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# The Social Structure and Ecology of Elephant-Shrews

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## III. Methods

### A. Capturing, marking and observing animals

#### *1. Rhynchocyon chrysopygus*

*R. chrysopygus* was captured in 10 m long, 1 m high, 7 cm mesh brown fishing nets strung vertically and loosely along the trails and paths in the forest. The elephant-shrews tangled themselves in the nets when they tried to get through them or, occasionally, when I chased them into the nets. Captured elephant-shrews were sexed, aged, weighed, and colour-ringed with plastic bird rings (Fig. 14). Both rear legs were given the same one or two-colour combination to facilitate field identification and ensure identity if a ring was lost. A total of 47 individuals were ringed at Gedi during the study. By slowly and silently walking the trail and path network, elephant-shrews were resighted

*Fig. 14:* Fitting coloured rings on the rear leg of an adult *R. chrysopygus*

and, when spotted, were identified and observed with 8 x 40 binoculars. Their location, activity and behaviour were recorded in a field notebook and on a study area map. Identification and observation was usually limited to 10 m because of the dense vegetation.

The study area was usually covered systematically by walking the paths from one end of the area to the other, recording data as elephant-shrews were sighted. In many of the behaviour analyses "first sightings" are used. This refers to the locus and/or behaviour of an animal when it was first spotted and is used instead of subsequent observations because of the possible effect I had on the animal's behaviour. Generally I could expect to spot an animal about every 15 min of searching. *R. chrysopygus* reacted to my approach, if it saw me before I saw it, by freezing or running approximately 10 m away and then freezing. After a few s to a few min, depending on the individual and my proximity and movements, the elephant-shrew continued its activity, either returning to the spot from where it was disturbed or moving on. The animals' habits and behaviour were such that sitting in one spot and waiting for them to appear was highly inefficient.

## B. Nest and trail use

### *1. The nest of Rhynchocyon chrysopygus*

The nests at Gedi were comprised of an oval depression in the soil approximately 8 cm deep and wide, which the elephant-shrews excavated with long scraping sweeps of a forefoot. Dead leaves were dragged into this bowl from the surrounding area which were then arranged into a layered lining by rapidly vibrating both front feet on the leaves' surface. Sticks and rootlets were arranged with the mouth. When the lining was completed, additional leaf litter was dragged and piled onto the top of the nest. To drag the leaves an elephant-shrew stretched out its front legs stiffly and then, by jerking its body backwards towards the nest, accumulated a pile of litter under its chest and abdomen. A newly completed nest looked like a 15 cm high pile of leaves about 50 cm in diameter with a ½ m barren area around it where the leaves had been gathered. There was no visible entrance to the nests and within 2 weeks they weathered and became extremely difficult to spot. The entire building sequence took approximately 2 h and was either done all at once or in sessions over 1—2 days. I never saw an elephant-shrew enter a newly completed nest to "try it out."

When the 26 nest building observations for the entire study period and study area are tabulated with respect to the daylight quarter they were seen in, and these are compared with the expected sightings calculated from the proportion of searching time in each quarter (Tab. 2), it is clear that nest building was an early morning activity. A monthly tabulation of the 18 nest build-

*Table 2:* Nest building observations per daylight quarter of *R. chrysopygus* at Gedi Ruins ($p < 0.01$, Kolmogorov-Smirnov test)

| Sightings | Time | | | |
|---|---|---|---|---|
| | Dawn to 09.00 h | 09.00 to 12.00 h | 12.00 to 15.00 h | 15.00 h to dark |
| Actual | 17 | 7 | 2 | 0 |
| Expected* | 2.9 | 7.3 | 5.8 | 8.5 |

* Calculated from proportion of time spent searching in each time period

*Table 3:* Nest building observations per month of *R. chrysopygus* at Gedi Ruins in 1972 ($p < 0.01$, Kolmogorov-Smirnov test)

| Sightings | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D |
| Actual | 0 | 1 | 1 | 1 | 0 | 0 | 2 | 0 | 8 | 4 | 0 | 1 |
| Expected* | 2.4 | 2.0 | 1.8 | 1.2 | 1.8 | .9 | 2.0 | .5 | 2.2 | 1.2 | 1.3 | .5 |

* Calculated from proportion of time spent searching in each time period

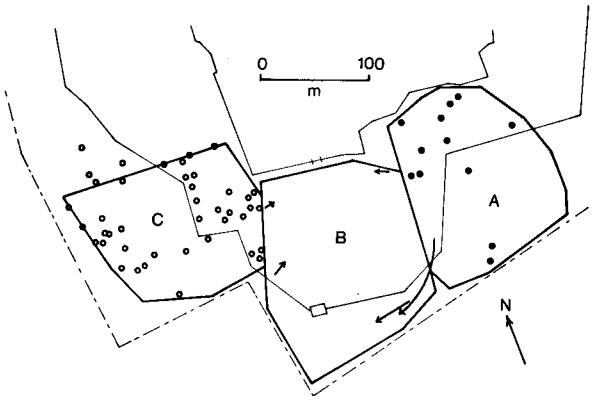


*Fig. 20:* Territorial areas A, B and C at Gedi Ruins (see Fig. 25). Solid circles show locations of visible nests on territorial area A in Jan. 1972. Arrows illustrate sighting loci of Yellow-red ♀ during Sept. 1975, all within her original territorial area (B). Open circles show locations of scent marking by White-dark blue ♂ on his territorial area (C) during the study period

ing observations in 1972 (Tab. 3) shows a peak of activity in September and October, the same months when the deciduous trees lost their leaves.

