

RELATIONSHIPS OF CERTAIN OWLS AROUND THE PACIFIC

by

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During recent studies of wild vertebrate reservoirs of arboviruses, I had opportunity to observe some little-known Asiatic owls, to record their songs on tape, and to collect their ectoparasitic Mallophaga. The resulting new evidence suggests that changes from current taxonomic alignments would better reflect their relationships. First the family allocation of the genus *Phodilus* is questioned, then a division of certain members of the genus *Otus* into full species is advocated. I thank Dr. THERESA CLAY and Dr. K.C. EMERSON for identifying the Mallophaga, and Dr. LOYE MILLER for examining the skeleton of *Phodilus*. I am grateful to Dr. JOHN WILLIAM HARDY and JAMES MCCAMMON of the Moore Zoological Laboratory, Occidental College, for making the sonagrams; to the SEATO Medical Research Laboratory for sponsoring the field expeditions of which my observations were an incidental by-product; and to Mr. BEN F. KING, leader of the Thai Migratory Animals Pathological Survey, and his Thai assistants for netting the birds, most of which they banded and released.

Phodilus badius, The Bay Owl

Bay owls were found by us in forests of Thailand where I heard at least three individuals and attracted one close by playing its own song on the tape recorder. Observations of its activities were made with binoculars in conjunction with a head flashlight, as were those of another collected and preserved for anatomical study. Three of the ten netted by Mr. KING were also thus preserved.

Families of owls. The order Striges is divided into two families, Tytonidae for the barn owl and grass owls of the genus *Tyto*, and Strigidae for all the rest. Characteristics deemed of family rank by ornithologists are found in the shape of the bill, notches on the sternum, and presence of specialized ranks of feathers—those comprising the facial disc (enormously developed in the barn owl for

catching sounds) and ear tufts (which give many strigid owls the protective mimicry of a cat). Reliance on such desperate criteria may astonish zoologists from other disciplines, who should be reminded that birds lack the teeth and skull sutures which give consistency to the classification of mammals.

Most authorities have placed *Phodilus* in the Tytonidae (PETERS, J.L., *Birds of the World*, Vol. 4, 1940:85; GROSSMAN, M.L. and HAMLET, J., *Birds of Prey of the World*, 1964:412-413) because of its narrow, elongated bill, pectinate middle claw, and heart-shaped facial disc; but, STUART BAKER (*Fauna of British India: Birds*, Vol. 4, 1927: 383-405) had placed it with the Strigidae because of its broad skull and large eyes. His key to families and subfamilies of owls uses skeletal traits, but if Baker had seen the skeleton of *Phodilus* he would have been more forthright in his assignment of it to the Strigidae. He mentions only that it is in many respects intermediate between Tytonidae and Strigidae, nearer the latter.

Skeleton. The complete skeleton was examined by Dr. LOYE MILLER. He has sent the accompanying sketches (Fig. 1) and writes as follows: "Why anyone ever put this in with the barn owls is beyond my vision. I would estimate *Phodilus* to be about the same body size as *Asio wilsonianus* but a bit chunkier. The skull however is immense and the big eyes set far apart. He must be very strictly nocturnal. The barn owl is a larger bird with smaller brain case and eyes but elongated facial part. (He hunts by ear largely.) The clavicles are mere slivers of bone which do not form a furcula—as also in *Glaucidium*, *Surnia*. The tarsus is rather short and stout with deeply furrowed shaft in front but no ossified bridge over extensor tendons. The expansion distally suggests a big and powerful foot with strong outer toe and hind toe. The tibia is short and stout also with narrow space between the condyles. The whole pelvic complex suggests a strongly predatory habit. The curved humerus, stout forearm, and short, broad manus suggest quick wing beat and versatility of forest dwelling raptor."

Syrinx. The syrinx of our first specimen was dissected and compared with *Tyto* by ALDEN H. MILLER (*Condor* 67, 1965: 536-538).

He found that the bronchi of *Phodilus* were not bound together by a dorsal ligament, and that the ventral fusion of syringeal semirings far exceeds that in Tytonidae. A uniform structural plan with unbound bronchi and unfused rings runs through all the species of Strigidae which Dr. MILLER has dissected; the syrinx of *Phodilus* therefore belongs to neither group and is not even intermediate.

