

Taxonomic Report on Small Mammals from Two Coastal Wetland (Ramsar) Sites in Ghana

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Abstract

Surveys of the small mammal populations of two coastal wetlands in Ghana, Muni-Pomadze (Central Region) and Keta (Volta Region), were undertaken over a 1-month period as part of an assessment of the ecological status of these wetlands. The study investigated aspects of the ecology of the small mammals, which are known indicators of habitat (environmental) quality. The methodology involved live-trapping of the terrestrial small mammals (rodents and insectivores) using collapsible Sherman traps (for smaller species) and National (Tomahawk) traps (for larger species). Bats were also live-trapped using mist nets at Muni-Pomadze only. A total of 11 species of small mammals were recorded at Muni-Pomadze, comprising 47 individuals of seven rodent species, four individuals of two insectivore species and two individuals of two bat species. Four species were recorded at Keta, made up of three individuals of two species of insectivores and eight individuals of two rodent species. Generally, majority of all the adult individuals captured at Muni-Pomadze were in reproductive condition. At Keta, most of the captures were sub-adult females, and only one of two males captured was in reproductive condition (scrotal testes). The grassland/thicket habitat at Muni-Pomadze was the most diverse, probably because the thicket "islands" provided shelter from potential predators, which were themselves scarce because of the openness of the habitat. The Keta Ramsar site was characterised by low abundance and diversity, attributable to human settlement and economic activity. A taxonomic report on the captured small mammal species is provided.

Introduction

Field baseline surveys of the small mammal populations of two coastal wetlands (Muni-Pomadze and Keta) in Ghana were undertaken during June and July, 1997 with the main objective of ascertaining the status of such wetland communities, as well as updating current species lists in selected protected areas in Ghana. Generally, information on small mammal diversity of Ghana's coastal Ramsar sites has been virtually non-existent, despite the important roles such mammals play in the socio-cultural life of the communities, as well as their importance as indicators of habitat quality. For example, large rodents such as grasscutters (*Thryonomys swinderianus*) and giant rats (*Cricetomys gambianus*) are hunted for subsistence as well as for economic purposes (bushmeat) (Ryan & Attuquayefio, 2000).

Even though there have been previous accounts of the systematics and distribution of the mammals of Ghana (Ingoldby, 1929; Cansdale, 1948; Booth, 1956; 1959), most of these have not been updated since they were published several years ago. It is, therefore, imperative to conduct as many surveys as possible, especially in previously unsurveyed areas like wetlands, in order to build up a badly-needed updated and comprehensive checklist of mammals for the whole country with time (Decher, 1997). For example, Booth's (1959) previous checklist of mammals of the Accra Plains has recently been updated by Decher (1997).

The surveys were undertaken as a collaborative effort involving the Zoology Department of the University of Ghana, Hobart and William Smith Colleges of New York, USA, and the Wildlife Division of the Ghana Forestry Commission, as part of a wider Coastal Wetlands Management Project (CWMP) commissioned by the Global Environmental Facility (GEF) of the World Bank. The ultimate objective was to provide the requisite scientific database that would lead to an increased understanding of the species diversity of the coastal regions of Ghana

(Piersma & Ntiamoa-Baidu, 1995) as a basis for developing effective management strategies for such wetlands.

The specific objectives were to (i) conduct complete small mammal field surveys of two coastal Ramsar sites (Keta and Muni-Pomadze) in Ghana, (ii) identify and determine the distribution and abundance of endemic and/or rare species and species of conservation concern with regard to their habitat associations, and prepare voucher specimens of the collections for accurate taxonomic identification and reference. This paper reports on the results of the survey, with species accounts covering reproductive condition and morphological measurements, supplemented with notes on distribution and taxonomy of the mammals inhabiting the two survey sites.

Study areas

Muni-Pomadze Ramsar site (05° 19' N; 00° 40' W). The site, located in the Central Region of Ghana, about 56 km west of Accra, covers a total management area of 90 km² surrounding the shallow coastal Muni Lagoon, which has an area of 3 km² and maximum depth of 1.5 m (Fig. 1). There were five survey localities within the Muni-Pomadze Ramsar site (Fig. 2).

