行政院國家科學委員會專題研究計畫 成果報告

台灣哺乳動物誌（II）
研究成果報告(精簡版)

計 畫 類 別 ：個別型
計 畫 編 號 ：NSC 97-2321-B-029-003-
執 行 期 間 ：97 年 12 月 01 日至 98 年 11 月 30 日
執 行 單 位 ：東海大學生命科學系

計 畫 主 持 人：林良恭

計畫參與人員：博士班研究生-兼任助理人員：王豫煌
博士班研究生-兼任助理人員：袁守立

處 理 方 式 ：本計畫可公開查詢

中 華 民 國 99 年 02 月 26 日

行政院國家科學委員會補助專題研究計畫 ■ 成 果 報 告 □期中進度報告

台灣哺乳動物誌(Ⅱ) Mammal Fauna of Taiwan

計畫類別：■ 個別型計畫　　□ 整合型計畫

計畫編號：NSC 97-2321-B-029-003-

執行期間：97 年 12 月 01 日至 98 年 11 月 31 日

計畫主持人：林良恭

共同主持人：

計畫參與人員：王豫煌、袁守立、林艾德

成果報告類型(依經費核定清單規定繳交)：■精簡報告　□完整報告

本成果報告包括以下應繳交之附件：

□赴國外出差或研習心得報告一份

□赴大陸地區出差或研習心得報告一份

□出席國際學術會議心得報告及發表之論文各一份

□國際合作研究計畫國外研究報告書一份

處理方式：除產學合作研究計畫、提升產業技術及人才培育研究計畫、列管計畫及下列情形者外，得立即公開查詢

□涉及專利或其他智慧財產權，■一年□二年後可公開查詢

執行單位：東海大學生命科學系

中　華　民　國　99　年　02　月　26　日

摘要
台灣陸域哺乳動物種類數已達 80 種，包括數種近五年新近發現尚未正式分類之物種。本誌內容乃整理以往的哺乳類研究報告及調查資料，針對台灣已命名的哺乳類動物進行哺乳動物誌的英文編撰。各物種誌的內容包括分佈(Distribution)、形態(Identification)、生態(Ecology)、及參考文獻(Reference)。藉由本誌的出版，將台灣地區的哺乳類動物資源做一個完整的資料彙整與介紹，以呈現台灣豐富的哺乳類動物多樣性，進而深化哺乳類動物的基礎研究與落實生物多樣性保育教育工作，並作為相關單位經營管理與生態旅遊規劃之參考。本年度哺乳動物誌的編寫已完成嚙齒目（20種）一冊及鮑型目（10種）一冊的英文稿準備印製，另翼手目（25種）一冊及中大型哺乳動物(17種)一冊之初稿審定中，預定今年八月以四冊分冊出版。

『關鍵字』：哺乳動物誌、生物多樣性、系統分類

Abstract
The native Taiwanese mammals consist of ca. 80 species, including recently new discovered species but not yet nomenclature. The number of the native species of per area is the highest in the eastern Asia areas. Thus, the Taiwanese mammal fauna is abundant for its small island area. An update fauna is very important for the reference on the conservation practice. In addition, a complete fauna published by English is also to aid foreign researchers to cooperative with us for mammaology. In order to understand the species diversity of mammals in Taiwan from the fauna project, the contents of each species incluing distribution, identification and ecology. The results of this year on the English writing for the Rodntia (20 spp.) and Soricmorph (10 spp.) are finished and to print. Also, the draft of the Chiropteria (25 spp.) and Large-Middle size of mammals are under review. We plan to publish four volumes on August 2010.

『Key words』: Mammalian fauna, Biodiversity, Systematic

一、前言

動物誌是一地區動物分類的集大成的表現。最早從事台灣哺乳動物的研究，始自於1862年當時駐高雄的英國領事Robert Swinhoe所。爾後，1895年甲午戰後至1945年止，台灣成為日本的殖民地，大約自1915年起往後的三十年間，台灣地區的哺乳動物誌相關研究工作開始為日籍學者所接手。陳兼善於1956年整理日據資料而出版”台灣脊椎動物誌”，內包含台灣哺乳類動物誌的雛形。。林良恭(1982)重新整理台灣陸生哺乳動物的文獻及野外調查後，共列出61種。台灣迄今仍缺乏英文版完整的哺乳動物誌的呈現。誌是明白各物種的系統分類位置、生態與生活史等資料，有了誌才能進行樣性的保育。其次，誌的編撰對於探討台灣周邊同類近緣種因地理隔離而分。本研究以兩年時間完成台灣哺乳動物誌英文版撰寫與出版。

