitat variables on nest parasitism

There was insufficient nest parasitism among BBIRD sites to investigate correlates with landscape variables.

Table 1. Summary of Gray Catbird breeding productivity and estimated finite rate of population increase (λ) across BBIRD sites.

Site	No. of nests	Clutch size[1]	Parasitism rate (%)[2]	DPR (%)[3]	Nest success (%)[4]	Fledglings/ nest[5]	Annual fecundity[6]	Lambda
NE Monongahela Natl Forest, WV	8	3.00	0	4.13	25.33	2.00	1.49	0.87
Bitterroot, MT	12	3.57	8.33	3.68	36.37	2.00	1.90	0.93
Hoosier Natl Forest, IN	41	3.54	0	4.34	28.68	3.00	2.43	1.02
Western Maryland	10	3.40	0	4.52	28.72	3.00	2.44	1.02
Snake River, ID	12	4.00	0	4.98	25.15	3.33	2.47	1.03
Pewaukee Lake, WI	9	3.80	0	1.46	67.23	1.83	2.54	1.04
Upper Mississippi, MN, WI, IL	85	3.91	1.18	3.74	32.29	3.31	2.90	1.09

[1]Number of host eggs incubated in non-parasitized nests

[2]Percentage of nests that received 1 or more cowbird eggs

[3]Percentage of nests lost to predators per day

[4]Percentage of nests that produced at least 1 host fledgling or cowbird

[5]Number of host young fledged per successful nest

[6]Average number of host young fledged per female per year

Table 2. Summary of the best predictor variables (fragmentation indices) for the relationship between landscape structure and lambda among BBIRD sites (plot averages for scales of patch and 1-10 km radii) using multiple regression analysis. Spatial scales included: the patch of forest within which the study plot was embedded; 1-10 km radii of study plot centers; and 50-100 km radii of study site centers. Non-significant results included for comparison across scales. $^{*}P < 0.05$; $^{**}P < 0.01$; $^{***}P < 0.001$.

Scale	Dependent variables	Independent variables	Adj. R^2	Slope
Patch	Lambda	Forest edge density	0.01	
1 km	Lambda	% core forest	0.01	
5 km	Lambda	Contagion index	0.3	
10 km	Lambda	Contagion index	0.33	
50 km	Lambda	% grassland	0.84**	0.59
100 km	Lambda	% grassland	0.83**	0.82

Effects of landscape-level habitat variables on nest predation rate

There were no significant relationships between daily nest predation rate and any landscape variable at any of the spatial scales examined. However, these data should be interpreted with caution, given that predation rate estimates from five of the seven sites are based on samples of just 8-12 nests (Table 1), whereas samples of 20-25 nests are generally considered necessary for adequate predation rate estimates.

Effects of landscape-level habitat variables on the finite rate of population increase

Among BBIRD sites, lambda was positively correlated with the degree of forest fragmentation across all spatial scales, the relationship being significant only at the broad landscape scales of within a 50-100 km radius. Again, these data should be interpreted with caution, given the small sample sizes from most sites.

Effects of silviculture on nest predation and nest parasitism

No data on effects on nesting success. Breeding densities were significantly greater in forest plots subjected to 50% and 75% clear-cutting than in mature, uncut mixed-oak and aspen forest in Pennsylvania (Yahner 1993), and densities were twice as great in 6-8-year-old even-aged aspen as in 2-4-year-old stands (Yahner 1991).

Effects of burning on nest success

No data.

Effects of grazing/browzing on nest success

No data on effects on nesting success. Gray Catbird nesting density in riparian (willow) vegetation was found to vary inversely with moose abundance in the Greater Yellowstone ecosystem (Berger et al. 2001). An increase in browsing pressure associated with increasing moose abundance altered the structure and density of riparian willow thickets, resulting in the loss of Gray Catbirds from riparian systems where moose densities were high. Similarly, Gray Catbirds are significantly less common in riparian habitats in the western United States exposed to long-term, moderate to heavy livestock grazing that reduced shrub/sapling cover (Tewksbury et al. 1998). Thus, any grazing/browsing that reduces shrub abundance and/or density, can be expected to reduce Gray Catbird abundance.

Overview of landscape-level habitat effects on breeding productivity and population growth rate

Variability in annual breeding productivity, and hence lambda, among sites is due to variability in both daily nest predation rate and the average number of young fledged per successful nest. The significant positive relationship between lambda and landscape indices at the broad landscape scale of within a 50-100 km radius can be explained by the

combination of a non-significant negative correlation between daily nest predation rate and broad-scale landscape indices of fragmentation, and a non-significant positive correlation between average number of young fledging per nest and broad-scale landscape indices of fragmentation. No ecological mechanism can be put forward to explain the latter. Predator abundance could be expected to vary across biogeographic regions (Thompson et al. 2002). Thus, the negative correlation between nest predation and broad-scale landscape fragmentation could theoretically indicate a reduction in predator abundance with greater forest fragmentation at a broad spatial scale. All available evidence suggests an opposite expectation (Donovan et al. 1997), except in situations where forest-interior predators are the most important nest predators (e.g. Tewksbury et al. 1998). Given the Gray Catbird's preference for early successional habitats, the latter is unlikely, so we are left to conclude that the significant positive relationship between lambda and broad-scale landscape indices of fragmentation is a statistical artifact.

Mapping predicted source and sink habitat

Uncertainty surrounding assumptions required for the estimation of lambda (relating primarily to adult survival rates), and insufficient resolution in the relationship between lambda and landscape metrics of forest fragmentation across BBIRD sites, preclude the mapping of predicted source and sink habitat.