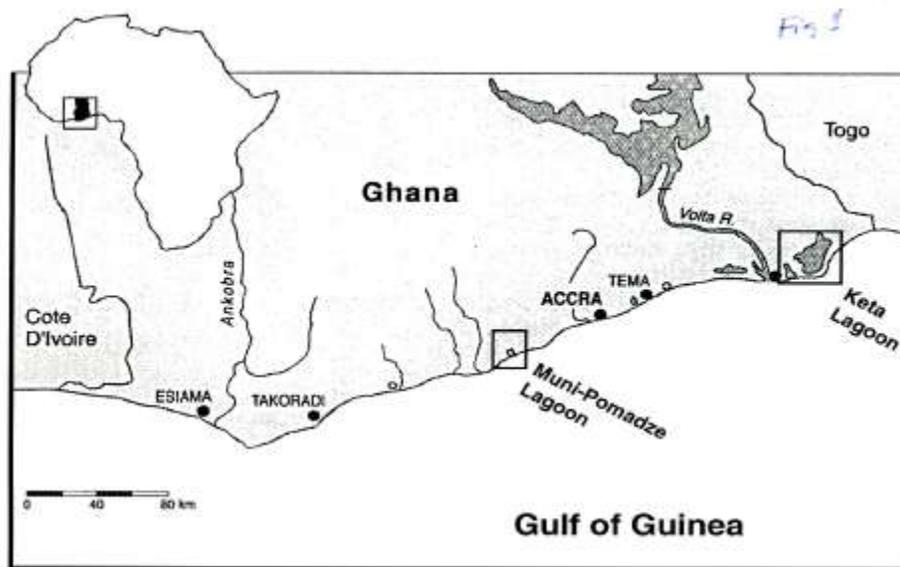


Fig. 1. Location of Muni-Pomadze and Keta Ramsar Sites, Ghana

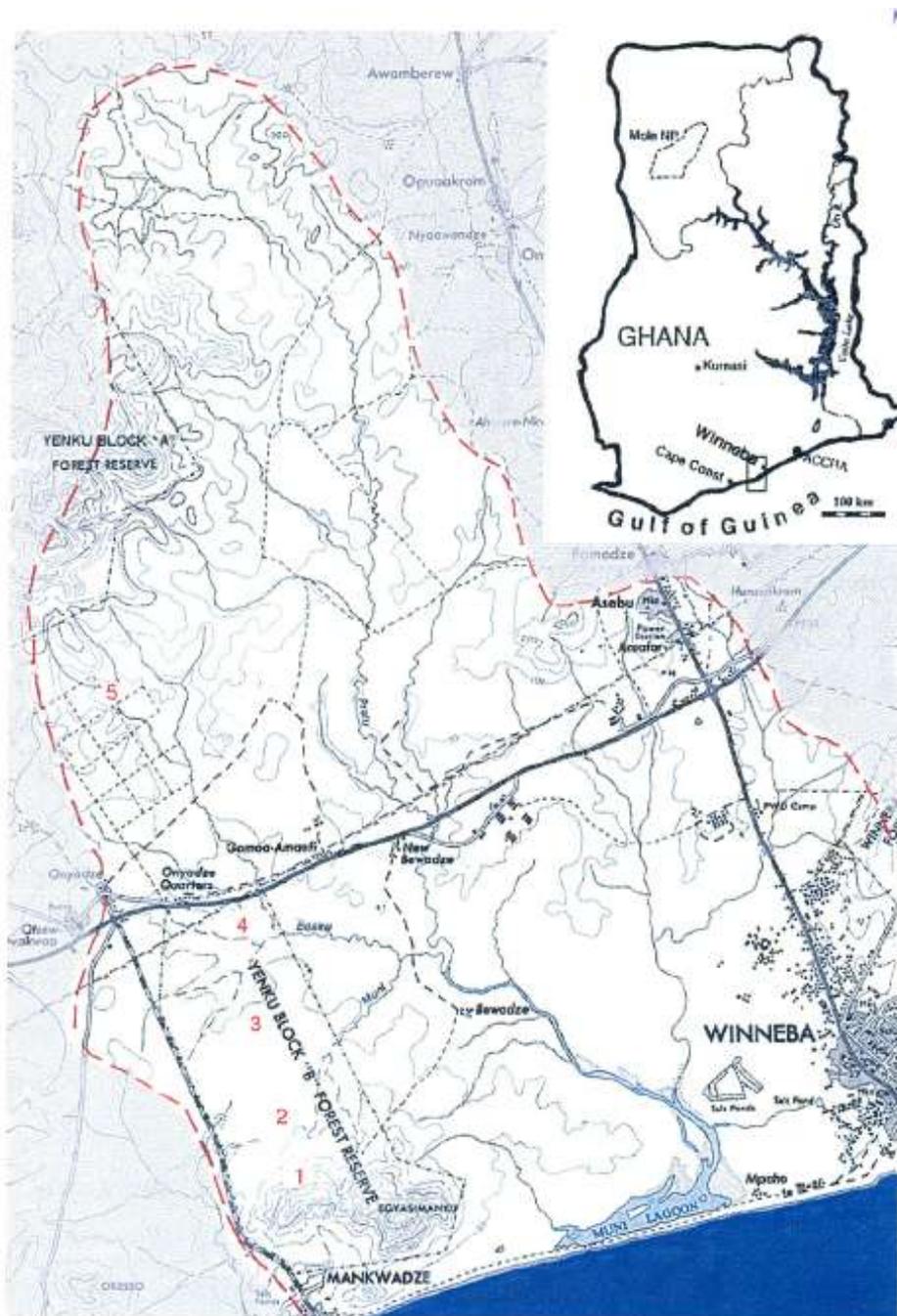


Fig.2. Location of the five Habitats sampled at Muni Pomadze

Grassland/thicket vegetation (05° 19.88' N; 0° 41.45' W). Located about 4 km south of the main Accra-Cape Coast road, within the boundaries of the Yenku Block B Forest Reserve (Fig. 2). The open grassland is characterised by grasses and sedges, notably *Sporobolus pyramidalis*, *Panicum maximum*, *Vertiveria fulvibarbis*, *Heteropogon contortus*, *Fimbristylis ferruginea*, and *Andropogon gayanus*. The thickets were of varying sizes, comprising mainly herbs (*Aspilia africana*, *Abutilon mauritianum*, *Chromolaena odorata*), shrubs (*Securinega virosa*, *Lantana camara*, *Lonchocarpus cyane-scens*, *Clausena anisata*), small trees (*Azadirachta indica*,

Zanthoxylon xantholoides, *Ficus congensis*, *Elaeo-phorbia drupifera*, *Gardenia nitida*) and climbers (*Asparagus africanus*, *Cissus arguta* and *Paulinia pinnata*).

Eucalyptus-teak-acacia-cassia secon-dary forest ($5^{\circ} 23.33' N$; $0^{\circ} 42.14' W$). An area characterised by an overgrown *Eucalyptus* plantation north-east of Onyadze Villge (part of Yenkou Block A Forest Reserve) and such trees and shrubs as *Baphia pubescens*, *B. nitida*, *Z. xantholoides*, *Griffonia simplicifolia*, *Cola millenii*, *Pycnoconia cornuta*. Climbers (*Acacia kamerunensis*) are also present, as well as a dense mat of leaf litter covering the forest floor.

