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MESH SIZE AS A FACTOR IN AVIAN COMMUNITY STUDIES USING MIST NETS

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Abstract.—This study tests the hypothesis that mist nets of different mesh size preferentially capture birds of differing masses. Species weighing <16 g were more frequently caught in 30 than 36 mm mesh nets, while species in the 16–25-g size category were equally likely to be caught in the 30 or 36 mm mesh nets. The species comprising the 26–50-g and >50-g categories were more often caught in 36 mm mesh nets.

ORIFICIOS DE TAMAÑO DIFERENTE, COMO FACTOR EN ESTUDIOS DE COMUNIDADES DE AVES EN DONDE SE UTILIZAN REDES

Sinopsis.—En este estudio se evalúa la hipótesis que redes con orificios de tamaño diferente capturan preferentemente aves de diferente masa corporal. Especies cuyo peso fue <16 g fueron capturadas con mayor frecuencia en redes de 30 mm que en redes de 36 mm, mientras que especies en la categoría de 16–25 g tuvieron la misma frecuencia de captura en ambos tipos de redes. Especies con peso entre las categorías de 26–50 g y >50 g fueron capturadas con mayor frecuencia en las redes de 36 mm.

Heimerdinger and Leberman (1966) found that mist net mesh size can greatly affect capture success of different-sized birds. Using 30 and 36 mm mesh sizes they demonstrated that bird size as quantified by Fish and Wildlife Service band sizes led to differential capture rates for the two mesh sizes. Species grouped by band sizes X, 0, and 1 were caught in significantly greater numbers in 30 mm nets. Similarly, species grouped by band sizes of 1B and larger were caught in significantly greater numbers in 36 mm nets. From these findings Heimerdinger and Leberman suggested that banders attempting to catch the broadest range of species use a variety of mesh sizes. Investigators focusing upon a single species should use the most efficient mesh size for the species. A corollary to these suggestions is that population samples using different size mist nets should not be compared.

Despite Heimerdinger and Leberman's (1966) work, many ornithologists still fail to report the mesh sizes of mist nets used in their studies. A literature search of several journals including *The Auk* (1977–1989),

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Ecology (1970–1979), and *Journal of Field Ornithology/Bird-Banding* (1979–1986) revealed twelve studies that used mist nets in the course of studies that compared relative abundance of species. The mesh sizes were reported in only three of these papers. In addition, twelve of thirteen studies of single species using mist nets failed to report mesh size, making replication of these studies impossible.

As many investigators ignore the possible results of using different mesh nets (i.e., skewed capture data and improper comparison of populations collected with different mesh sizes), we felt that Heimerdinger and Leberman's (1966) conclusions should be re-examined. Our study objective was to collect data for tropical bird species captured with nets of different mesh sizes and determine if capture ratios were different for different-sized birds.

STUDY AREA AND METHODS

The study was conducted at the El Verde Field Station of the Center for Energy and Environment Research, which lies in the Luquillo Experimental Forest in northeastern Puerto Rico. The study area is located in the lower montane wet forest life zone (Ewel and Whitmore 1973) at an elevation of 425 m. The dominant tree species is the tabonuco (*Dacryodes excelsa*), with sierra palm (*Prestoea montana*) and cacao motillo (*Sloanea berteriana*) also abundant. The mean annual rainfall at the El Verde Field Station is 346 cm, based on 15 yr of records (Brown et al. 1983).

Black mist nets (NEBBA, sizes HTX and ATX) were arranged in lines alternating 30 mm and 36 mm mesh size. The nets were placed in seven locations throughout the forest in lines of 4–20 nets in length. Sampling occurred between Sep. and Oct. 1980 (1632 net h), and from 4 to 20 Apr. 1990 (1130 net h).

Weight, wing chord, location, fat, breeding condition, age and time of day were recorded for each bird at the time of capture. The birds were then color banded and released.

Unlike Heimerdinger and Leberman (1966), who used band size to define classes, bird weights were used to divide the birds into different size categories. The groupings were: <16 g, 16–25 g, 26–50 g and >50 g.

Goodness-of-fit statistical analysis (Sokal and Rohlf 1981) was then used to test for a difference between numbers of captures for the two mesh sizes for each of the weight classes. *G*-tests were also performed upon the individual species (when sample size allowed) to determine whether a particular species was more likely to be caught in 30 or 36 mm mesh. Species are listed according to standard nomenclature (American Ornithologists' Union 1983).