MANAGEMENT GUIDELINES

As a common, widely distributed species occupying early successional habitats, the Gray Catbird has generally benefited from anthropogenic forest fragmentation and a variety of silvicultural practices. In addition, it is largely unaffected by cowbird parasitism, and there is no indication that nest predation rates are subject to edge effects. At a continental scale, therefore, no active management is considered necessary. However, evidence of recent population declines in the southeastern United States warrants monitoring (Cimprich & Moore 1995).

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Given the Gray Catbird's sensitivity to moderate to high levels of grazing and browsing, management actions that reduce grazing/browsing pressure will benefit Gray Catbird populations, particularly in riparian habitats in the western United States.

FILLING THE GAPS – FUTURE RESEARCH AND MONITORING NEEDS

An accurate estimate of annual adult female survival rate is critical for the estimation of lambda. The available information suggests that Gray Catbird survival estimates should control for a potentially high degree of breeding dispersal, both within and between seasons, and for possible sex differences in breeding dispersal. Published survival

estimates have not controlled for these potential sources of bias, so should be treated with caution. A future study should determine adult female survival rate through intensive monitoring, over a period of at least five years, of a color-banded population occupying an area of high quality habitat where reproductive success is high, given that poor reproductive success may result in higher levels of breeding dispersal (e.g. Darley et al. 1977, Roth & Johnson 1993, Porneluzi & Faaborg 1999, Bayne & Hobson 2002).

Further data on nesting success in both small and large forest/shrubland patches in landscapes with differing extents of forest fragmentation at broad scales in different regions within the breeding range of the Gray Catbird are needed to improve resolution in our understanding of the influence of landscape structure on breeding productivity, and thus on the patterns of sources and sinks in the landscape. These data are not difficult to collect, requiring a sample of ideally at least 25 nests (to give a sample of at least 10 successful nests for a reliable estimate of mean number of host young fledged per successful nest) that are monitored frequently enough to accurately determine their fate, and collected from a plot, up to 50 ha in size, of homogenous habitat whose center can be geo-referenced with a precision of approximately 30 meters (to allow plot-specific landscape features to be characterized from a digital land cover map). If any nests are located within 100 m of a habitat edge, measurements of the distance between that nest and the nearest edge would be useful for investigating patch-scale edge effects.

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Figure 1. Gray Catbird laying season (number of new nests initiated each week) in relation to latitude. Laying season length estimated using the MacArthur index (Ricklefs 1966).

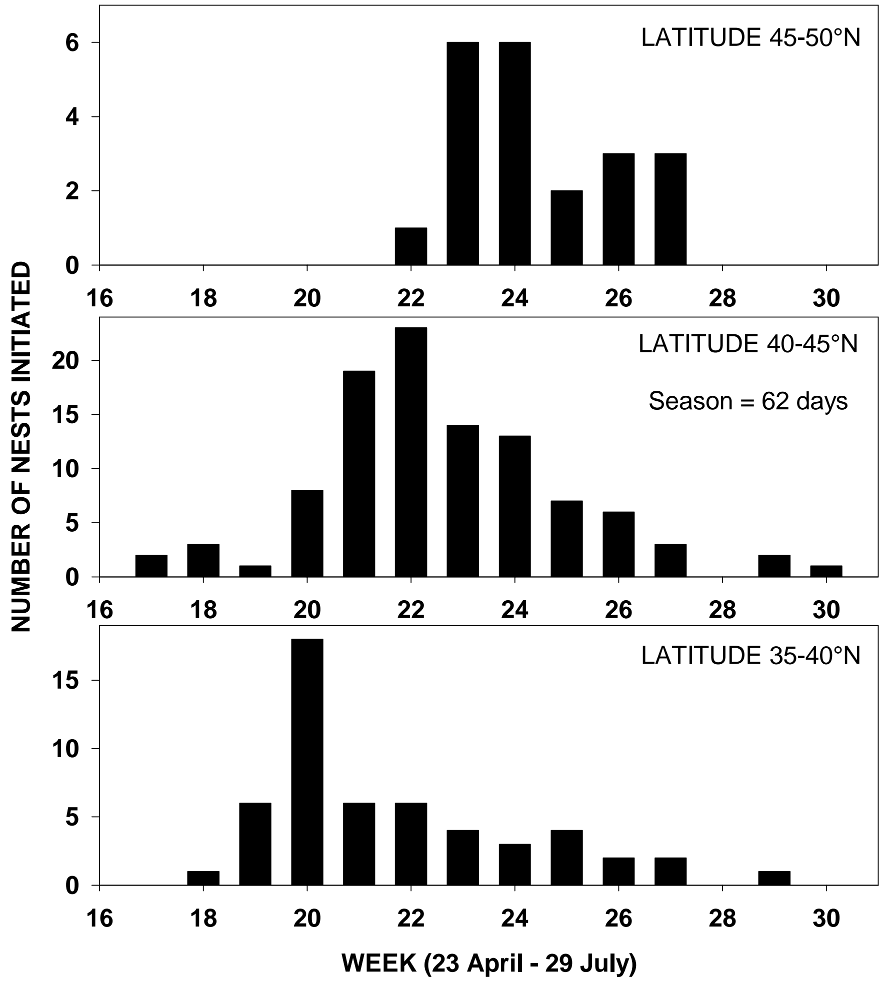

Figure 2. Relationship between lambda and various indices of forest fragmentation at spatial scales of the forest patch, within 1-10 km radii of plot centers (site averages), and within 50-100 km radii of site centers.