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A NEW POPULATION ESTIMATE FOR THE FLORIDA SCRUB JAY ON MERRITT ISLAND NATIONAL WILDLIFE REFUGE

DAVID R. BREININGER
The Bionetics Corporation, Mail Code BIO-2,
NASA, Biomedical Operations and Research Office,
John F. Kennedy Space Center, Florida 32899

Abstract.—The variable circular plot method was used to sample avifauna within different vegetation types determined from aerial imagery. The Florida Scrub Jay (*Aphelocoma coerulescens coerulescens*) population was estimated to range between 1,115 and 3,603 birds. Approximately half of the scrub and slash pine habitat appeared to be unused by Florida Scrub Jays, probably because the slash pine cover was too dense or the oak cover was too sparse. Results from the study suggest that the entire state population may be much lower than believed because the size of two of the three largest populations may have been overestimated.

The Florida Scrub Jay population has declined by nearly half the size it was a century ago due primarily to habitat destruction (Cox 1984, 1987) and has subsequently been listed as a threatened species by the U.S. Fish and Wildlife Service (hereafter USFWS). Habitat requirements include oak scrub with open sandy spaces and low or no tree cover (Westcott 1970, Woolfenden 1973, Breininger 1981, Cox 1984). The three largest population centers for the subspecies in Florida are found on the Merritt Island National Wildlife Refuge (hereafter MINWR), which comprises John F. Kennedy Space Center lands and waters not being used by the space program; Cape Canaveral Air Force Station (hereafter CCAFS); and Ocala National Forest. These areas are believed to contain over 80% of the known Florida Scrub Jay population which was estimated to be 15,600 to 22,800 birds in 1984 (Cox 1984, 1987).

The Florida Scrub Jay population on MINWR was first estimated in 1980 to be 2,616 to 4,777 birds by surveying 0.8 km transects located along roads, fire breaks, or other man-made edges and playing a tape of alarm calls for two minutes every 150 m (Salata unpublished). The maximum estimate was derived using transect widths of 336 m, and the minimum estimate was derived using transect widths of 524 m. Mean densities of

all transects were 16.7 birds/40 ha (maximum) and 9.2 birds/40 ha (minimum).

Strip plots and line transect procedures were used on MINWR by Breininger (1981) to investigate differences in Scrub Jay density estimates associated with different proportions of oak scrub vegetation and open space. Estimates along the 0.4 km transects ranged from 0.3 to 3.4 birds/ha. The estimates were not converted to birds/40 ha because high estimates were associated only with disturbed areas which were < 20 ha in size, and because it was suspected that those densities might not have represented carrying capacity.

Methods used in the initial MINWR survey (Salata unpublished) may have underestimated densities (Cox 1984, 1987). The extent of areas with high densities reported by Breininger (1981) was unknown during the statewide status and distribution survey (Cox 1984, 1987). Cox (1984, 1987) used a combination from both investigations to derive a population estimate for MINWR recognizing that there was no certain average density estimate. He used density estimates that ranged from 28 to 43 birds/40 ha for the various habitat types. The CCAFS population estimate was derived by assuming that densities on CCAFS were similar to MINWR, since no recent data on Florida Scrub Jay populations on CCAFS were available (Cox 1984, 1987).

A detailed vegetation map of MINWR has recently been prepared using aerial imagery (1:12000) that allows accurate determination of the acreage of scrub, slash pine, and disturbed scrub. In addition, avian community studies were conducted to characterize these cover types, which represent nearly all the Florida Scrub Jay habitat on MINWR. These data are used to reevaluate the population size of this threatened species on MINWR.

Study Area and Methods

Merritt Island National Wildlife Refuge in Brevard and Volusia counties, consisting of 57,000 ha of land and lagoonal waters, is located on the northern part of Merritt Island on the east coast of central Florida (Fig. 1). Merritt Island and the adjacent Cape Canaveral form a barrier island complex. The topography is marked by a sequence of ridges and swales reflecting relict beach ridges. Scrub and slash pine communities dominate much of the landscape. Oak scrub dominates the drier sites (greater depth to water table), while saw palmetto scrub dominates the wet end of a gradient (Schmalzer and Hinkle 1987). Over intermediate sites, dominance is mixed and the vegetation is termed oak/palmetto scrub. Scrub on MINWR differs from the intensively studied scrub at Archbold Biological Station in Highland County in several ways, including differences in vegetation composition and habitat structure (Schmalzer and Hinkle 1987). Slash pine on MINWR differs from scrub by having a pine overstory and a scrub understory that also occurs as a gradient from oak scrub to palmetto scrub. Disturbed scrub represents scrub that has had considerable clearing or other past mechanical disturbance and comprises scrub vegetation mixed with many openings which are seldom present in undisturbed scrub. A general policy of fire suppres-

