MESH SIZE AND BIRD CAPTURE RATES IN MATO GROSSO DO SUL STATE, BRAZIL

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(With 2 figures)

ABSTRACT

Mist-nets alternating 36-mm and 61-mm mesh in woods and low vegetation of "cerrado" (Brazilian savanna) tested bird-capture efficiency relative to bird length and mass. Of 1,296 birds captured and 102 species, 785 (93 species) were with 36-m mesh and 511 (69 species) with 61-mm mesh. The 61-mm mesh improved capture rates only for some larger species; so, in general, 36-mm mesh mist-nets are more appropriate for field work in "cerrado" areas.

Key words: Central Brazil, Cerrado, mesh size, mist nets.

RESUMO

Tamanho de malhas e taxas de capturas de aves no Estado de Mato Grosso do Sul, Brasil

Este trabalho teve por objetivo comparar a eficiência na captura de aves, relativamente à massa corporal e ao comprimento total, de redes ornitológicas de malhas de 36 e 61 mm. O estudo foi realizado em área de Cerrado, dispondo-se as redes alternadamente em transectos lineares. Das 1.296 capturas e 102 espécies, 785 (93 espécies) foram efetuadas com redes de 36 mm e 511 (69 espécies) com redes de malha de 61 mm. De modo geral, as últimas redes não aumentaram as taxas de capturas, exceto para as espécies maiores e com maior massa corporal, e as redes de malha de 36 mm seriam mais apropriadas para estudos em área de Cerrado.

Palavras-chave: Brasil Central, Cerrado, tamanhos de malha, redes ornitológicas.

INTRODUCTION

Mist nets have often been used for bird studies, and their results compared with other methods (e.g., Ralph *et al.*, 1993; Rappole *et al.*, 1998; Poulin *et al.*, 2000). Rappole *et al.* (1998) have proposed a methodology that combines two procedures (*mist nets* and *point counts*) to provide a more accurate assessment of avian habitat use. According to Poulin *et al.* (2000), while point counts are less demanding in the field, the manipulation of netted birds allows documentation of various aspects of their biology. However, a lot of restrictions concerning mist-net use were listed by Remsen & Good (1996).

When mist nets are employed, the question arises as to which mesh size produces more captures per hour, since one reason why an individual cannot be sampled is its size; it can be too big or too small to get tangled in nets (MacArthur & MacArthur, 1974). Jenni *et al.* (1996) determined capture efficiency of 36-mm-mesh by observing birds flying towards the nets in various habitats. They concluded that different species (morphology and body mass) and climatic conditions (wind, shade) can provide different capture rates for 36-mm nets.

Some authors have also examined mesh size as a factor affecting bird capture rates (e.g., Heimerdinger & Leberman, 1966; Pardieck & Waide, 1992).

With this objective, Karr (1981) indicated that 36-mm-mesh nets were the most effective ones for a wide range of birds encountered in most terrestrial habitats, and these have been most frequently used (Karr, 1980; Blake & Loiselle, 1991; Loiselle & Blake, 1994). Pardieck & Waide (1992) observed however, that in most works involving mist-net captures, mesh size is not mentioned. From 25 studies on birds, using mist nets that the authors reviewed, in only four of them mesh size was specified. In more recent works, one can find a similar situation; as it has been exemplified by Young *et al.* (1998) for Costa Rican birds; Silkey *et al.* (1999) for Californian birds; Reinert *et al.* (1996), Marini *et al.* (1997), Oniki & Willis (1999) and Stratford & Stouffer (1999) (the four latter about Brazilian birds).

The goal of the present study was to compare bird capture efficiency of two mesh sizes (36 and 61 mm) in areas of *cerrado* and some other habitats of Mato Grosso do Sul State, Central Brazil.

MATERIALS AND METHODS

From ten to sixteen 36- and 61-mm-mesh mist-nets were alternately spaced for 28 months (August 1994 to December 1996) in linear transects.

All nets had the same dimension (12 x 2 m) and were operated for the same length of time (usually from 5:30 am to 3:00 pm) in 14 locations. These study plots were located on large eucalyptus plantations outside the cities of Brasilândia (21º25'S; 52º03'W), with three study sites; Selvíria (20º36'S; 51º41'W), with two study sites; and Três Lagoas (20º75'S; 51º67'W), with nine study sites. Eucalyptus plantations belong to the paper manufacture and cellulose products industry, and large plantations of this exotic species coexist with fragments of native vegetation.