二、研究方法

1.哺乳動物誌分為4大組別進行資料整理收集：(1) 翼手目(Chiropteria)：飛行性哺乳動物；(2) 鼩鼱型目(Soricmorpha) (3) 嚙齒目(Rodentia)；(4)中、大型哺乳動物：主要包括兔型目(Lagomorph)、鱗甲目(Pholida)、靈長目(Primate)、食肉目(Carnivora)及偶蹄目(Artiodactyla)等動物類群。
2.各物種將就分類分佈(Distribution)、形態(Identification)、生態(Ecology)編撰。
3.形態資料以分辨哺乳類物種，體型大小(外形及體重)、毛色等重要指標。
4.各物種參考重要文獻(Reference)整理及相關 Index 製作。

三、結果與討論

1. 各物種描述格式確立：11個項目整理，包括分佈、分類回顧、形態、測距、化石、遺傳、棲地及出現、生態、保育、檢索表(屬下)和文獻，其中生態部分再分成9類，包括寄生蟲、族群、生殖、成長發育、食性、掠食、生理、微棲地偏好及行為等。

2. 例

FAMILY SORICIDAE

Genus *Anourosorex* Milne-Edwards, 1872

The genus *Anourosorex* currently includes four species (Hutterer, 2005a): *A. assamensis* in northeast India; *A. schmidi* in northeast India and Bhutan; *A. squamipes* in China, Myanmar, eastern India, north Vietnam and Thailand; and *A. yamashinai* in Taiwan. Type species is *Anourosorex squamipes* Milne-Edwards, 1872 (Hutterer, 2005a). These four species, however, have been considered to represent only a species *A. squamipes* until recently. Hutterer (2005a) separated these four species following the morphological and karyological studies by Motokawa and Lin (2002) and Motokawa et al. (2004).

Anourosorex yamashinai Kuroda, 1935

Formosan burrowing shrew, Formosan mole-shrew.

台灣短尾鼩, 山階氏鼩鼱

Synonym

Anourosorex squamipes yamashinai Kuroda, 1935: 288; Tanaka, 1936: 313; Okada, 1938: 3; Ou, 1938: 105; Kuroda, 1938: 85; Kuroda, 1940: 187; Ellerman and Morrison-Scott, 1951: 87; Kuroda, 1952: 286; Ellerman and Morrison-Scott, 1966: 87; Jones et al., 1969: 50; Kuntz and Dien, 1970: 33; Jameson and Jones, 1977: 476; Chen and Yu, 1984: 456; Yushan National Park, 1988: 97; Cheng et al., 1995: 19; Chang Chien and Cheng, 1997: 199; Cheng et al., 2000: 19; Tsai, 2000: 207; Tsai, 2002: 20, 209; Wang, 2003: 19; Tsai, 2005: 178; Chen, 2005: 196.

Anourosorex squamipes; Ellerman and Morrison-Scott, 1951: 87; Ellerman and Morrison-Scott, 1966: 87; Jones et al., 1971: 269; Jones, 1975: 186; Corbet and Hill, 1980: 32; Hutterer et al., 1982: 67; Corbet and Hill, 1986: 37; Corbet and Hill, 1991: 37; Corbet and Hill, 1992: 33; Hutterer, 1993: 106; Zhang, 1997: 15; Ci, 1998: 212; Duff and Lawson, 2004: 131; Wang, 2003: 19; Wang and Wang, 2005: 58; Yang and Yan, 2007: 49; Shao et al., 2008: 795.

Anourosorex yamashinai; Hutterer, 2005a: 268; Pan et al., 2007: 369; Hoffmann and Lunde, 2008: 305; Lin, 2008: 107; Yu, 2009: 152.

Distribution

Species — Anourosorex yamashinai is an endemic species to Taiwan (Hutterer, 2005a). A distinct distribution gap exists with the other three *Anourosorex* species (Motokawa et al., 2004).

Taiwan — Anourosorex yamashinai is distributed throughout mountains of Taiwan main-island from about 300 m elevation; and is the most abundant in hardwood forests between 1,500 and 2,500 m elevation (Jameson and Jones, 1977).