In January 1972 a nest count was made on the territorial area of Red-purple ♀ and White ♂. The area was covered by walking parallel transects which were within sight of each other. 12 nests were found (Fig. 20), but these represent something less than the total as only relatively new nests were visible. In addition to the dispersed nests on territorial areas, some were found in loose clusters. One such nest cluster was periodically checked for new activity over one year and it was found that most of the nests were in disrepair, i.e., the cavity collapsed, but there was always one fresh nest in evidence. These clusters represented traditional sites of an individual elephant-shrew and new nests were built or old nests rebuilt as others were abandoned.

Two watches on nests were carried out to determine how frequently they were used. On 12 evenings between 17.30 h and dark, from 14 through 28 May 1971, I sat high in a tree overlooking a nest. A single elephant-shrew entered the nest on 2 evenings and approached, but did not enter, on 2 other evenings. A similar watch was carried out on another nest, from 6 through 13 January 1972, and here a single elephant-shrew entered the nest on 2 evenings. Six instances of solitary elephant-shrews entering nests in the evenings were seen and all occurred between 1 min before and 16 min after sunset. When approaching a nest, the elephant-shrews were extremely cautious. They frequently paused to sniff the air and leaf litter before reaching the site and then sniffed the nest itself before finally slipping into it from a side. I never saw animals emerging from their nests at dawn. There is some indication that they were not fully active in the early morning (Tab. 1), so perhaps they emerged well after dawn.

On 3 occasions *R. chrysopygus* was observed using nests during the day, suggesting that *R. chrysopygus* may occasionally retire to a nest during the day. Green-orange ♀ entered a nest at 12.45 h and then emerged and began foraging at 14.16 h. On another occasion the same ♀ emerged from a nest at 15.33 h, while her mate, White-dark blue ♂, stood on the nest's edge. An unidentified elephant-shrew ran out of a nest at 09.30 h when I scared it by walking past at 1 m distance.

*R. chrysopygus* did not normally build or use trails. However, one young animal at Gedi, which was using a densely vegetated portion of its parents' home range, repeatedly used a short, very indistinct trail through a thicket.

Among the longest lived individuals at Bushwhackers was Black ♀, tagged in May 1974 and still alive in November 1975, nearly 19 months later. Light-green ♂ and Orange ♀, a stable pair, were tagged as adults in May and July 1974 and tracked again in February 1976. In April 1976 the ♂ and an unmarked ♀ were tracked in the original territorial area. Apparently Orange ♀ had disappeared and a new ♀ had taken her place. This suggests, along with other individual records (Fig. 32), pair association for life and a relatively long life expectancy.

## VI. Feeding Ecology

### A. *Rhynchocyon chrysopygus*

#### *1. Foraging behaviour*

*R. chrysopygus* fed on the forest floor mainly in the leaf litter, although some soil excavation was also performed. While foraging, an animal slowly walked along continually poking its long nose in and out of the leaf and branch litter. Occasionally a forefoot was used to sweep away an obstructing object or to create a small opening in the litter into which the nose probed. A forefoot was also used to disturb the leaf litter by vibrating it on the surface while the animal probed under it with its nose. The elephant-shrews often flushed flying or hopping insects, such as cockroaches, but these were only rarely pursued. During a pursuit the elephant-shrews chased with short, quick bounds and frantically attempted to pin the insect with the forefeet. Of the 9 pursuits observed, it is doubtful if more than one resulted in a successful capture. Foraging animals turned the ears forward from the normal laterally facing position, presumably allowing them to localize prey acoustically.

The nearly continuous forward movement while searching for food items was periodically interrupted when an animal started to dig into the soil, which was removed posterior-laterally either with long sweeps of a single forefoot or by simultaneous movement of both forefeet, which was reminiscent of a digging dog. The resulting excavations were conical holes up to 5 cm deep and 2—3 cm across at the top. The elephant-shrews normally foraged while standing on their hind toes, but if more stability was required (as when digging a hole), they dropped down onto their heels.