Hillside thicket ($05^{\circ} 19.89' N$; $00^{\circ} 41.40' W$). An area comprising a dense stand of shrubs and trees without grasses or sedges, extending from the base of Egyasimanku Hill. The dominant vegetation includes *Z. xantholoides*, *C. arguta*, *A. indica* and *L. cyanescens*.

Grassland/thicket and eucalyptus transition zone ($05^{\circ} 20.94' N$; $00^{\circ} 41.69' W$). The location comprises grassland/thicket vegetation as above, but interspersed with scattered *Eucalyptus* trees. *Eucalyptus plantation* ($05^{\circ} 21.60' N$; $00^{\circ} 41.89' W$). Located south of the Accra-Cape Coast highway and dominated by tall *Eucalyptus* trees with understorey comprising grasses, sedges and large areas of *C. odorata*.

Keta Ramsar site ($06^{\circ} 03' N$; $00^{\circ} 53' E$)

The Ramsar site is located at the south-eastern coast of Ghana in the Volta Region. This wetland, the largest in Ghana, has an area of 530 km² surrounding the 300 km² Keta lagoon ($05^{\circ} 55' N$; $00^{\circ} 59' E$). There is little natural forest remaining in the wetland because of the proliferation of human settlements and farmlands around the lagoon, as well as a thriving local fishing industry. Two survey localities were selected (Fig. 3).