The fourteen study sites sampled five different vegetation types, with varying degrees of human disturbance: "cerrado" *strictu sensu* (five study sites – 3,750 net-hours); "cerradão" – a closed-canopy tall *cerrado* (five study sites – 5,300 net-hours); gallery forest (one study site – 2,370 net-hours); degraded second-growth forest (one study site – 710 net hours), and eucalyptus plantations with and without understory (two study sites – 1,400 net-hours). Although sampling effort varied between study sites, both 36-mm and 61-mm mesh nets were always simultaneously used in equal numbers. Chi square tests were used to check statistical significance of different capture rates, and Yates' Correlation was used when there were only two categories in a distribution (Fowler & Cohen, 1995). All captured birds were banded with bands supplied by Cemave/Ibama.

For alternating 36- and 61-mm mesh nets, I compared captures relative to bird length (measured by means of a metal ruler) and body mass (measured with 50-, 100-, 300-, and 1000 g spring scales). The term "efficiency" is used here to indicate the mesh size that has captured the number of individuals of each species per unit of effort.

RESULTS AND DISCUSSION

In 13,468 net-hours, I captured 1,296 birds: 785 (60.6%), with 36-mm, and 511 (39.4%), with 61-mm mesh ($\chi^2 = 28.96$; d.f. = 1; p = 0.01). Of 102 captured species, 93 were caught by 36-mm mesh (91.2% of the total), while nets of larger mesh captured 69 species (67.6%) ($\chi^2 = 3.56$; d.f. = 1; p = 0.1).

The smaller mesh nets captured most individuals and species (Table 1). *Platyrhynchus mystaceus*, one of the smallest species, was only captured with 36-mm mesh nets. However, for some larger species, the 61-mm mesh was more efficient. This is the case of *Piaya cayana* (only captured with these nets), *Momotus momota*, some doves (*Leptotila verreauxi*, *L. rufaxilla* and *Claravis pretiosa*), and Passeriformes (*Taraba major* and *Automolus leucophthalmus*).

For 12 species, differences in capture rates were statistically significant. Ten species were more captured with 36-mm mesh: *Cnemotriccus fuscatus* ($\chi^2 = 13.60$; p = 0.01) *Basileuterus flaveolus* ($\chi^2 = 5.94$; p = 0.05), *Amazilia fimbriata* ($\chi^2 = 4.00$; p = 0.05), *Camptostoma obsoletum* ($\chi^2 = 5.82$; p = 0.05), *Hemitriccus margaritaceiventer* ($\chi^2 = 5.06$; p = 0.05), *Vireo chivi* ($\chi^2 = 4.92$; p = 0.05), *Platyrhynchus mystaceus* ($\chi^2 = 10.8$; p = 0.01), *Poecilurus scutatus* ($\chi^2 = 7.69$; p = 0.01), *Pipra fasciicauda* ($\chi^2 = 10.41$; p = 0.01), and *Dysithamnus mentalis* ($\chi^2 = 9.33$; p = 0.01). Only two species were captured more with 61-mm mesh: *Piaya cayana* ($\chi^2 = 9.14$; p = 0.01) and *Leptotila verreauxi* ($\chi^2 = 8.47$; p = 0.01). This suggests that the 36-mm mesh nets were more efficient for several captured species.

TABLE 1
Number of captures (except recaptures) and species with 36- and 61-mm mesh, with mean body mass (g) and mean total length (mm). See Piratelli *et al.* (2001) for more morphological data.

Species	Mean body mass (g)	Mean total length (mm)	36 mm	61 mm
Crypturellus tataupa	–	207.5	0	2
Rupornis magnirostris	–	–	1	0
Columbina minuta	–	–	1	0
Columbina talpacoti	49.7	167.4	5	9
Claravis pretiosa	54.3	183.9	6	11
Leptotila rufaxilla	144.8	249.1	7	12
Leptotila verreauxi	157.7	259.5	3	14
Geotrygon montana	–	180.0	1	0
Piaya cayana	111.9	474.2	0	7
Coccyzus melacoryphus	44.0	255.5	1	1
Glaucidium brasilianum	64.0	162.0	0	1
Nyctidromus albicollis	–	275.0	2	0
Hydropsalis torquata	–	290.0	0	1
Phaethornis pretrei	–	–	1	0
Colibri serrirostris	6.5	108.0	1	0
Chrysolampis mosquitus	–	–	1	0
Thalurania furcata	4.8	99.3	3	0
Chlorostilbon aureoventris	4.5	85.5	1	1
Hylocharis chrysura	3.2	85.7	4	0
Amazilia fimbriata	4.3	90.2	8	1
Anthrachotorax nigricollis	–	–	1	0
Chloroceryle americana	36.8	198.0	2	0
Momotus momota	112.6	387.9	31	43
Brachygalba lugubris	17.5	165.0	2	0
Galbula ruficauda	25.1	215.5	3	1
Nystalus maculatus	42.5	179.7	2	6
Nonnula rubecula	16.6	145.9	6	6
Monasa nigrifrons	92.0	277.4	2	3
Picumnus cirratus	10.0	120.0	1	0
Picumnus guttifer	12.8	96.5	1	1
Picumnus sp.	–	–	3	0
Colaptes melanochloros	–	226.5	1	1
Veniliornis passerinus	30.5	142.8	3	1
Campephilus melanoleucos	–	–	1	0
Taraba major	53.6	209.1	4	8
Thamnophilus doliatus	29.1	162.3	6	8
Thamnophilus punctatus	19.3	137.6	49	31
Dysithamnus mentalis	14.0	108.1	18	3
Formicivora rufa	10.8	141.0	2	0