Taxonomic review

Anourosorex yamashinai has long been considered to be a synonym or subspecies of *A. squamipes*. Hoffmann (1987) found the small size of Taiwan *A. yamashinai* among the genus based on specimens collected from Alishan, Feng Chi Hu, Chueifeng in Nantou Hsien, and Wushe; then noted that "they are recognized as a separate subspecies, *A. s. yamashinai*, but it is at best weakly differentiated." *Anourosorex squamipes* (2n = 48, FN = 96) and *A. yamashinai* (2n = 50, FN = 100) have different karyotypes with the latter characterizing in having two large subtelocentric autosome pairs (Motokawa et al., 2004). Motokawa and Lin (2002) made cranial morphometric analyses and

revealed the distinction between populations referable to *A. yamashinai*, *A. squamipes*, and *A. assamensis*. Taiwan *A. yamashinai* is characterized by the low ascending ramus, flattened cranium, as well as short and tiny tail (Motokawa and Lin, 2002). Hutterer (2005a) elevated *A. yamashinai* as full species based on these evidences.

Holotype — Holotype was originally described as Marquis Yamashina Collection no. 58, an adult female from Taiheizan, Taihoku-siu, 5,500 feet, northern Formosa, collected on October 7, 1932 by H. Orii. It is currently deposited at the Yamashina Institute for Ornithology, Abiko as YIO 714 (our examination). Type locality is currently known as "Taiping Shan, Ilan Hsien, 24°30'N; 121°28'E" (Jones, 1975). Head and body length 107 mm, tail 11, hind foot 16. Skull: greatest length including incisors 26 mm, superior margin of foramen magnum to tip of premaxilla 25, condylobasal length 25.9, basilar length including incisors 23.5, palatal length 10.5, interorbital constriction 6.1, mastoid width 14, upper tooth row 11.5, mandible with incisors 17, mandible without incisors 14.5, lower tooth row length (Kuroda, 1935).

Morphology

External — *Anourosorex yamashinai* is a medium-sized shrew characterized by small eye and very short tail. Dorsal and ventral sides are both blackish; feet and tail are white. An albino individual was reported from Tayuling (2,565 m elevation) in Hualien County (Alexander et al., 1986).

Skull — Skull is robust with well-developed condylar process and mastoid process.

Skeleton — Fore limb morphology of *A. yamashinai* was compared with shrew species *Crocidura tanakae* and mole species *Mogera insularis* in relation to different degree of adaptation for underground life (Chang et al., 2005).

Dentition — Dental formula is 3013 / 2013 = 26 (Hutterer, 2005b). Dental morphology was studied in detail by Hanamura et al. (1980). Posterior cusp of the upper first incisor is well developed. Upper fourth premolar is well developed and has the similar size to the first molar. The upper and lower third molar are much reduced, and missing in some individuals.

Measurements

External — Yu (1993) reported measurements from Yushan National Park (n = 43 in males, n = 33 in females): body weight 18.99 ± 2.69 gram in male, 19.70 ± 3.59 in female; head and body length 92.35 ± 5.03 mm in male, 93.42 ± 5.00 in female; tail length 9.74 ± 0.85 in male, 10.36 ± 1.08 in female; hind foot length 15.77 ± 0.81 in male, 15.88 ± 0.65 in female. Motokawa and Lin (2002) reported measurements for pooled sample from Taiwan (n = 26): head and body length 78.33 ± 10.16 mm (50.7–98.0 in range), tail length 10.05 ± 1.36 (7.0–12.6), hind foot length excluding claws 14.45 ± 0.76 mm (13.0–16.0).

Skull — Motokawa and Lin (2002) reported 18 measurements for pooled samples from Taiwan (n = 29) including condylo-incisive length 24.64 ± 0.63 mm (23.50–25.84 in range), upper tooth row length 11.19 ± 0.36 (10.34–11.71), and lower tooth row length 10.32 ± 0.34 (9.46–11.00).

Fossil

There is no fossil record of *A. yamashinai*.

Genetics

Karyotype — 2n = 50, FN = 100 (2n: diploid chromosome number, FN: fundamental number including two X chromosomes). Conventional, G-band, and C-band karyotypes were examined for specimens from Alishan in Chiayi County, Tsuifeng in Nantou County, Wanrong in Hualien County, and Tengchih in Kaohsiung County; autosomes consisted of 22 large-to-small metacentric or submetacentric pairs and two large subtelocentric pairs; X chromosome is large metacentric; and Y chromosome is medium-sized subtelocentric (Motokawa et al., 2004). Secondary constriction was found in a small metacentric autosomal pair (Harada and Takada, 1985; Motokawa et al., 2004). The karyotype of *A. yamashinai* is distinct from that of *A. squamipes* from Sichuan Province, China (2n = 48, FN = 96: Motokawa et al., 2004, 2009).