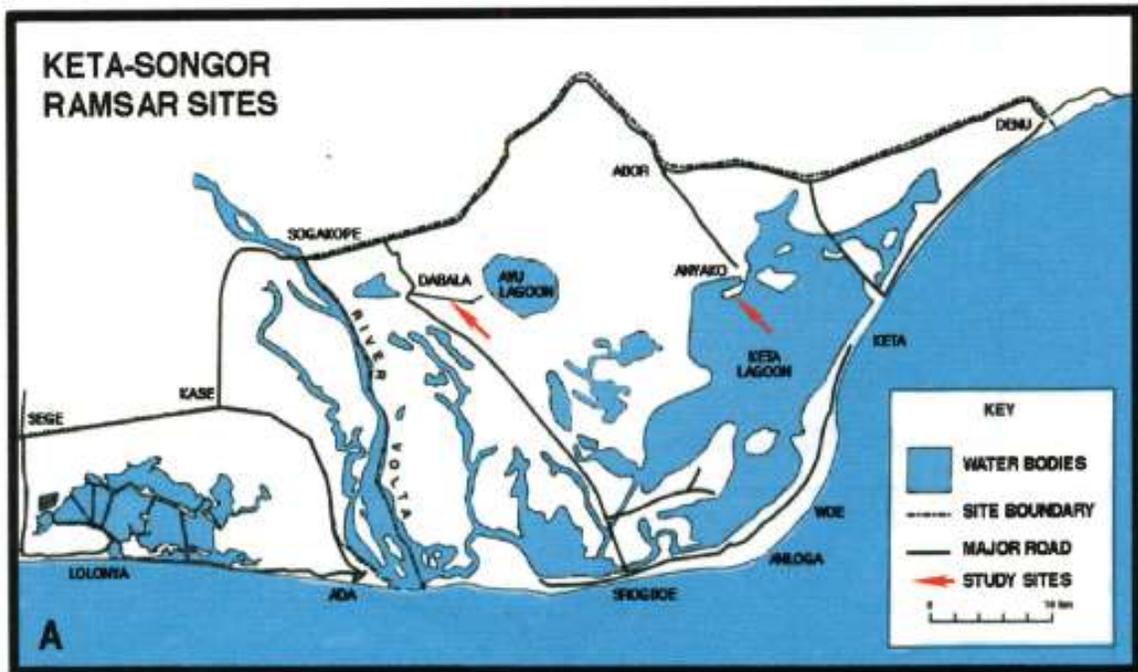


Fig. 3. Keta Ramsar Site

Adutor-Dadala-Avu lagoon site ($05^{\circ} 58.29' N$; $00^{\circ} 40.17' E$). The area comprises tall grasses and sedges interspersed with small *A. indica* (neem) thickets. It also comprises the Avu lagoon, a large freshwater lagoon surrounded by a floating mat of vegetation and a small forest of balsa trees. The lagoon is accessible only by canoe from the nearby Avutor village.

Anyako site (05° 59.40' N; 00° 53.99' E). An “island” of degraded baobab (*Adansonia spp.*) forest surrounded by marshland and the Keta lagoon. Most of the baobab trees are covered by climbers (*Ipomoea aquatica*) with the understorey covered by herbs (e.g. *Polygonum langerum*, *Mimosa pigra*).

Materials and methods

Live-trapping of terrestrial small mammals

Terrestrial small mammals (rodents and shrews) were captured using two types of live-traps: Sherman collapsible traps (HB Sherman Traps Inc., Florida, USA) measuring 23 cm × 9 cm × 7.5 cm (suitable for the smaller species), and larger National Tomahawk folding traps (Tomahawk Trap Company, Wisconsin, USA) measuring 51 cm × 11 cm × 11 cm. The traps were baited with a mixture of groundnut paste, corn meal, and fish oil, placed at 10-m (Sherman) and 40-m (Tomahawk) intervals along transects cut through representative vegetation. Transect lengths varied from 100–500 m, and there were between three to five consecutive nights of trapping, depending on study area, habitat type and the time available for a particular survey.