Voice. The song of *Phodilus* (Fig. 3), unlike the long rasping snore of Tytonidae, is for an owl remarkably shrill and expressive, containing a great range in pitch, loudness and timbre within the one outburst. Individuals differ in pattern but agree in the peculiar timbre and in having the loudest notes slurred upward—reminiscent in both respects of the rising shriek of *Strix occidentalis* (incorrectly substituted for the normal hooting song of the Spotted Owl on a recently issued commercial recording). Two of the birds, when territorially aroused by imitated calls or by play-back with the tape recorder, would prolong the series of rising notes, the voice breaking on each one. A recognizably similar song was given by the same bird night after night.

Facial disc. The living bird in the field reveals a facial disc unlike that of any other owl. Dorsally there are two flat Teddy-bear ears (Fig. 2) that can be hooded in the direction of the sound, and which seem therefore to assist the rest of the disc in focusing sound waves upon the ear openings. Of course these rounded "ears" are totally unlike the decorative ear tufts of Strigidae.

Ectoparasites. The bird lice from *Phodilus* are a new species of *Strigiphilus* (*marshalli* CLAY, *in press*) similar to species of that genus on Strigidae but bearing superficial resemblance to *S. rostratus* infesting the barn owl. This seems to be convergence upon plumages of similar texture in the barn owl and bay owl.

Behavior. Tytonidae hunt by flying over grassland, using auditory clues to detect rodents. Their eyes are small but hearing acuity reaches its highest known perfection, for barn owls can capture prey in absolute darkness (PAYNE, *Natural History*, 67, 1958: 316-323). Most owls of the family Strigidae, on the other hand, hunt from a

perch in forest or woodland. Sighting the prey involves a characteristic sharpening of the gaze by circular rotation of the head in a plane perpendicular to the line of sight. With the large eyes both focused upon an object, such movement would make it stand out against an apparently shifting background. Finally the long-winged bird launches itself for the capture, generally through an opening in the forest or to bare ground at the edge of forest or woods. *Phodilus* also hunts from a perch, but sharpens its gaze by rocking the head rhythmically from side to side over a small amplitude (almost hypnotic to the observer), and it flies for its captures through dense stands of young trees beneath the forest canopy. Uniquely short, rounded wings facilitate this rapid flight by which the bird threads its way easily through the maze of vertical stems. This is an adaptation found in no other owl known to me, but is the same as that achieved by the genus *Accipiter* of the diurnal birds of prey (order Accipitres).

By far the most curious behavior trait of the bay owl is its perching upon vertical trunks, a habit necessitated by a unique foraging site. The bird perches in the attitude of an owl comfortably sitting on a horizontal twig; close inspection by flashlight shows that there are no horizontal twigs in these young groves of saplings, and that the bird's huge feet are grasping the vertical trunk, one level with the chest, the other down by the tail as shown in the sketches of a foraging bird (Fig. 2, bottom).

Taken together, this novel array of traits of the bay owl perplexes us by showing departures from Strigidae, even greater removal from Tytonidae, and nothing clearly intermediate. Considering its unique characteristics, I recommend placing *Phodilus* in its own family, the Phodilidae.

The Genus *Otus*, Scops-Owls and Screech-Owls

Species criteria and voice. The scops-owls and screech-owls of the genus *Otus* are characterized by the combination of small size and ear tufts. Morphological differences of value in distinguishing species are found in the feathering of the foot, hair-like prolongations

of feathers of the face, body and limb proportions, iris color, and details of a color pattern which is rather constant throughout the genus. Size and coloration vary racially within some wide-ranging species to such a spectacular degree as to transcend the differences expected of full species. Nor is ecologic preference an infallible distinction, for it is common to find two or three species coexisting in the same habitat. The taxonomic confusion thus engendered is aggravated by polymorphism involving a rufous color phase with simplified pattern which is practically indistinguishable among the different species. It is pertinent therefore to inquire how the owls, color-blind as they are, can tell each other apart! The answer is to be found in their distinctive songs, and I have relied heavily on voice in conjunction with morphologic criteria in my revision of the genus *Otus* of North and Middle America (Proc. W. Foundation of Vert. Zool. *in press*). Each species has a song of particular quality, pitch, and pattern which is used in advertising the territory. It elicits a territorial response only in an individual of the same species. A duetting song is also used by the pair; it is important in initiation of and nightly reinforcement of the pair bond. The species with which I have field acquaintance fall into the following vocal scheme, to which I add *Otus scops* and *Otus choliba* learned from tape and phonograph recordings.

