A TECHNIQUE FOR ESTIMATION OF BARN OWL (*TYTO ALBA STERTENS* Hartert, 1929) PREY BIOMASS WITH SPECIAL REFERENCE TO MANDIBLE LENGTH-BODY WEIGHT RATIO OF SMALL MAMMALS

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ABSTRACT

An investigation was made to study the relationship between mandible length and body weight in six species of small mammals, which are the chief prey base of the Barn Owl *Tyto alba*. Regression equations for four species of rodent pests, *B. bengalensis*, *M. meltada*, *T. indica* and *R. rattus* are given for the quantification of prey biomass by using mandible length as a function of body weight. The prey biomass for *S. murinus* (40g) and *M. booduga* (12g) can be estimated by using mean body weight values.

KEYWORDS

Barn Owl, *Bandicota bengalensis*, *body weight*, *mandible length*, *Millardia meltada*, *Mus booduga*, prey biomass, *Rattus rattus*, small mammals, *Suncus murinus*, *Tatera indica*, *Tyto alba*

Owls are in general highly beneficial birds of prey to mankind since they are rodent hunters. They hunt rodents at night and help to keep in check the populations of these mammals. Among the owls, Barn Owls have global distribution matched by few other species in the world (Burton, 1984; Taylor, 1994), with 36 subspecies distributed throughout the world (Taylor, 1994). In the Indian subcontinent there are two known subspecies, *Tyto alba stertens* in peninsular India and *Tyto alba de-roepstroffi*, a rare subspecies restricted to the southern Andaman Islands of the Indian Ocean (Bunn *et al.*, 1982; Ali & Ripley, 1983; Taylor, 1994).

The literature reviews on major diet of barn owls from six continents were reported to be rodents, the most important small mammalian group. Out of 52 key studies, analysed on Barn Owl's diet by Taylor (1994), the rodents constituted more than 50% of all prey items in 47 studies and they formed more than 75% of all prey items by number in 33 studies, suggesting thereby that Barn Owls are excellent rodent hunters in nature.

The results of average daily food requirements of Barn Owls under wild conditions have shown that in two studies, they required more than 75g prey/day (Taylor, 1994; Kanakasabai *et al.*, 1998); and in one study (Kanakasabai *et al.*, 1998) their requirements were more than 100g/day, indicating that Barn Owls are potential rodent eaters in nature.

The predatory pressure of Barn Owls over different prey spectrum was studied by an indirect method, namely, the regurgitated pellet analysis, which is a reliable technique than other techniques as far as owls are concerned (Errington, 1932; Glading *et al.*, 1943) and particularly for Barn Owls (Marti, 1987). The pH of the Barn Owl's stomach is higher (less acidic) than that of many other predatory birds and hence most of the bones of ingested prey are left undigested (Smith & Richmond, 1972). Further, the skulls and mandibles of even the most delicate small mammal and bird prey are found intact in the pellets and can easily be identified (Taylor, 1994).

According to Marti (1987), both prey frequency and biomass quantification methods are equally valuable because the former provides better information on the relative impact of a raptor upon various prey species, while the latter may give a more accurate evaluation of the relative importance of different prey species in the diet.

The prey biomass quantification involves two methods. The first method is to utilize the mean body weight of respective prey species (Marti, 1987). Quantification of prey biomass by using standard log-log regression equations of right/left mandible length as a function of body weight (Hamilton, 1980) is the second method. It is understood from the review of literature that there is no published information on quantification of prey biomass by using mandible length as a function of body weight and hence the present study was conducted with the following objective, *i.e.*, to study the relationship between mandible length and body weight in six species of small mammals.

MATERIALS AND METHODS

Six adult and six sub-adult Barn Owls (approximately 8-12 months old) were captured from the temple towers of Mayiladuthurai (11°2'N-79°49'E) Tamil Nadu, India. They were brought to the aviary and were kept in individual cages. The size of each cage was 3ft x 3ft x 3½ft. Adequate care was taken to have smooth surface on both inside and outside the cages in order to avoid any physical injury to the caged animals. Of the birds, four healthy adults (mean = 382.50g; range = 375-390g) and four normal sub-adults ($\overline{X}$ = 413.75g; range = 410-420g) were employed for this study.