Captured animals were euthanized with chloroform, according to the American Society of Mammalogy Animal Care and Use Committee guidelines. Captured animals were identified on the spot (if possible), sexed (using the anal-genital distance, which is longer in males), aged (assigned to three broad age-classes: juvenile, sub-adult and adult), weighed, and examined for reproductive condition (abdominal or scrotal testes in males and enlarged nipples, perforate vaginas and pregnancy in females). The specimens were prepared either as standard museum skins, fluid-preserved or full/part skeletons. Standard measurements (body, tail, ear, and hind limb lengths) were taken of all the animal specimens as follows: (i) TOTL (total body and tail length, from nose-tip to end of tail), (ii) TL (tail length, from base of tail at right angles to body to end of tail), (iii) HBL (head and body length, TOTL minus TL), (iv) HFL (hind foot length, from heel to tip of the longest toe, excluding claw), (v) EL (ear length, from basal notch to distal tip of pinna), (vi) WT (weight, in grams), (vii) FA (forearm length, bats)

The specimens were then serially labelled and preserved in formalin. Key references for small mammal taxonomy and identification were Rosevear (1969), Meester & Setzer (1971), Delany & Happold (1979), Happold (1987), Haltenorth & Diller (1988), and Kingdon (1997), and voucher specimens were stored in the vertebrate museum of the Zoology Department, University of Ghana and in the Museum of Natural History, Smithsonian Institution, Washington DC, USA. Small mammal field handling techniques were as outlined in Wilson *et al.* (1997). The relative abundance (number of individuals of a particular species per 100 trap-nights) of the captured small mammal species in the various habitats was estimated as follows:

Relative abundance (RA)

$$= \frac{\text{Number of individuals captured} \times 100}{\text{Number of trap-nights (TN)}}$$

where one trap night = one trap set for one night.

Species diversity was estimated using the Shannon Index (Stiling, 1998) as follows:

$$\text{Species diversity (H')} = - \sum_{i=1}^s p^i \ln p^i$$

(H' = species diversity; s = number of species; pⁱ = proportion of ith species in the sample)

Live-trapping of bats

Bats were captured using two mist nets measuring 12 m long and 2 m high, and set at locations along trails or power-line cuts at the Muni-Pomadze Ramsar site only. The nets were typically opened from dusk to about 21.00 h (GMT) on two consecutive nights. After capture, the bats were identified and measured.

Results

Species diversity and abundance

Muni-Pomadze. A total of 11 species belonging to three small mammalian orders was recorded at this site, comprising seven species of rodents, two species of insectivores and two species of bats (Table 1). The rodents were zebra mice (*Lemniscomys striatus* and *L. barbarus*), gerbils (*Tatera kempfi*), brush-furred mice (*Uranomys ruddi*), multimammate mice (*Mastomys erythroleucus*), African wood-mice (*Hylomyscus alleni*), giant pouched rat (*Cricetomys gambianus*), and the insectivores were shrews (*Crocidura oliveri* and *C. bottegi*). Two species of bats (*Nanonycteris veldkampii*, and *Hipposideros commersoni*) were caught. The diversity of the terrestrial small mammal fauna was related to habitat type (Table 2). The dense hillside thicket did not record any captures of small mammals, even though the area provided excellent cover, being characterised by densely-spaced thickets, trees and shrubs, and the absence of grasses.

TABLE 1
Small mammal species recorded at Muni-Pomadze and Keta Ramsar sites

Species	Common name	Locality			
		Muni-Pomadze SF	G/T	Keta A/D	A
INSECTIVORA					
<i>Crocidura oliveri</i>	White-toothed shrew	*	*		*
<i>Crocidura bottegi</i>	Bottego's shrew			*	
CHIROPTERA					
Pteropodidae					
<i>Nanonycteris veldkampii</i>	Veldkamp's dwarf bat	*			
Rhinolophidae					
<i>Hipposideros commersoni</i>	Commerson's leaf-nosed bat	*			
RODENTIA					
Muridae					
<i>Lemniscomys striatus</i>	Zebra mouse		*		
<i>Lemniscomys barbarus</i>	Zebra mouse		*		
<i>Tatera kempfi</i>	Kemp's gerbil		*	*	*
<i>Uranomys ruddi</i>	Brush-furred rat		*		
<i>Mastomys erythroleucus</i>	Multimammate rat	*	*		
<i>Hylomyscus alleni</i>	African wood mouse	*			
Cricetidae					
<i>Cricetomys gambianus</i>	Gambian giant pouched rat		*		*

Legend:

SF = Secondary forest; G/T = Grassland/thicket; AD = Adutor/Dabala; A = Anyako

TABLE 2
Relative abundance (*italics*) and diversity of small mammals of Muni-Pomadze and Keta Ramsar sites