- I. Long territorial and duetting songs are regularly used by both male and female in definite periods of singing; female's song same as male's but of higher pitch (except *whiteheadi*) and less mellow quality; in territorial encounters with neighboring pairs or with playback from a tape recorder, response is with like sex.
 - A. The above two functions divided between two different songs (Fig. 4) *Otus asio*
(with which I have synonymized *kennicattii*, *seductus*, and *cooperi*),
and *Otus trichopsis*.
 - B. One song used for both functions.
 1. Song particularly long; in duetting, the female chimes in to join the male and their songs become synchronized so

that they end together (this sometimes occurs also in longer duets of *O. asio*) ... *Otus "bakkamoena" whiteheadi*, and *Pyrroglaux ("Otus") podargina*.

2. Duetting not synchronized *Otus guatemalae*, and *Otus bakkamoena*.

II. Short territorial song only; no regular duetting by the pair; voice of female rarely heard, and at least in *Otus flammeolus* it is entirely different from that of the male; singing is antiphonal among males on several neighboring territories; duration (unknown for *choliba*) is for hours at a time, sometimes all night, in a steady rhythm.

. <i>Otus choliba</i>	8 or 9 notes,
. <i>Otus scops</i>	1 to 6 notes,
. <i>Otus flammeolus</i>	1 note,
and <i>Otus spilocephalus</i>	2 notes.

The common scops-owl. *Otus scops* has been considered to include the North American *Otus flammeolus* as the same species by DELACOUR (Zoologica 26, 1941: 133-142). There is no question that they are closely related, geographically complementary forms that are ecologically equivalent. Their songs, however, are as different as owl voices can be. *Flammeolus* is unique in possessing, for its size, one of the lowest-pitched, most resonant voices in the family Strigidae. A.H. MILLER found that not only was the syrinx of ample proportions but the tympaniform vibratile membranes were thicker than in other species of Strigidae dissected by him (Auk 64, 1947: 133-135). The normal song of *Otus scops* is a high-pitched staccato whose chirping quality runs identically through the differently timed songs of its far-flung races, three of which are represented in the sonagrams and contrasted with *flammeolus* (Fig. 3). It is inconceivable that a female of *scops* would recognize the singing male *flammeolus* as a potential mate and *vice versa*. They cannot be in the same species.

Collared scops-owl of Asia. Several authors, for instance DEIGNAN (The birds of northern Thailand, Bull. U.S. Nat. Mus. 186, 1945: 175), were formerly tempted to unite *Otus bakkamoena* with its

ecological counterpart in North America, *Otus asio*, a woodland bird with equally spectacular geographic variation and broad latitudinal distribution. Unlike *Otus asio*, *bakkamoena* has brown eyes in most races, ochraceous coloration, continuation of the paper-like feathers of the facial disc down around the chin, and naked toes in all but the northernmost races. These latter have the toe feathers restricted to a band on top; whereas the toe feathering of *Otus asio*, found on all races, is not confined to such a distinct band. Departure in voice equals that in structure. *Otus bakkamoena* of Thailand utters a single, muffled, downward inflected hoot at regular intervals. Both songs of *Otus asio* are rather long and mellow; representative sonagrams are contrasted with the simple utterances of *bakkamoena* (Fig. 4). The bird lice (Mallophaga) of these two owls are different: *Otus bakkamoena* harbors *Strigiphilus heterogenitalis* and *Kurodaia deignani* whereas *Otus asio* is infested with *S. otus* and *K. painei*. These two pairs of species are at opposite extremes of their respective genera, so that *S. otus* is more like a parasite of the burrowing owl than that of *bakkamoena*. The two hosts must not be closely related, as already decided by EMERSON and ELBEL (Proc. Oklahoma Acad. Sci. 39, 1959; 76-78).