In previous studies, the diet of Barn Owl comprising of small mammals were to the tune of 98.18% (Neelanarayanan *et al.*, 1995) and 90.5% (Santhanakrishnan, 1995) prompting me to study *Bandicota bengalensis*, *Millardia meltada*, *Mus booduga*, *Tatera indica*, *Rattus rattus* and *Suncus murinus* as small mammal representatives for prey biomass estimation by using the mandible or lower jaw or dentary bone as a function of body weight. The rodents/insectivore were provided to the four individually caged adult Barn Owls with a body weight of 10g-interval ranging from 10g to 200g for *B. bengalensis*; 10g to 90g for *M. meltada*, 10g to 180g for *T. indica*; 10g to 180g for *R. rattus*; and 10g to 60g for *S. murinus*. As for *M. booduga* 10g and 15g animals were given to the caged Barn Owls. For every 10g weight category of each species, a minimum of three and up to a maximum of six rodents were used. The mean length

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values of mandibles were taken for representing each 10g weight category. The following day the regurgitated pellets were collected, oven dried, labelled (species and weight of the prey given with date) and bagged. They were analysed individually by using 8% NaOH as suggested by Neelanarayanan *et al.* (1998) for obtaining the mandibles. The mandibular length was measured between incisor socket and condyle / angular process using a vernier caliper with 0.1mm accuracy. The regression of body weight (Y) on mandible length (x) was calculated separately for six species of small mammals as suggested by Morris (1979).

Results and Discussion

Mandible length and prey weight relationship

The regression lines of four species of small mammals *viz.*, *B. bengalensis*, *M. meltada*, *T. indica* and *R. rattus* showed a linear relationship between the two variables *viz.*, mandible length and prey body weight. This can be noticed from Figs. 1-4 that the points are close to the line indicating a close relationship between mandible length and prey body weight.

The regression equations for mandible length and prey body weight of four species of small mammals are:

B. bengalensis
Y = -320.81 + 184.37 x 17.3 (r = 0.97; n = 81; range = 17.1 - 27.7mm)

M. meltada
Y = -171.56 + 130.57 x 14.0 (r= 0.96; n = 39; range = 13.6 - 19.5mm)

T. indica
Y = -248.65 + 163.77 x 14.0 (r = 0.98; n = 57; range = 13.8 - 25.3mm)

R. rattus
Y = -277.32 + 181.18 x 15.7 (r = 0.97; n = 55; range = 15.6 - 24.6mm)

It is evident from Figs. 5 and 6 that the regression lines of *S. murinus* and *M. booduga* did not show a linear relationship between mandible length and prey body weight. The regression equations for these species are:

S. murinus
Y = 30.43 + 1.70 x 16.7 (r = 0.13; n = 23; range = 16.5 - 19.0mm)

M. booduga
Y = -16.47 + 28.23 x 10.3 (r = 0.48; n = 16; range = 10.3 - 11.4mm).

Morris (1979) reported such relationship between lower jaw length and body weight in the Brown Rat, *Rattus norvegicus*. The above cited regression equations for *B. bengalensis*, *M. meltada*, *T. indica* and *R. rattus* can be utilized for prey biomass estimation. The prey biomass for *S. murinus* (40g) and *M. booduga* (12g) can be estimated by using mean body weight values given by Kanakasabai *et al.* (1998).