Species	Muni-Pomadze						Keta			
	GT	HT	EET	EP	SF	Tot	DAB	ANL	ANY	Tot
<i>Lemniscomys striatus</i>	230.53		80.53			31				
<i>Lemniscomys barbarus</i>	60.14					6				
<i>Uranomys ruddi</i>	50.12		30.20			8				
<i>Taterakempfi</i>	40.09		10.07	10.01		6	20.50		50.83	7
<i>Crocidura oliveri</i>	30.07		10.07			4			10.17	1
<i>Crocidura bottegi</i>							20.50			2

<i>Mastomys erythroleucus</i>	20.05		10.07	40.80		7			
<i>Hylomyscus alleni</i>						10.04	1		
<i>Cricetomys gambianus</i>			10.07				1	1	1.00
Total	43	0	15	5	1	4	1	6	11
Species diversity (H')	1.43		1.42	0.50		0.70		0.45	

Legend:

GT = Grassland/Thicket; HT = Hillside/Thicket; EET = *Eucalyptus* edge thicket; EP = *Eucalyptus* plantation; SF = Secondary forest; DAB = Dabala; ANL = Anloga; ANY = Anyako; Tot = Total.

The secondary forest habitat also recorded only one capture despite its dense canopy cover and lush understorey of leaf litter. The *Eucalyptus* plantation site, close to the coastal highway, recorded two species of rodents: *M. erythroleucus* (multimammate mouse) and *T. kempfi* (Kemp's gerbil) ($H' = 0.50$) (Table 2). The grassland/thicket ($H' = 1.43$) and eucalyptus/grassland ($H' = 1.42$) transition habitats were the most diverse, recording six species each of rodents, including the diel-active (crepuscular) zebra mice (*L. striatus* and *L. barbarus*) which did not occur in any of the other habitats (Table 2). Compared with most other savanna communities, the Muni-Pomadze rodent community is not particularly diverse, even though some particular species, notably *T. kempfi*, *L. striatus* and *U. ruddi*, are very abundant. Also, grasscutters (*Thryonomys*) and giant rats (*Cricetomys*), which are known to be common in the area, are important bushmeat species.

Keta. The area recorded 11 individuals of four species of small mammals belonging to two orders (Insectivora and Rodentia) (Table 1). Insectivore species captured were Bottego's shrew (*C. bottegi*) and the white-toothed shrew (*C. oliveri*), the former being recorded only at Keta, and the latter at both Ramsar sites. The rodents captured were the giant pouched rat (*C. gambianus*) and Kemp's gerbil (*T. kempfi*), both of which were also captured at Muni-Pomadze. The site was generally characterised by low abundance and diversity of mammals, with evidence of habitat degradation through serious overgrazing by cattle in the grassland/thicket habitats of the wetland. The most diverse site was Dabala ($H' = 0.70$), where two individuals each of *T. kempfi* and *C. bottegi* were captured. Anyako site ($H' = 0.45$) also recorded five individuals and one individual of *T. kempfi* and *C. oliveri*, respectively. Only one individual of *C. gambianus* was captured at the Anloga site (Table 2).

Reproductive characteristics of the rodent community

Muni-Pomadze. All the species of rodents sampled showed some evidence of reproductive activity. For some species, every adult individual captured was in reproductive condition (Table 3). This suggests a thriving small mammal community at Muni-Pomadze. No definite conclusion could be drawn about the breeding seasons of the various species, because the surveys were conducted only in the month of July. Only a long-term monitoring programme of the commonest species of the area could reveal the breeding cycles of the various species of rodents at Muni-Pomadze.

TABLE 3
Reproductive characteristics of the five commonest rodent species at Muni-Pomadze Ramsar site

Species	Males			Females		Total	% RC
	% ST	Lac	Preg	E/F	PS/F		
<i>Lemniscomys striatus</i>	70	1	3	4.5	5	9	82
<i>Lemniscomys barbarus</i>	100	0	2	5.5	0	2	100
<i>Tatera kempfi</i>	100	1	0	0	0	2	100

<i>Uranomys ruddi</i>	50	1	2	4.5	0	4	100
<i>Mastomys erythroleucus</i>	60						

Legend:

ST = Scrotal testes; Lac = Lactating; Preg = Pregnant; E/F = Embryos per female
PS/F = Placental scars per female; RC = Reproductive condition.

Keta. Of the seven individuals of gerbils (*T. kempi*) captured, five were all sub-adult females. Even though both of the two males captured were adults, only one had scrotal testes, which is an indication of reproductive activity. No juveniles were captured.