RESULTS AND DISCUSSION

A total of 530 birds representing 17 species was captured (Table 1). Two-hundred ninety-seven (56%) were caught in the 30 mm nets and 233 (44%) were caught in the 36 mm nets. Statistical analysis across the

TABLE 1. Capture ratio of species within weight classes (g). (Average masses from W. J. Arendt and J. M. Wunderle, unpubl. data.)

Weight class/species	Mean mass (n)	# captures 30 mm	# captures 36 mm	G-test[a]
<16 g				
Black-faced Grassquit (*Tiaris bicolor*)	9.8 (32)	1	1	—
Bananaquit (*Coereba flaveola*)	10.2 (47)	106	58	***
Black-throated Blue Warbler (*D. caerulescens*)	9.3 (21)	4	1	—
Green Mango (*Anthracothorax viridis*)	6.8 (11)	4	2	—
Puerto Rican Emerald (*Chlorostilbon maugaeus*)	3.2 (26)	31	11	**
Puerto Rican Tody (*Todus mexicanus*)	6.5 (31)	45	21	**
Total		191	94	***
Pooled				***
Heterogeneity				ns
16–25 g				
Black-whiskered Vireo (*Vireo altiloquus*)	20.4 (24)	32	23	ns
Louisiana Waterthrush (*Seiurus motacilla*)	18.8 (10)	1	1	—
Ovenbird (*Seiurus aurocapillus*)	20.3 (2)	1	0	—
Total		34	24	ns
26–50 g				
Puerto Rican Bullfinch (*Loxigilla portoricensis*)	37.8 (43)	3	9	+
Puerto Rican Tanager (*Nesospingus speculiferus*)	35.4 (26)	30	47	+
Puerto Rican Woodpecker (*Melanerpes portoricensis*)	68.1 (18)	1[b]	0	—
Stripe-headed Tanager (*Spindalis zena*)	31.3 (22)	2	2	—
Total		36	58	*
Pooled				*
Heterogeneity				ns
> 50 g				
Pearly-eyed Thrasher (*Margarops fuscatus*)	107.6 (139)	2	10	*
Puerto Rican Lizard-Cuckoo (*Saurothera vieilloti*)	75.6 (6)	0	2	—
Red-legged Thrush (*Turdus plumbeus*)	80.2 (27)	8	9	ns
Ruddy Quail-Dove (*Geotrygon montana*)	148.7 (14)	26	36	ns
Total		36	57	+
Pooled				*
Heterogeneity				ns

[a] — = sample size too small for analysis. ns = $P > 0.1$. + = $0.1 > P > 0.05$. * = $0.05 > P > 0.01$. ** = $0.01 > P > 0.001$. *** = $0.001 > P$.

[b] This Puerto Rican Woodpecker weighed 41.8 g when captured.

weight classes using all captures revealed a significant difference in the capture numbers for the two mesh sizes (G-total = 45.388, $P < 0.001$). The G-total value is comprised of a G-pooled value (7.748, $P < 0.01$) and a G-heterogeneity value (37.640, $P < 0.001$), however. The G-pooled value indicated that there was a statistically significant difference in the

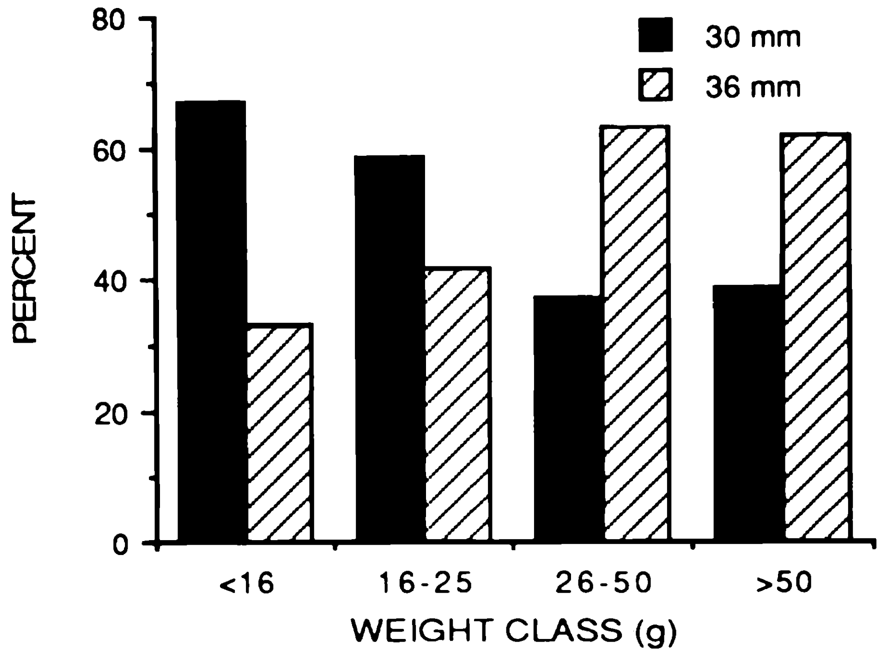

FIGURE 1. Percentage of birds captured in 30 mm and 36 mm mesh nets within weight classes.

capture numbers for the two mesh sizes, but the *G*-heterogeneity value indicated that the direction of the difference in capture numbers was not homogeneous across the weight classes (Fig. 1).