TABLE 1 (*Continued*)

Species	Mean body mass (g)	Mean total length (mm)	36 mm	61 mm
Synallaxis frontalis	15.5	145.0	4	1
Synallaxis albescens	12.5	–	1	0
Poecilurus scutatus	13.7	136.4	12	1
Cranioleuca vulpina	20.5	140.0	0	1
Automolus leucophthalmus	30.7	175.5	4	6
Sittasomus griseicapillus	18.8	146.4	13	11
Dendrocolaptes picumnus	62.0	265.0	0	1
Dendrocolaptes platyrostris	58.4	253.1	9	6
Campylorhamphus trochilirostris	–	241.0	2	6
Xiphorhynchus guttatus	34.0	258.0	1	0
Lepidocolaptes angustirostris	28.7	192.5	6	6
Myiopagis viridicata	9.9	121.5	4	0
Camptostoma obsoletum	9.6	112.1	10	1
Elaenia flavogaster	–	–	2	3
Elaenia parvirostris	15.7	132.3	2	2
Elaenia mesoleuca	15.6	136.3	6	2
Serpophaga subcristata	–	–	2	0
Phyllomyias fasciatus	–	–	1	0
Leptopogon amaurocephalus	11.4	125.4	8	4
Corythopis delalandi	–	–	5	3
Hemitriccus margaritaceiventer	9.0	103.1	12	3
Tolmomyias sulphurescens	11.0	128.0	1	0
Platyrhynchus mystaceus	9.6	89.9	12	0
Myiophobus fasciatus	–	–	1	0
Cnemotriccus fuscatus	13.8	33.9	58	24
Casiornis rufa	20.6	164.4	21	16
Myiarchus ferox	24.0	178.0	0	1
Myiarchus tyrannulus	26.5	183.7	18	16
Pitangus sulphuratus	–	225.8	3	2
Myiodynastes maculatus	47.2	213.1	4	5
Empidonomus varius	26.6	171.6	2	3
Tyrannus melancholicus	–	–	1	1
Pachyramphus polychopterus	19.0	144.0	2	1
Tityra cayana	75.0	213.0	0	1
Lathrotriccus euleri	16.6	138.3	4	2
Pipra fasciicauda	15.7	104.2	47	20
Antilophia galeata	21.8	154.3	2	1
Neopelma pallescens	20.5	144.0	2	0
Cyanocorax chrysops	140.3	336.3	5	6

TABLE 1 (*Continued*)

Species	Mean body mass (g)	Mean total length (mm)	36 mm	61 mm
Polioptila dumicola	6.5	120.0	1	0
Turdus nigriceps	49.0	194.0	1	0
Turdus leucomelas	66.7	222.0	44	35
Turdus amaurochalinus	57.1	216.1	23	27
Cyclarhis gujanensis	28.8	150.5	13	6
Vireo chivi	15.3	124.2	11	2
Basileuterus flaveolus	13.9	137.0	103	43
Basileuterus hypoleucus	10.3	117.2	5	0
Thlypopsis sordida	14.0	130.0	2	1
Eucometis penicillata	26.8	174.7	11	5
Tachyphonus rufus	31.2	178.3	19	10
Trichothraupis melanops	19.5	149.0	0	1
Habia rubica	12.0	150.0	1	0
Piranga flava	24.0	185.0	1	0
Ramphocelus carbo	–	173.0	1	0
Thraupis sayaca	30.1	151.0	4	1
Thraupis palmarum	40.5	170.0	2	1
Tangara cayana	22.0	129.3	3	1
Zonotrichia capensis	14.8	138.5	2	0
Oryzoborus angolensis	12.0	122.0	2	0
Arremon flavirostris	23.5	149.2	4	5
Coryphospingus cucullatus	15.6	132.8	10	3
Saltator similis	43.1	202.7	42	38
Total of captures			785	511
Total of species			93	69

The 36-mm mesh nets captured birds from 10 to 450 mm long (mean = 164 mm, s.d. = 64.7), while the 61-mm mesh captured birds from 83 to 490 mm long (mean = 199 mm, s.d. = 80.3). Both meshes were more efficient for birds between 100 and 149 mm long, and the 61-mm mesh captured more individuals over 250 mm long (Fig. 1).