Species taxonomic accounts

Order: Insectivora
Family: Soricidae
Subfamily: Crocidurinae
Crocidura olivieri (Lesson, 1827)

There were a total of five specimens recorded. Four specimens (GHM-017, GHM-023, GHM-031 and GHM-042) were recorded at Muni-Pomadze, and one (GHM-063) at Keta. Two of the specimens were females (GHM-023, GHM-042). Average measurements for the Muni-Pomadze specimens: TOTL 202.3, (192-215) HBL 128.7 (122-137), TL 73.7 (65-78), HFL 19.3 (19-20), EL 11.5 (11-12) and WT 29 (27-37) g. The Keta specimen was an adult with the following measurements: TOTL 236, HBL 143, TL 93, HFL 22, EL 13 and WT 42 g.

Order: Insectivora
Family: Soricidae
Subfamily: Crocidurinae
Crocidura bottegi (Thomas, 1898)

Three specimens were recorded at Keta, two of which, a female (GHM-055) and male (GHM-056), were caught together in the same Sherman trap, and one (GHM-064) in a pitfall trap set for invertebrates (insects). Average measurements of two juveniles captured at Keta were TOTL 101.5, HBL 66.5, TL 40.3, HFL 10, EL 7.5 and WT 3.4 g.

Order: Chiroptera
Suborder: Megachiroptera
Family: Pteropodidae
Nanonycteris veldkampii (Jentink, 1888)

One male adult was captured at Muni-Pomadze (GHM-045). Its measurements were: TL 103, HFL 12, EL 12, FA 47 and WT 19 g.

Order: Chiroptera
Suborder: Microchiroptera
Family: Rhinolophidae
Hipposideros commersoni (Wagner, 1845)

One male adult was captured at Muni-Pomadze (GHM-050). Measurements were: HB 140, HF 25, EL 35, FA 98 and WT 80 g.

Order: Rodentia
Family: Muridae
Subfamily: Gerbillinae
Tatera kempfi (Wroughton, 1906)

Thirteen specimens were recorded, six (GHM-009, GHM-016, GHM-018, GHM-019, GHM-044 and GHM-052) from Muni-Pomadze, and seven (GHM-053, GHM-054, GHM-058, GHM-059, GHM-060, GHM-061, and GHM-062) from Keta. Of the Muni-Pomadze specimens, only one (GHM-016) was female, while two out of the seven Keta specimens (GHM-058 and GHM-061) were male. GHM-053 was captured near Dabala, while the others were all trapped at Anyako. Average measurements were TOTL 318 (300-351), HBL 156 (136-173), TL 162 (150-178), HFL 33 (29-36), EL 21 (19-23), WT 99-127 g. Keta specimens: TOTL 227 (221-243), HBL 111 (86-124), TL 116 (98-132), HFL 29.1 (28-30), EL 17.1 (16-18) and WT 58.7 (35-135) g (mostly sub-adults). In this study all the males captured had scrotal testes, while half the females were lactating. Females possess three pairs of mammae (one inguinal and two pectoral pairs).

Order: Rodentia
Family: Muridae
Subfamily: Murinae
Lemniscomys striatus (Linnaeus, 1758)

There were 19 specimens collected at Muni-Pomadze (GHM-001, GHM-003, GHM-004, GHM-005, GHM-010, GHM-011, GHM-012, GHM-013, GHM-014, GHM-015, GHM-020, GHM-021, GHM-022, GHM-024, GHM-025, GHM-026, GHM-027, GHM-030, and GHM-033) out of which seven (GHM-004, GHM-011, GHM-012, GHM-022, GHM-024, GHM-026, GHM-030) were males. No specimens were recorded at Keta site. Average measurements were: TOTL 225 (210-243), HBL 109 (95-124), TL 115 (107-130), HFL 23 (21-24), EL 15 (12-16) and WT 37 (32-48) g. In this study, 70% of the males had scrotal testes, while one-third of the females were pregnant or showed some placental scarring, an indication of recent birth. Females have four pairs of mammae (two pectoral and two inguinal), and litter sizes ranged between 4 and 5 young.