Collared scops-owl of Luzon. Only one phrase of the long song of *Otus "bakkamoena" whiteheadi* is shown on the sonagram. (I still lack absolute proof that the song goes with the owl because I have not secured nor seen a specimen while it was actually singing. However the abundance of these singers—two or three pairs within hearing distance from any one spot in the forested Zambales Mountains, Luzon—agrees with the normal prevalence of *Otus* as contrasted with more widely spaced and far flying *Glaucidium* and *Ninox*; also a specimen was collected at a spot where I had heard these duets.) The male's song shown is made up of low and high notes: the low ones sound like the single call of the male *Otus bakkamoena* from Singapore; the higher ones sound like the female from Singapore, which in turn sounds like the ordinary calls heard from presumed males in Thailand. Therefore I hesitate to remove *whiteheadi* from *bakkamoena* in spite of the difference in the way the notes are put together, as well as their different shape on the sonagram.

Palau owl. Synchronized duetting by *Pyrroglaux podargina* (MARSHALL, Condor, 51, 1949: 200-221) is an interesting point of similarity between that species and the genus *Otus* which loses force as a generic trait from the fact that other owls, for instance *Glaucidium cuculoides*, seem to do the same thing. In consideration of the lack of ear tufts, it is recommended that YAMASHIMA (Tori, 10, 1938: 122) be followed in excluding *podargina* from the genus *Otus*.

Summary and Conclusions

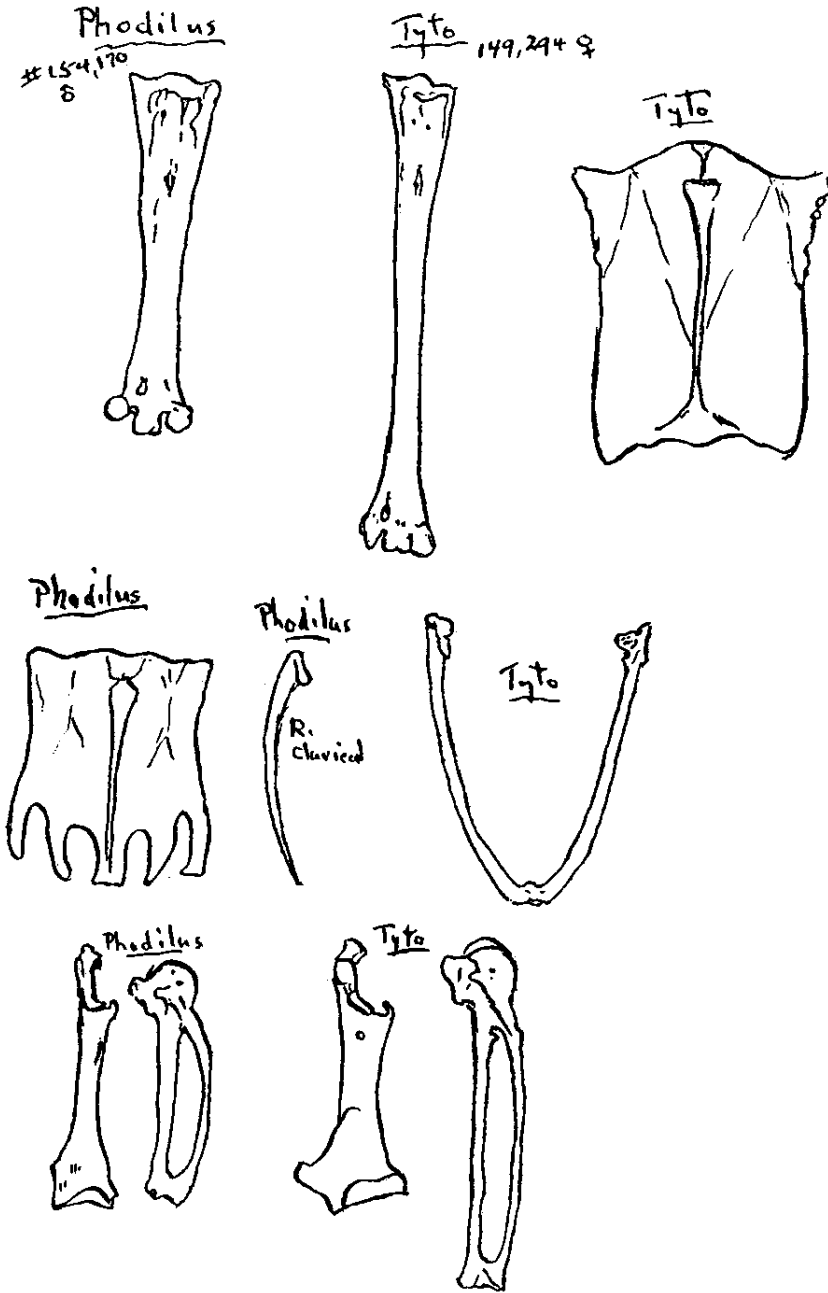
1. *Phodilus badius*, the bay owl, should be put into its own family, the Phodilidae, standing between Tytonidae and Strigidae, which is not to imply that it is intermediate. It is less closely related to the former than to the latter. Unique attributes of *Phodilus* are short wing, extensively fused cartilaginous semirings of the syrinx, expressive voice of peculiar timbre, bilateral dorsal extensions of the facial ruff, unique species of ectoparasitic *Strigiphilus*, side to side movement to aid visual focusing, foraging niche in dense understory vegetation, habitual perching upon vertical trunks, and finally the odd pink ventral coloration.

