

AN IMPROVED NECKLACE FOR MARKING FRUIT BATS (PTEROPODIDAE)*

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For most Microchiroptera the attachment of bands (rings) to the forearms is a suitable marking technique (Barclay & Bell 1988). In the Megachiroptera one has to avoid the constriction of the propatagium by a band affecting their flight, often leading to injuries and infections (e.g., Bradbury 1977, Heidemann & Heaney 1989). At least smaller pteropodids have been banded successfully by making a small incision in the propatagium and slipping the band through it around the forearm (Bonaccorso *et al.* 1976). For our purposes and applying the criteria mentioned we found this method too invasive and time-consuming.

To avoid the risk of injury and infection we were looking for suitable necklaces to mark pteropodids of varying body size in our study area (NW-Panay Peninsula, Philippines). This method should fulfill the following requirements:

- Markings should last lifelong.
- Individual identity is required in large numbers.
- It is sufficient if marks can be identified on captured bats.
- The mark must not affect the survival or behavior of the animal.

Accordingly we used necklaces made of bead chains of stainless steel (available in hardware departments) which were closed around the neck with a stainless steel lock. For individual identification we

had the number (four digits) laser-engraved onto the outer surface of the lock (Fig. 1), thus bypassing the necessity of employing a numbered bird band closed around the chain of beads (Barclay & Bell 1988). This is a crucial improvement, sparing the bat the carrying of an additional load. Further, the omission of the band with its sharp edges reduces inevitable fric-

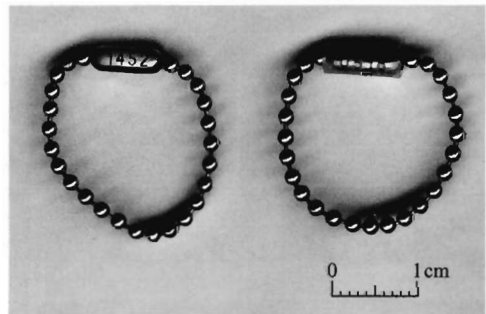


FIG. 1. Necklace for marking fruit bats.

tion on the skin. The necklace can be adjusted in 2 mm steps and each bead thus cut off from the chain's end saves 0.1 g of weight per centimeter of chain length. Depending on the species the weight of the necklace ranged from 0.5 g for *Cynopterus brachyotis* to 0.8 g for *Harpyionycteris whiteheadi*. The necklaces weighed 0.71–0.73% of the average body mass of each species. Only for *C. brachyotis*, with

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35.15 g average body mass for adults the smallest of the marked fruit bat species, was the necklace as much as 1.42% of its weight (Table 1). This technique proved adequate under field conditions and was used for four species of Philippine fruit bats ranging from 35 to 112 g. With a selfmade chain holder the free end of the chain was pushed into the lock with slight pressure. Although it is possible for one person to mark a bat with this method we preferred a two-person team. One person holds of the bat while the other adjusts and closes the necklace. This procedure takes less than five minutes for an experienced person. All marked bats were adults.

The same necklace type has been used to attach radio-transmitters to *Ptenochirus jagori* (Reiter & Curio, submitted). For that purpose the transmitter was glued onto a piece of shrink tube with epoxy. This pack was then attached to the necklace also using epoxy. The total mass of this 'transmitter backpack' as less than 5 g (less than 6% of the body mass). Although this method seems to work well, two individuals out of ten were able to remove the transmitter and showed abrasions at their throat.

One recapture, bats of three species (*C. brachyotis*, *H. whiteheadi*, and *Rousettus amplexicaudatus*) showed no or a only a small change of weight (see Table 1). Only in *P. jagori* did 12 out of 109 marked individuals show a higher loss after capture. It is noteworthy, that of these animals six showed an increase

(6.63% \pm 5.24; mean of increase of capture mass in % \pm SD, n = 6) in their body mass while eight animals lost weight (4.51% \pm 2.92; mean of decrease in capture mass in % \pm SD, n = 8). Similarly, some animals, which were recaptured more than once, showed deviations from their capture mass in both directions. *P. jagori* No. 0508 had been marked on 16 August 1997 with a body mass of 78 g; on 1 December 1997 it weighed 80 g, on 22 January 1998 70 g and on 2 February 1998 again 78 g. It is unlikely that these changes are connected with the necklace and are not the results of ecological factors, e.g., the availability of food.

Five of 109 *P. jagori* showed minor injuries after wearing the necklace. On two individuals we found old scars of superficial scratches, which we identified as the results of attempts to remove the necklace with their claws. The other three animals two of which were wearing the described transmitter 'backpack' showed abrasions resulting from ill-fitting necklaces. We identified a combination of too-wide necklaces and the resulting friction of the lock on the skin as the main cause of such injuries. To prevent this side effect we started to cover the lock with transparent silicon tube (electronic supply, transparent shrink tubes) with 3 mm inner diameter. To forestall any friction by the tube edges they were smoothed with a file before pulling them over the lock. The number is then still readable (Fig. 1) and thus allows perfect identification upon

TABLE 1: Data from 136 marked fruit bats including changes in body mass, weight of necklace used and time span between marking and latest recapture.

Bar Species	Average body mass of adults* [g]	Number of marked individuals	Number of recaptures	Decrease of weight between capture and recapture [%] (mean \pm SD)	Average time period in which weight changed [days] (mean \pm SD)	Weight of necklace [g]	Maximum time period between first capture and latest recapture [days]
<i>Cynopterus brachyotis</i>	35.2	4	3	0	—	0.5	336
<i>Harpyionycteris whiteheadi</i>	112.0	11	9	- 1.7 n = 1	29.0	0.8	976
<i>Ptenochirus jagori</i>	84.2	109	31	- 4.5 \pm 2.92 n = 8	68.13 \pm 74.6	0.7	145
<i>Rousettus amplexicaudatus</i>	84.7	12	3	- 1.8 \pm 0.78 n = 2	17.5 \pm 5.5	0.6	65

* see Luft 1998

recapture. This method works well and recaptured bats showed no more abrasions so far.

In conclusion: The necklace used for marking bats has been improved in two ways. One is making use of the chain lock as the number tag, thus dispensing with the bird ring. This improvement leads to no or an inconsequential loss of body mass. The other is reducing any abrasion of fur by the lock by covering it with soft silicon tubing. We regard the marking method described as superior to all previous alternatives published.

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