Order: Rodentia
Family: Muridae
Subfamily: Murinae
Lemniscomys barbarus (Linnaeus, 1766)

Five specimens were collected at Muni-Pomadze (GHM-002, GHM-008, GHM-029, GHM-035, GHM-036), two of which (GHM-029, and GHM-036) were females. There were no captures at Keta. Average measurements were: TOTL 218, HBL 102, TL 116, HFL 23, EL 14, and WT 22-48 g. All the three males recorded in this study had scrotal testes, while the two females were pregnant.

Order: Rodentia
Family: Muridae
Subfamily: Murinae
Uranomys ruddi (Dollman, 1909)

Eight specimens (GHM-006, GHM-028, GHM-032, GHM-034, GHM-038, GHM-039, GHM-040, GHM-043) were collected at Muni-Pomadze, out of which three (GHM-028, GHM-039, GHM-040) were males. No specimens were recorded at Keta site. Average measurements were: TOTL 176 (168-183), HBL 124 (105-168), TL 69 (65-73), HFL 17, EL 15 and WT 41 (35-48) g. Two of the four females recorded were pregnant, and average litter size was 4.5 embryos.

Order: Rodentia
Family: Muridae
Subfamily: Murinae
Mastomys erythroleucus (Temminck, 1853)

Six specimens (GHM-007, GHM-041, GHM-046, GHM-047, GHM-048, GHM-051) were collected at Muni-Pomadze, five males and one female (GHM-048). Average measurements were TOTL 258 (235-278), HBL 134 (120-141), TL 124 (115-138), HFL 23 (18-26), EL 18 (16-19) and WT 68 (40-80) g.

Order: Rodentia
Family: Muridae
Subfamily: Murinae
Hylomyscus alleni (Waterhouse, 1838)

One female specimen (GHM-049) was collected at Muni-Pomadze, with measurements: TOTL 209, HBL 92, TL 117, HFL 21, EL 16 and WT 16 g.

Order: Rodentia
Family: Muridae
Subfamily: Cricetomyinae
Cricetomys gambianus (Waterhouse, 1840)

A single male (GHM-037) was collected from Muni-Pomadze, and a single female (GHM-057) from Keta (Anyako). Average measurements were Muni-Pomadze: TOTL 724, HBL 341, TL 383, HFL 66, EL 42 and WT 1.4 kg Keta; TOTL 675, HBL 319, TL 356, HFL 61, EL 36 and WT 0.8 kg. The single male collected at Muni-Pomadze had large scrotal testes, while the female collected at Keta was lactating.

Discussion

The general lack of captures in the secondary forest habitat, despite its dense canopy cover and lush understorey of leaf litter, could be attributed to the presence of potential predators of these small mammals in these habitats. For example, mongooses (*Mungos* spp.) were sighted in the dense hillside thicket on a few occasions during the study. It is not surprising that the *Eucalyptus* plantation site, close to the coastal highway, being the closest to human settlements, recorded two species of rodents, *M. erythroleucus* (multimammate mouse) and *T. kempfi* (Kemp's gerbil), the former generally known to be commensal with humans.

The greater rodent diversity of the grassland/thicket and eucalyptus/grassland transition habitats suggested a higher preference of these habitats by the rodents, because the numerous thicket islands provided cover, while the grasses and sedges provided sources of food. The open grasslands were also probably unsuitable habitats for the larger mammals that are potential predators of these rodents. The generally low abundance and diversity of small mammals in the

Keta Ramsar site could be attributed to the heavy human settlement and economic activity as well as the absence of natural forest, as pertained in Muni-Pomadze.

The reproductive data obtained on the species suggests a thriving small mammal community at Muni-Pomadze. Even though no definite conclusion could be drawn about the breeding seasons of the various species, because of the short duration of the survey, it could be conjectured that the rodents were in their breeding season. Obviously, only a long-term monitoring programme of the commonest species of the area could reveal the breeding cycles of the various species of rodents at Muni-Pomadze. The reproductive data on Keta small mammals suggested that their breeding season probably did not coincide with that of their Muni-Pomadze counterparts. This could be attributed to the different timing of the rainy season of the two areas.

Acknowledgement

The authors thank the Wildlife Division of the Ghana Forestry Commission for commissioning the survey and granting permission to work at the Ramsar sites. The financial support provided by the Global Environmental Facility of the World Bank is also gratefully acknowledged. Staff of the Ghana Wildlife Society and the Zoology Department, University of Ghana provided field technical support. Finally, thanks go to the people of Onyadze and Bewadze villages for their co-operation.

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