2. *Otus scops* and *Otus flammeolus* are separate species which belong to the same superspecies—defined as a group of closely related species which replace each other geographically.

3. *Otus bakkamoena* and *Otus asio*, although they are geographically complementary, are dissimilar and not closely related.

4. *Otus bakkamoena whiteheadi* is considered a geographic race of *O. bakkamoena*, with grave reservations which could be alleviated by better field acquaintance.

5. *Pyrroglaux podargina* is tentatively kept out of the genus *Otus* until anatomical evidence is forthcoming.



Sketched from specimens by Loye Miller
(near 1/1 size.)

Fig. 1.
Sketches by LOYE H. MILLER comparing bones of *Tyto* and *Phodilus*, showing from left to right and top to bottom the tarsi, sterna, clavicles, coracoids and carpi.

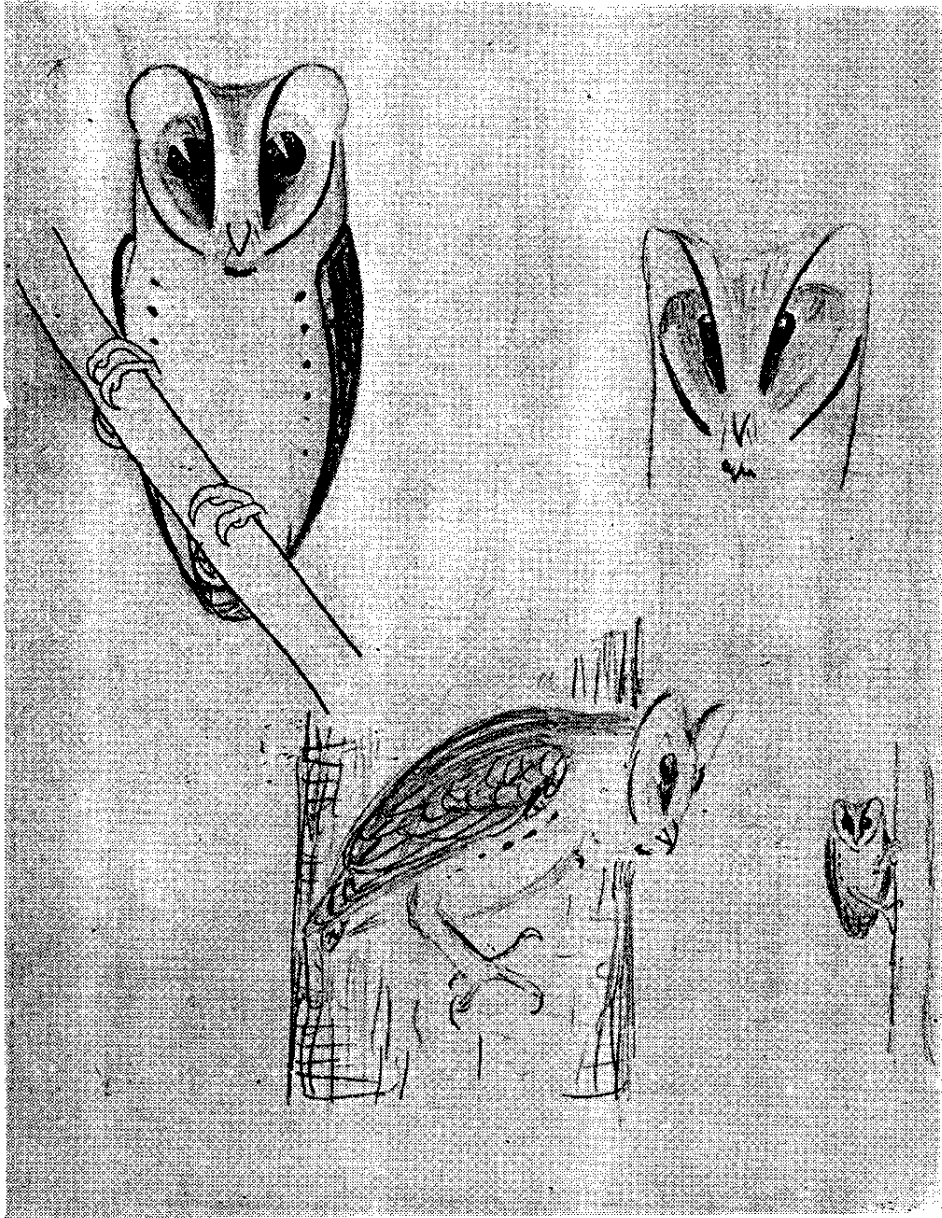


Fig. 2.
Field sketches of *Phodilus* as seen at night by flashlight.