Molecular data — Eleven microsatellite markers (GenBank AF261959–AF261969) were developed by Yu and Liao (2000). Using these microsatellite markers, relatedness structure and individual identification were examined for 36 individuals originated from five localities: Xialixianshi, Dweiguan, Chitou, Nanheng, and Wuling (Liao, 1999; Yu et al., 2001). Cytochrome b phylogeography within Taiwan was studied by Yuan et al. (2006) based on 103 individuals from 24

localities (35 haplotypes, DDBJ AB190460–AB190495). It was revealed that *A. yamashinai* consists of a monophyletic clade that is distinct from Sichuan *A. squamipes*, and *A. yamashinai* include two distinct geographical clusters: northern phylogroup (Li-dungshan, Guanwu, Wulin farm, Suyuanyakou, Jhenshibao) and southern phylogroup (Heping, Guanyuan, Meifung, Tsufung, Nenggau, Aowanda, Wanrong, Danda, Xitou, Shalinxi, Alishan, Mount Taguan, Tianchi, Mount Guan, Rueiyanshi, Tengjhih, Wujie Dam). Samples from Mount Houhuan were included in northern or southern clusters or positioned in a distinct clade between the two clades (Yuan et al., 2006). Yuan et al (2006) discussed the evolutionary history using interglacial refugia hypothesis postulating three past refugia (Northern, Houhuan, and Southern refugia) in Taiwan. Ohdachi et al. (2006) examined mitochondrial cytochrome b gene sequences of two specimens of *A. yamashinai* from Nantou County and Chiayi County (AB175088, 175089) within the study of Soricidae molecular phylogeny; and revealed that *Anourosorex* genus formed basal clade in the subfamily Soricinae and that *A. yamashinai* is distinct from Thailand *A. squamipes*. In contrast, Dubey et al. (2007) did not support the basal position of *A. yamashinai – A. squamipes* clade within the subfamily Soricinae.

Ecology

Habitat — Anourosorex yamashinai is semi-fossorial species. In Alishan, Alexander et al. (1987) reported that *A. yamashinai* showed strong preference for dense vegetational cover and favorable burrowing conditions, characteristic of the *Chamaecyparis* habitat. Lin and Shiraishi (1992c) reported that *A. yamashinai* was captured at places with dense trees, twigs and looser soil conditions. In Yushan National Park, Yu (1993, 1994) reported that *A. yamashinai* is widely distributed across elevation, and is strongly associated with moist microhabitats such as areas along streams in both broad-leaf and conifer forests.

Reproduction — In Yushan National Park, Yu (1993) reported that breeding males had mean body weight of 19.37 $\pm$ 1.77 gram (range 17.0–22.5, n = 15) and testis length 5.33 $\pm$ 0.82 mm (range 4.0–6.0, n = 15); breeding females were found only in the wet season and mean body weight was 24.33 $\pm$ 4.05 gram (19.5–31.0, n = 6); and litter size was 2.50 $\pm$ 1.00 (range 2–4, n = 4). In Alishan, five pregnant females with 2–4 embryos were captured in April, August, and December;

testes were developed in June to August (Alexander et al., 1987).

Growth and development— Not reported.

Food habits — Food habits in Meifeng, Nantou County was reported by Huang (2004).

Population — Population and community ecology in Alishan Recreation Area was studied by Lin et al. (1987).

Predator — Not reported.

Physiology — Not reported.

Behavior — Not reported.

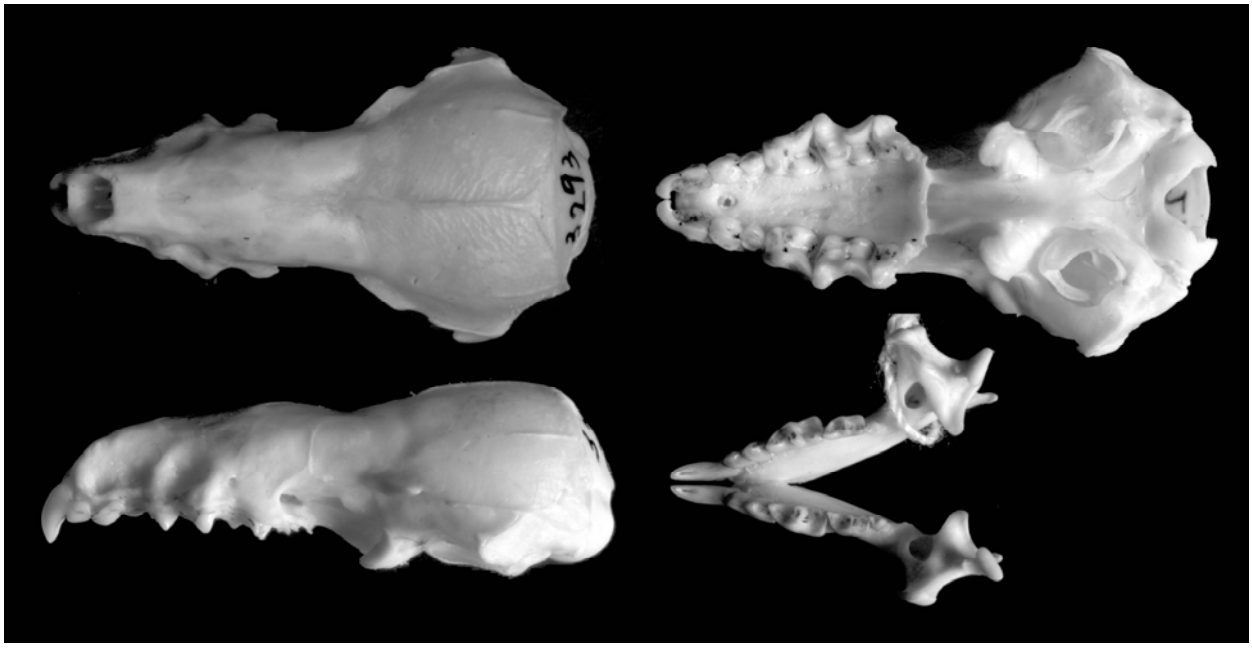
Conservation and relationship with human

