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.

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).

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.
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 (21º25’S; 52º03’W), with nine 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 terrestrial habitats, and these have been most frequently used (Fowler & Cohen, 1995). All captured birds were banded with bands supplied by Cemave/Ibama.

In 13,468 net-hours, I captured 1,296 birds: 785 (60.6%), with 36-mm, and 511 (39.4%), with 61-mm mesh (χ^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%) (χ^2 = 3.56; d.f. = 1; p = 0.1).

The smaller mesh nets captured most individuals and species (Table 1). Platyrhinchus 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 (χ^2 = 13.60; p = 0.01) Basileuterus flavoeolus (χ^2 = 5.94; p = 0.05), Amazilia fimbriata (χ^2 = 4.00; p = 0.05), Camptostoma obsOLETum (χ^2 = 5.82; p = 0.05), Hemitriccus margaritaceiventer (χ^2 = 5.06; p = 0.05), Vireo chivi (χ^2 = 4.92; p = 0.05), Platyrhinchus mystaceus (χ^2 = 10.8; p = 0.01), Poecilurus scutatus (χ^2 = 7.69; p = 0.01), Pipra fasciaCauda (χ^2 = 10.41; p = 0.01), and Dysithamnus mentalis (χ^2 = 9.33; p = 0.01). Only two species were captured more with 61-mm mesh: Piaya cayana (χ^2 = 9.14; p = 0.01) and Leptotila verreauxi (χ^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 Pirizelli 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     |
| Glaucidiurn 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 mosquitos   | –                  | –                      | 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 nigrinollis| –                | –                      | 1     | 0     |
| Chloroceryle americana   | 36.8               | 198.0                  | 2     | 0     |
| Monotus monota           | 112.6              | 387.9                  | 31    | 43    |
| Brachygalba lugubris     | 17.5               | 165.0                  | 2     | 0     |
| Galbula ruficauda        | 25.1               | 215.5                  | 3     | 1     |
| Nyctalus 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     |
| 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     |
| Antimonus 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     |
| Seriphaga subcristata      | –                  | –                      | 2     | 0     |
| Phyllomyias fasciatus      | –                  | –                      | 1     | 0     |
| Zeptopogon amaurocephalus  | 11.4               | 125.4                  | 8     | 4     |
| Corythopis delalandi       | –                  | –                      | 5     | 3     |
| Hemiriculus margaritaceventer | 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 fasciatus     | 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     |
| Empidonum varius           | 26.6               | 171.6                  | 2     | 3     |
| Tyrannus melancholicus     | –                  | –                      | 1     | 1     |
| Pachyramphus polychopterus | 19.0               | 144.0                  | 2     | 1     |
| Tiryna cayana              | 75.0               | 213.0                  | 0     | 1     |
| Lathrotriccus euleri       | 16.6               | 138.3                  | 4     | 2     |
| Pipra fasciicauda          | 15.7               | 104.2                  | 47    | 20    |
| Antilophia pallescens      | 21.8               | 154.3                  | 2     | 1     |
| Neopelma pallescens        | 20.5               | 144.0                  | 2     | 0     |
| Cyanocorax chrysops        | 140.3              | 356.3                  | 5     | 6     |

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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).

### 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 guianensis     | 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     |
| Eucromis penicillata     | 26.8               | 174.7                  | 11    | 5     |
| Tachyphonus rufus        | 31.2               | 178.3                  | 19    | 10    |
| Trichoathraupis 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    |
**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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