Birds with body masses from 2.5 g to 265 g were captured with 36-mm mesh (mean = 24.5 g, s.d. = 25.5). With 61-mm mesh, body masses ranged between 4.5 g and 186 g (mean = 36 g, s.d. = 33.8). Both mesh sizes were effective for birds in the 10-20 g range, even though the 36-mm mesh captured more birds. For birds over 30 g, both meshes captured similar numbers and, in these cases, sometimes the 61-mm mesh was more efficient (Fig. 2).

Although I have found that bird length is related to mesh capture rates, Jenni *et al.* (1996) indicate that body mass and cranium size are more useful measures than the total length for determining the capture rates, since individuals' capture probability is directly related to head entanglement. Most birds were 10-20 g in three previous studies in southern Brazil (Reinert *et al.*, 1996; Marini *et al.*, 1997; Oniki & Willis, 1999).
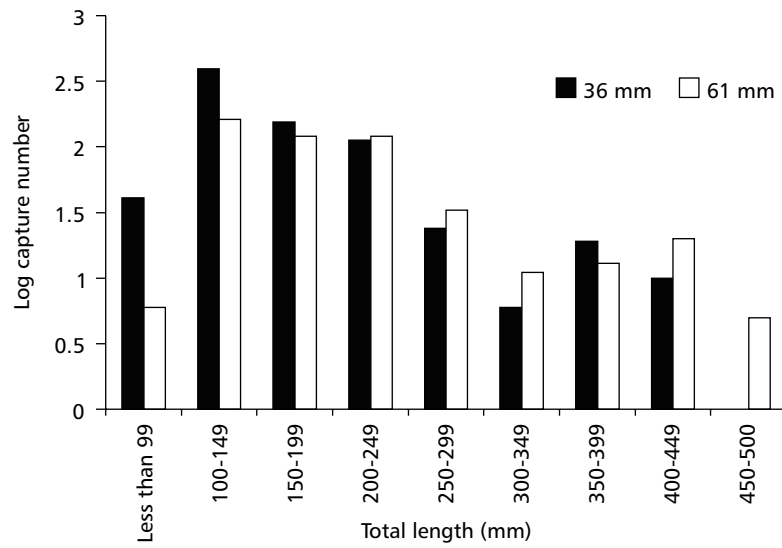
Fig. 1 — Bird total length (mm) and number captured (data transformed in $\log_{10}$) with 36 and 61-mm-mesh mist nets.
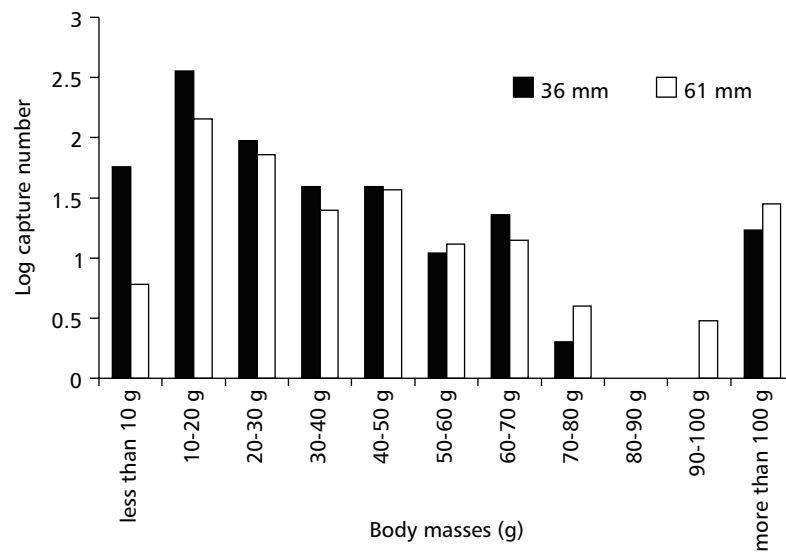

Fig. 2 — Bird body masses (g) and number captured (data transformed in $\log_{10}$) with 36 and 61-mm-mesh mist nets.

The simultaneous use of two nets has the advantage of improving the abundance estimates for some larger species. In relation to species diversity, the isolated use of smaller mesh nets would produce almost the same results as the simultaneous use of two mesh sizes, at least in these "cerrados" and nearby areas.

By using only 36-mm mesh one can increase the capture rate, particularly when there is a greater density of small birds, which is almost always the case in tropical-forest understories. For bigger, heavier species, the 61-mm mesh would substantially improve capture rates.

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