We found that for the <16-g weight class each species and all species pooled deviated from the expected 1:1 capture ratio. The magnitude and direction of deviation was the same for the three species in the weight class; the Bananaquit (*Coereba flaveola*), Puerto Rican Emerald (*Chlorostilbon maugaeus*) and Puerto Rican Tody (*Todus mexicanus*) were all caught in significantly greater numbers in the 30 mm mesh than in the 36 mm nets (Table 1).

Analysis of the 16–25-g weight class revealed that Black-whiskered Vireos (*Vireo altiloquus*) were not caught preferentially in either size net (Table 1). In the 26–50 g weight class each species deviates from the expected 1:1 ratio. Magnitude and direction of the deviation are the same for the two most commonly caught species in the class, the Puerto Rican Bullfinch (*Loxigilla portoricensis*) and the Stripe-headed Tanager (*Spindalis zena*), which were caught more often in the 36 than in the 30 mm mesh nets (Table 1). The species comprising the >50-g weight class gave mixed results. Only Pearly-eyed Thrashers (*Margarops fuscatus*) were caught in significantly greater numbers in the 36 than in the 30 mm nets. When the data are pooled, however, species of this size category were caught more frequently in 36 than in 30 mm nets (Table 1). One possible reason for this lack of a clear pattern may be that both of the mesh sizes used were too small to catch some species in this size class efficiently. Ruddy Quail-Doves (*Geotrygon montana*) and Red-legged Thrushes (*Turdus plumbeus*) were often not entangled in the nets but only hung in the net pocket. On several occasions they were observed moving along the pocket until they reached the end of the net and escaped.

It is generally recognized that many factors, such as time of day, habitat, weather, net color and deployment, affect the capture rates of birds by mist nets (Karr 1979, 1981). Given the importance of mesh size (Heimerdinger and Leberman 1966, Karr 1979) and the propensity of investigators to ignore mesh size, however, investigators need to be aware of the relative efficiencies of different mesh sizes.

The tropical bird species in this study, as with the temperate bird species in Heimerdinger and Leberman (1966), were caught differentially in 30 or 36 mm mesh nets depending on the size of the bird. Thus, ornithologists should choose the mesh size based upon the purpose of the study. Mist nets are imperfect tools for avian community studies, and ignoring the known biases of different size mesh reduces the value of data generated in these studies. At the very least, mesh size should be reported routinely in the description of mist netting methodology to enable other researchers to compare data through time and in different habitats.

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COMMITTEE FOR THE NATIONAL INSTITUTES FOR THE ENVIRONMENT

The Committee for the National Institutes for the Environment has opened a Washington office to spearhead efforts to establish a National Institutes for the Environment (BioScience 40(8):567). Dr. David E. Blockstein has been appointed as Director of the Washington office. Dr. Blockstein, an ornithologist, was the 1987-1988 Congressional Science Fellow for AIBS and the American Society of Zoologists where he worked on national legislation to conserve biological diversity. Most recently Dr. Blockstein was a project associate for women and minority affairs for AIBS. Dr. Blockstein earned a M.S. in 1982 and Ph.D. in 1986 in ecology and behavioral biology at the University of Minnesota.

The NIE proposal is an effort to expand greatly environmental research and education through a new funding agency that would support competitively-awarded mission-oriented environmental research. Of the $9 billion in federal extramural support for science, 11% goes to environmental sciences (broadly defined). This amount could be increased and the results of this research made more applicable to solving environmental problems through an interdisciplinary agency, analogous to the National Institutes of Health. The present proposal is to set up a series of problem-oriented institutes that would support competitively-awarded mission-oriented environmental research. Legislation to have the National Academy of Sciences study the NIE concept is presently moving through Congress. The plan for the NIE is still in an early conceptual stage. Environmental scientists who are interested in having input in the process should contact Dr. David E. Blockstein, Director of the Washington office of the NIE Committee. The office is housed at the American Institutes for Biological Sciences building, 730 11th St. NW, Washington, DC 20001-4521; phone 202-628-4303; fax 202-628-4311.