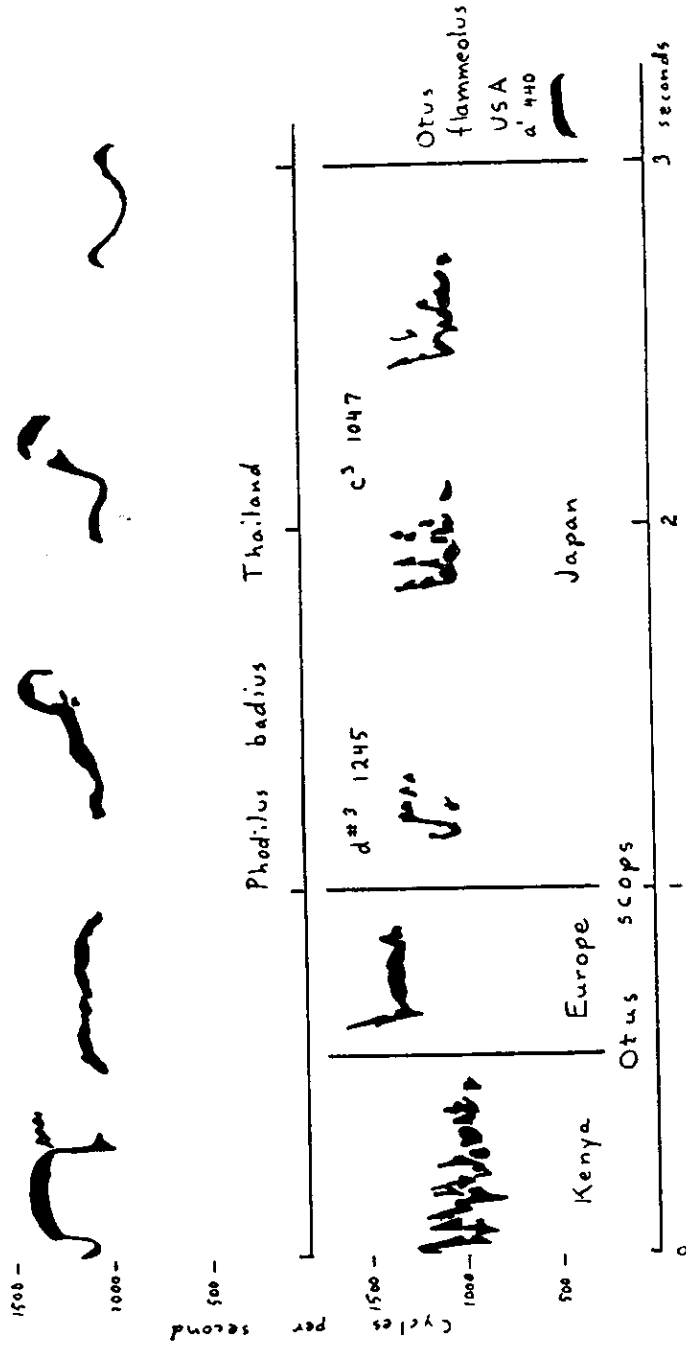


Fig. 3.

Sonagrams from tape recordings made of *Phodilus badius* and *Otus flammeolus* by author; *Otus scops* in Kenya by MILES NORTH, in Europe by K.H. VOOUS, and in Japan by TSURUHIKO KABAYA. The sonagram is an electrically produced graph which reads just like a sheet of music; pitch