Anourosorex yamashinai is not currently under consideration of conservation or control.

Identification key

Among four species of the genus *Anourosorex*, *A. yamashinai* is characterized by the low ascending ramus, flattened cranium, as well as short and tiny tail (Motokawa and Lin, 2002); tail length does not exceed the hind foot length without claws. Four *Anourosorex* species may be allopatric and the detailed identification key has not been established, Species and distribution boundaries among three species in the continent need to be clarified.

Among soricid species in Taiwan, *A. yamashinai* is easily distinguished by its reduced tail that is shorter that hind foot.



四、參考文獻：

Aoki, B. 1913. A handlist of Japanese and Formosan mammals. Annot. Zool., Japan 13(2):261-353.
Ellerman, J. R. and T. C. S. Morrison-Scott. 1951. Checklist of Palaearctic and Indian mammals, 1758-1946. British Museum (Natural History), London. 1280pp.
Fang, Y. P., L. L. Lee, F. H. Yew & H.T. Yu. 1997. Systematics of white-toothed shrews (*Crocidura*) (Mammalia : Insectivora : Soricidae) of Taiwan: Karyological and morphological studies. J. Zool. London, 242:151-166.
Jameson, E. W. and G. S. Jones. 1977. The Soricidae of Taiwan. Proc. Bio. Soc, Washington 90: 459-482.
Jones G. S. 1971. Two bats new to Taiwan, J. Mamm. 52: 479.
Jones G. S. and Mumford R. E. 1971. *Chimarrogale* from Taiwan. J Mamm. 52: 228-232.
Kuroda, N. 1952. Mammalogical history of Formosa, with zoogeography and bibliography. J. Taiwan Mus., 5(4):267-304.
Swinhoe, R. 1862 On the mammals of Taiwan. Proc. Zool. Soc. London, 347-365.
Swinhoe, R. 1864 On a new rat from Formosa. Proc. Zool. Soc. London, 185-187.
Yoshiyuki, M. 1991. Taxonomic status of *Hipposideros terasensis* Kishida, 1924 from Taiwan (Chiroptera：Hipposideridae). J. Mammal. Soc. of Japan. 16(1):27-35.
方引平。2001。台灣麝鼩屬動物之系統分類及親緣地理學研究。台灣大學動物學研究所博士論文。
林俊義、林良恭。1983。台灣陸生哺乳動物學研究史。省博年刊 26:37-52.
林良恭，1982。台灣陸生哺乳動物研究。東海大學生物系碩士論文。
李玲玲、林良恭。1992。台灣哺乳動物之研究與現況。台灣生物資源調查及資源管理研習會論文集，中央研究院植物研究所專刊第11號，PP. 245-267.
周政翰。2004。台灣地區鼠耳蝠屬分類地位。東海大學生物系碩士論文。
郭浩志。2004。台灣地區管鼻蝠蝠屬蝙蝠的系統分類學研究。台灣大學生態學與演化生物學研究所碩士論文。
鄭維新。2007。台灣地區小黃腹鼠與亞洲家鼠之地理變異及親緣地理學研究。嘉義大學生物資源研究所碩士論文。

五、計畫成果自評

本研究完成英文稿編撰及出版工作。本計畫可擴大與東亞地區相關哺乳動物物種之資訊交流，促進國際交流合作，提升台灣哺乳類學發展。

。