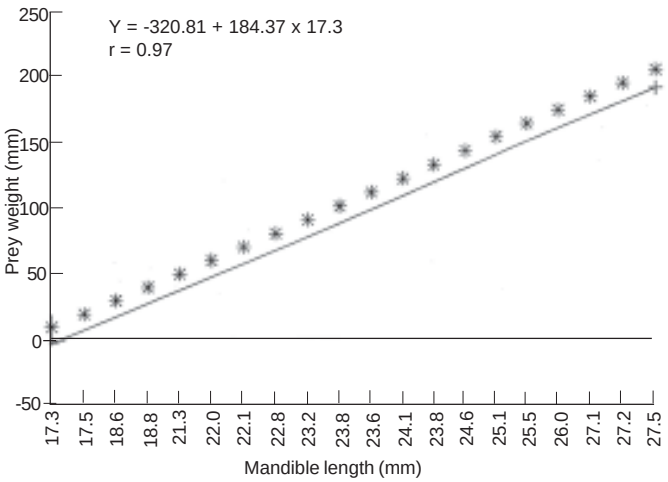

Figure 1. Regression of* Bandicota bengalensis *body weight on mandible length

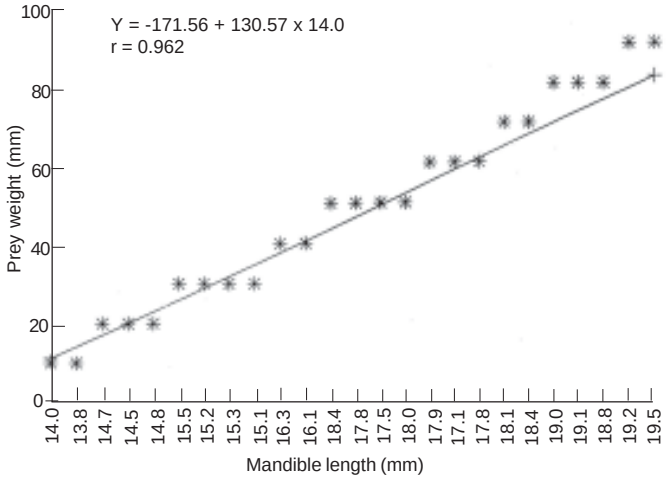

Figure 2. Regression of* Millardia meltada *body weight on mandible length

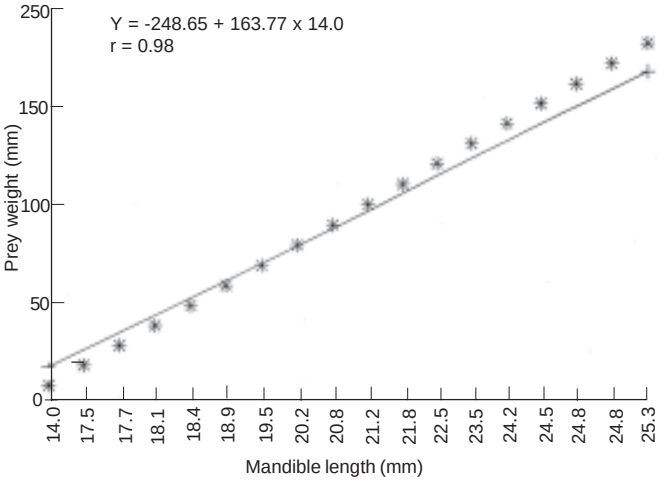

Figure 3. Regression of* Tatera Indica *body weight on mandible length

References

Ali, S. & S.D. Ripley (1983). *Hand Book of Birds of India and Pakistan.* Oxford University Press, London.

Bunn, D.S., A.B. Warburton & R.D.S. Wilson (1982). *The Barn Owl.* Buteo Books. Vermillion, S.D., 264pp.

Burton, J.A. (ed.) (1984). *Owls of The World.* Tanager Books, Dover, New Hampshire, 208pp.