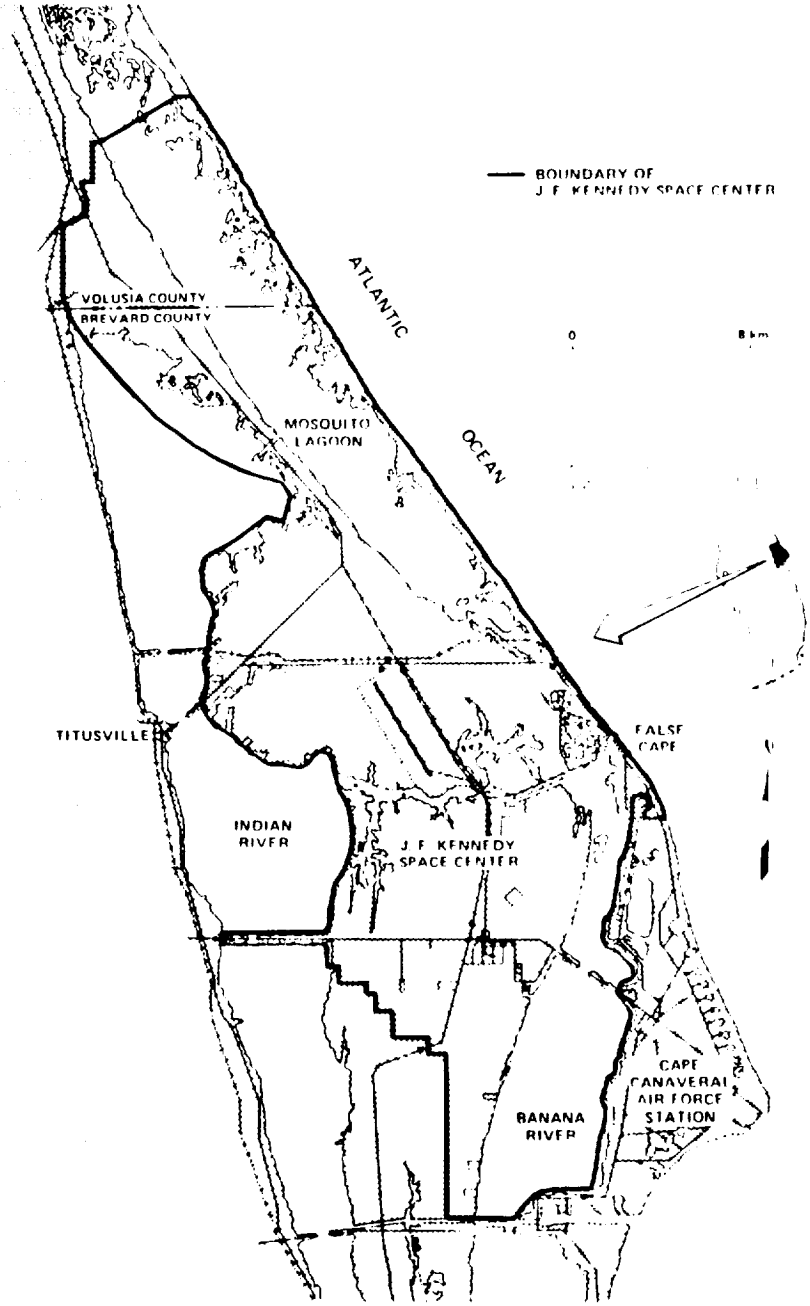

Figure 1. Boundary of John F. Kennedy Space Center which includes areas managed as Merritt Island National Wildlife Refuge.

sion was in effect at MINWR from 1963 until 1975, when the USFWS began a very limited prescribed fire program. After severe wildfires during 1981, a more extensive program was instituted to provide a three year cycle for most areas to reduce fuel loads and reduce the possibility of major wildfires.

The variable circular plot (VCP) method (Reynolds et al. 1980) was used to sample avifauna on MINWR beginning in February 1985 and ending in February 1986. The method was selected for its advantages for use in patchy habitat, for surveying large geographic areas, for comparisons of a large range of variation in vegetation, and for working in remote and rugged terrain. Eight stations were assigned to a route arranged in a roughly elliptical pattern with stations at least 200 m apart. There were 15 routes used to survey scrub, slash pine, hammocks, and swamps. The beginning and end stations were located near man-made edges. Nine stations were located in disturbed scrub, 29 stations in scrub, and 35 stations in slash pine (*Pinus elliottii*). Slash pine was sampled more intensely than scrub because of its greater variation in vegetation structure and composition.

Counts were made for seven minutes at each station; pause time was not used after arriving at a station since birds detected upon arrival were not always detected again (Anderson and Ohmart 1981). The distances were occasionally measured using a range finder to keep the observer calibrated. All Florida Scrub Jays heard also were sighted. Surveys were conducted between one half hour before sunrise and three hours after sunrise. No surveys were conducted during rain or windy conditions.