The majority of food items were small enough to be ingested with a flick of the long tongue, which could be extended at least 5 mm beyond the tip of the nose. However, ingestion was rarely seen as the elephant-shrew's nose and mouth were nearly always hidden in the leaf litter. The only food items that I saw being ingested by free-living animals were 10—15 cm long earthworms, family Lumbricidae (8 cases) and the 6—10 cm long red-legged millipedes, genus *Metiche* (9 cases). This millipede was not recorded in the leaf litter nor in the stomach samples from the Sokoke-Arabuko Forest. After a large prey item was exposed, it was awkwardly taken into the side of the mouth by tilting the head to one side. While being chewed, portions hanging from the mouth were clawed apart with a forefoot. Ingestion of large items was sloppy and some of the small pieces that fell from the mouth were eventually flicked up with the tongue. In only one case did this feeding technique vary, when an earthworm was pinned to the ground using a forefoot and then ripped in two when ingested. The red-legged millipedes were only partially consumed and large pieces were left on the ground. Neither the toss nor the death shake, as described by EISENBERG and LEYHAUSEN (1972) for other mammals, were observed.

## VII. Interspecific Ecology

### A. Predation

#### *1. Rhynchocyon chrysopygus*

At Gedi Ruins, only 2 predation attempts on elephant-shrews were observed, not including those of man. A Southern Banded Harrier Eagle, *Circaetus fasciolatus,* was seen carrying a known juvenile (Y-4) in its talons. On another occasion, an unidentified diurnal raptor, possibly a Harrier Eagle, swooped down and chased an adult (? Ragged-ear ♀) for 50 m. The elephant-shrew, running at full speed in a straight line, escaped by heading into a patch of undergrowth and freezing. In order to demonstrate the swiftness of *R. chrysopygus* locomotion, I tethered and ran with a captive. Its maximum speed was estimated at about 7.5 m/s (27 km/h). Based on ciné film taken of 3 tethered individuals, they used a half bound gait (rh = lh, rf, lf) (RATHBUN 1973).

I examined over 50 Barn Owl *(Tyto alba)* pellets and 27 genet (*Genetta* sp.) fecal boli from Gedi Forest and found no remains of *R. chrysopygus.* A single *Petrodromus* milk tooth molar was found in one genet bolus. Although other carnivores were present at Gedi (Egyptian Mongoose, *Herpestes ichneumon;* Slender Mongoose, *Herpestes sanguineus;* and White-tailed Mongoose, *Ichneumia albicauda*), I do not believe any of the mammalian predators captured *R. chrysopygus* frequently.

No encounters were seen between the elephant-shrews and the numerous potential reptilian predators at Gedi (Monitor Lizard, *Varanus* sp.; Black Mamba, *Dendroaspis polylepis;* Forest Cobra, *Naja melanoleuca;* Spitting Cobra, *Naja nigricollis;* Python, *Python sebae* and Puff Adder, *Bitis arietans*). JACKSON IHA (pers. comm.), curator of the Nairobi Snake Park, caught a Black Mamba at Gede town with a *R. chrysopygus* in its digestive tract, indicating that reptiles may have occasionally preyed on Gedi elephant-shrews.

The Giriama people along the northern coast of Kenya hunt both *Rhynchocyon* and *Petrodromus* for food using snares and they probably have a considerable effect on local populations. This is especially true of *Petrodromus,* which is preferred and easier to snare.

Judging from the Golden-rumped Elephant-shrew's reaction to disturbances, its senses are very keen. At the slightest unusual sound or sight, it froze and cautiously sniffed the air (Fig. 46). After a disturbance or potential predator passed, *R. chrysopygus* walked quietly away and continued its activity. If a predator was close and obviously aware of its presence, then 1 of 3 things happened. The elephant-shrew either (1) slowly walked away while loudly slapping its tail on the leaf litter every 1—3 s; (2) ran away in a gait that was very similar to the stotting of gazelle; or (3) ran away in its typical, swift, cursorial bounding gait. While stotting or bounding, it hammered the leaf litter loudly with its rear feet, producing a very characteristic "crunch, crunch, crunch" sound as it fled. After running 10—15 m, the elephant-shrew stopped and froze. Depending on the predator's action, it then either began to forage or took one of the evasive actions just described. If suddenly and violently

*Fig. 46:*
Adult *R. chrysopygus* sniffing the air

disturbed, an elephant-shrew immediately took flight. If a pair or a ♀ and her newly emergent juvenile were disturbed, they fled in different directions.

On several occasions tail slapping or rear foot hammering elephant-shrews that were out-of-sight caused individuals under observation to become alert or even to take flight, which suggests that these behaviours may serve as intraspecific predator warning signals.

The response of *R. chrysopygus* to being captured and handled was rather atypical of a predatory animal, for they never attempted to bite defensively. They would alternately be passive and then burst into a violent bout of struggling and kicking, a behaviour often resulting in claw wounds and in effecting escape from one's hands. Some captured individuals screamed loudly, similarly to a rabbit's distress cry.