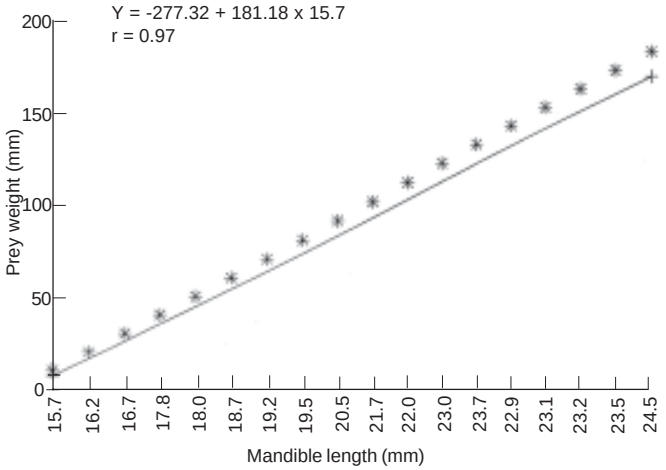

Figure 4. Regression of* Rattus rattus *body weight on mandible length

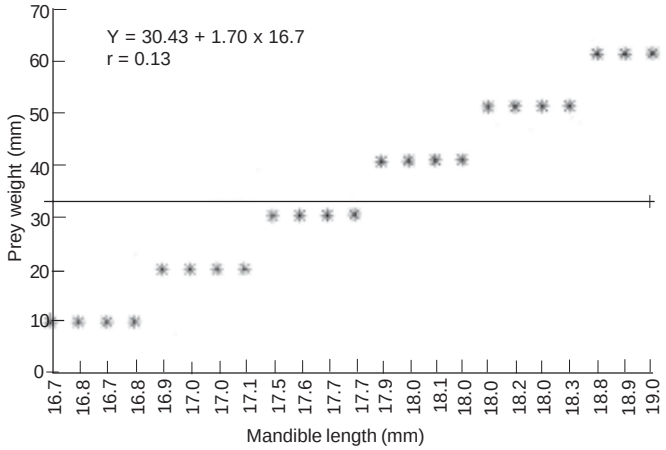

Figure 5. Regression of* Suncus murinus *body weight on mandible length

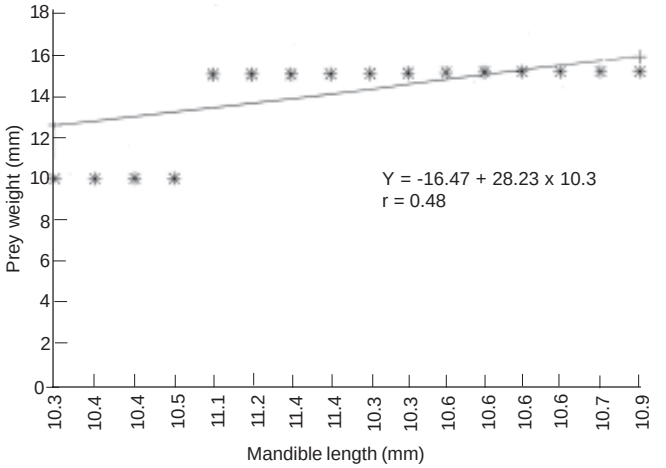

Figure 6. Regression of* Mus booduga *body weight on mandible length

Errington, P.L. (1932). Technique of raptor food habit study. *Condor* 34: 7586.

Glading, B., D.F. Tillotson & D.M. Selleck (1943). Raptor pellets as indicators of food habits. *California Fish and Game* 29: 92-121.

Hamilton, K.L. (1980). A technique for estimating Barn Owl prey biomass. *Raptor Research* 14(2): 52-55.

Kanakasabai, R., P. Neelanarayanan & R. Nagarajan (1998). Quantifying Barn Owl *(Tyto alba stertens)* prey frequency and biomass. Proceedings of the First National Symposium on Birds in Agricultural Ecosystem, A.N.G.R. Agricultural University, Hyderabad, 153-157pp.

Marti, C.D. (1987). Raptor food habit studies, pp.67-79. In: Pendleton, B.G., B.A. Millsap, K.W. Kline & D.A. Bird (eds.). *Raptor Management Techniques Manual*. National Wildlife Federation Science & Technology Series No. 10, Washington, D.C.

Morris, P. (1979). Rats in the diet of the Barn Owl (*Tyto alba*). *Journal of the Zoological Society of London* 189: 540-545.

Neelanarayanan, P., R. Nagarajan & R. Kanakasabai (1995). The Common Barn Owl, *Tyto alba*: A potential predator of rodent pests. *Pestology* 19(9): 34-37.

Neelanarayanan, P., R. Nagarajan & R. Kanakasabai (1998). Studying diet of Barn Owl (*Tyto alba stertens*) by pellet analysis. Proceedings of the First National Symposium on Birds in Agricultural Ecosystem, A.N.G.R. Agricultural University, Hyderabad, 125-131pp.

Santhanakrishnan, R. (1995). Ecology of Barn Owl, *Tyto alba* (Scopoli) with special reference to its population, Feeding and Breeding in Mayiladuthurai, Tamil Nadu, South India. Ph.D. Dissertation, Bharathidasan University, Tiruchirappalli, South India (Unpublished).

Smith, C.R. & M.E. Richmond (1972). Factors affecting pellet egestion and gastric pH in the Barn Owl. *Wilson Bulletin* 84: 179-186.

Taylor, I.R. (1994). *Barn Owls: Predator prey relationships and conservation.* Cambridge University Press, Cambridge, 303pp.

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