Each station was sampled eight times throughout the one year period. Stations were clumped into three classes according to their visibility for determination of the effective detection radius (R); recently burned (<4 yrs since last fire, average shrub height of 96 cm), unburned (>10 yrs since last fire, average shrub height of 186 cm, few openings in shrub layer), and mechanically disturbed habitat (>10 yrs since disturbance, average shrub height of 204 cm, numerous openings in shrub layer). The R-value was determined for each class by estimating the inflection point of a graph of the number of birds detected within 10 m concentric bands, according to criteria of Reynolds et al. (1980). The lowest R-value among the three visibility classes was selected to calculate density estimates for every station and to calculate estimates for the three cover types. Estimates of birds/ha were calculated by summing the number of birds detected within R, dividing by the number of samples (eight times the number of stations), dividing by the area within the circle with a radius of R, and multiplying by 10,000.

Results and Discussion

The percent of unsuitable habitat within scrub and slash pine was estimated using the percent of stations where no Florida Scrub Jays were sighted during any of the eight visits. At least half of the scrub and slash pine on MINWR appears to be unsuitable (Table 1). Stations without sightings of Florida Scrub Jays had numerous slash pine trees or sparse oak cover. Not all the stations with sightings of Florida Scrub Jays should be considered suitable for nesting because some of the remaining stations only had infrequent use and did not have characteristics described as preferred habitat (Westcott 1970, Woolfenden 1973, Breininger 1981, Cox 1984). Florida Scrub Jays were sighted at all disturbed scrub stations except one (Table 1).

Densities within prime scrub at Archbold Biological Station ranged from 11.1 to 14.6 birds/40 ha over a nine year period (Woolfenden and

Fitzpatrick 1984). Average density estimates for scrub and slash pine on MINWR (Table 1) are much lower as expected, since much of this habitat is unsuitable on MINWR. Disturbed scrub had higher densities than scrub and slash pine (Table 1) but this cover type composes <5% of the total Florida Scrub Jay habitat on MINWR. Only 3 of 73 stations had more than 1.0 birds/ha; two of these were within disturbed scrub, and one was along a man-made edge with dense oak cover.

This new estimate of approximately 2,500 Florida Scrub Jays on MINWR is several times lower than the previous estimate of 6,000 to 10,000 birds (Cox 1984, 1987). The 95% confidence interval is 1,115 to 3,603 birds. The new estimate is much lower than the previous estimate because the extent of areas with high densitites of Florida Scrub Jays is low and this information was unavailable to Cox (1984, 1987).

Verner (1985) critiqued avian counting techniques and concluded that total territory mapping of color-banded birds is the only method currently suitable for accurately estimating avian densities. An alternative approach to estimate the population is to divide the total estimated acreage of suitable habitat for the three cover types by an average territory size of 9 ha (Woolfenden and Fitzpatrick 1984) and multiply this value by 3, representing the 11 year average of the number of birds within territories at Archbold Biological Station (Woolfenden and Fitzpatrick 1984). This estimate is approximately 1,870 birds, which is between the 95% confidence limits. Although average group and territory size may be different on MINWR, this suggests that the new estimate is much more reasonable than an estimate of 6,000 to 10,000 birds. Group sizes averaged slightly higher than 3 birds and territories were slightly less than 9 ha in undisturbed scrub on MINWR using color-banded birds (Breininger and Smith, unpublished data). Group sizes were often larger than 3 and territory sizes were all less than half of the Archbold average territory size in an adjacent area of scrub mixed with large patches of mowed grass (Breininger and Smith, unpublished data). Only one study area and one breeding season were involved so it is probably not appropriate to use average values of group size and territory size at this time to represent scrub and slash pine on MINWR.

These findings suggest that not only is the MINWR population substantially lower than previously believed, but that the CCAFS population estimate may also be in error. The CCAFS population was estimated to be between 3,600 and 6,000 birds derived by assuming that densities on CCAFS were similar to MINWR, since no recent data on Florida Scrub Jays on CCAFS were available (Cox 1984, 1987). If one applies an average of 0.23 birds/ha to an estimate of 4,000 ha of scrub on CCAFS, one arrives at an estimate of only 920 birds. This assumes that average density value is similar for MINWR and CCAFS. Not only may densities

Table 1. Densities and population estimates of the Florida Scrub Jay on Merritt Island National Wildlife Refuge 1985 to 1986.

	Cover types		
	Scrub	Slash pine	Disturbed scrub
Proportion of stations used[1]	15/29	18/35	8/9
Estimate of birds/ha	0.23	0.20	0.63
Estimate of birds/10 ha	9.2	8.0	25.2
Range of densities (birds/ha)	0-2.2	0-1.0	0-1.8
Available habitat (ha)	6,527	3,558	451
Estimate of population	1,515	709	288
95% Confidence interval	498-2,532	361-1,057	116-460

[1]Stations having >1 sighting of a Florida Scrub Jay during 1 of 8 visits.

vary but the amount of suitable habitat may be different. If all habitat on CCAFS is assumed to be suitable, the average density might be twice the estimate at KSC suggesting a maximum estimate for CCAFS of 1,840 birds. These findings suggest that, since MINWR and CCAFS are believed to represent much of the entire population of the Florida Scrub Jay, the entire state population may be much smaller than is currently believed. A state population of 7,010 to 10,978 birds is derived by substituting the above estimates with previous figures (Cox 1984, 1987).

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