is on the vertical scale against time which proceeds from left to right on the horizontal. Some musical equivalents are given, as for the flammulated owl at a' 440. The call of the Kenya bird sounds like a rapid succession of 5's or 6 notes.

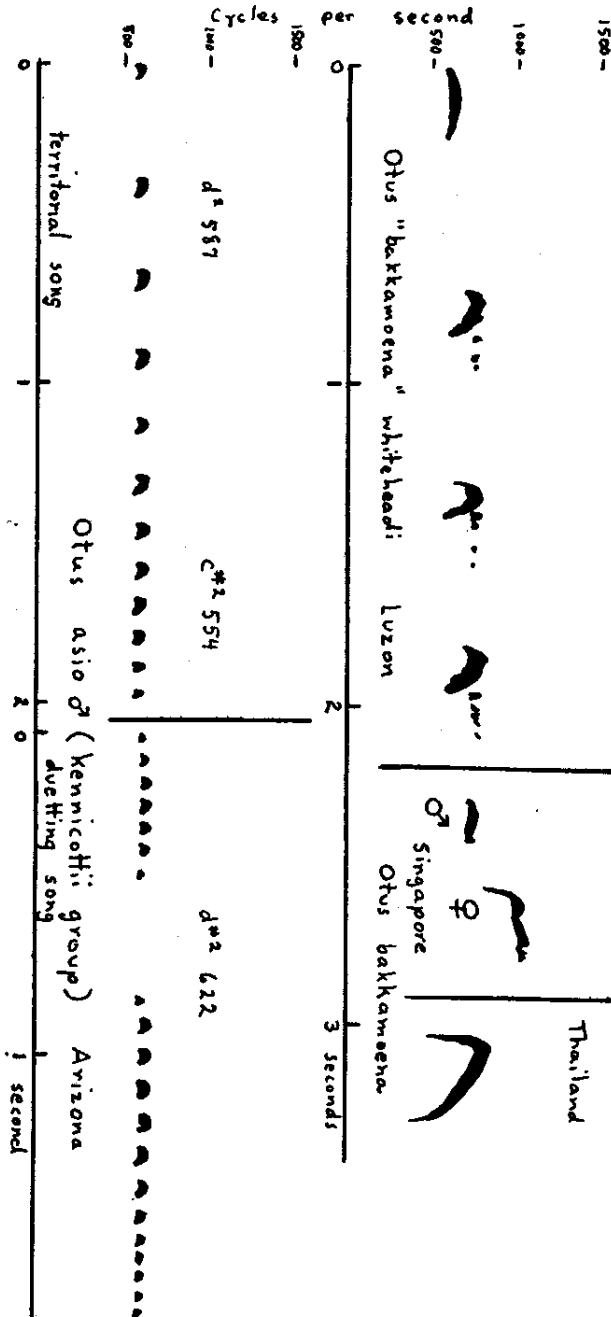


Fig. 4.
Sonagrams of *Otus* recorded by author