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The Amphibian Fauna of Thailand

by

Edward H. Taylor


The following forms are described as new:

Leptobrachium minimum, Leptobrachium hendricksoni, Rhacophorus bisaccatus, Theloderma stellatum, Theloderma gordonii, and Microhyla inornata lineata.

Three generic names have been revived:

Hazelia Taylor has been revived for Philautus pictus (Peters) and Hazelia spinosa Taylor. Theloderma has been revived for certain arboreal Rhacophorids formerly considered under Rhacophorus and Philautus, species that have a very rough surface. They lay four to eight eggs (perhaps more in some cases) in trees, above cavities containing water. They may or may not have vomerine teeth.

Leptobrachium is revived for certain Pelobatids sometimes considered under the genera Megophrys (a composite genus) and Xenophrys. The four Thai species are L. hasseltii, pelodytoides, minimum, and hendricksoni.

Frogs formerly regarded as belonging to Chirixalus are here treated in the genus Philautus, for the reason that the limits of the two genera are as yet not clearly drawn.

The number of species and subspecies treated in the work is 100. However, two are of doubtful validity or of doubtful occurrence.

Practically all forms are described, and illustrated with black and white photographs.

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INTRODUCTION

The work involved in preparing this review of the herpetology of Thailand was undertaken at the specific request of Professor Supachai Vanijuvadhana, Secretary General of Chulalongkorn University, Bangkok, Thailand, who has himself long been interested in the Thai faunas.

The Fulbright Foundation in Thailand, through the kind offices of Professor Supachai, helped to expedite a Fulbright Grant which was made available to me for the period from September, 1957, to June, 1958, and made possible my journey to Thailand. In July, 1958, I found that it was imperative for me to return to America to resume my work at the University of Kansas.

A year later another similar request caused me to apply for a second Fulbright Grant. This was readily made available to me for
another ten-months period beginning July, 1959, and was later extended to September, 1960.

Thus a total of 24 months was spent in Thailand. Of this period, approximately 13½ months were devoted to exploration and collecting in various parts of the country.

One is scarcely aware of the size of Thailand from an examination of an ordinary map of Asia, and one is usually surprised to learn that from north to south the country measures over 1,000 miles, and the east-west measurement is more than half this distance. But once realizing the size of the country it becomes evident that no adequate sampling of the fauna could be done in a single year of exploration.

Many areas must be investigated, many mountain tops attained, and much work both day and night must be expended before one might say the sampling was adequate.

The remainder of my time, some ten and a half months, was spent in Bangkok, the time devoted to a study of the collections and the preparation of the manuscripts.

For the most part this publication follows the over-all design for the study agreed upon by Dr. Supachai and the author. While this was not specific in detail it was proposed that the fauna be considered in three groups: first, a volume treating exclusively of the Amphibians; another dealing with the Lizards, Turtles, and Crocodiles; and a third with the Serpents.

M. L. Pootipong Nupartpat Varavudhi—an instructor in Chulalongkorn University—was assigned to accompany me on my earlier journeys of exploration, and proved to be an excellent companion. I have had most excellent help and numerous specimens from Mr. Oliver Gordon Young of Chiang Mai, and his father, Mr. Harold Young.

I also find myself under considerable obligation to Dr. Boonsong Lekagul, Secretary General of the Association for the Conservation of Wildlife, both for his companionship on numerous collecting trips and for numerous specimens.

The design of this work does not permit the inclusion of a very considerable body of notes on the specimens collected. These have in a measure been sacrificed to have space for illustrations, since pictures may be regarded as a universal language substitute. While the illustrations can scarcely be regarded on a par with color photographs, one is more often concerned with the identification of preserved specimens, in which case the illustration in color may be
no more serviceable than the black and white illustrations offered here.

No effort has been made to provide complete synonymies or literature lists, the titles listed frequently being works dealing with the species as it occurs in Thailand or adjoining countries. With regard to distribution I have, for the most part, been content to list the changwats or provinces where specimens are known, rather than list all exact localities at which specimens have been taken; although frequently exact localities are given of specimens where this data is pertinent.

Elsewhere more details are given regarding the materials used. On my leaving Thailand Dr. Supachai provided for a division of the collections, giving to me a considerable portion of the collection. Unless otherwise stated all specimen numbers are those of Chulalongkorn University.

Finally I must offer my sincerest gratitude to the Rector of the University, Air Marshal Muni M. Vejyant-Rangvrisht, and especially to Dr. Supachai Vanijvadhana its Secretary General for the opportunity to undertake this task; for their untiring and prompt concern with my needs; and for their delightful hospitality in this land of Freedom and Smiling.

Lawrence, Kansas, May 1, 1961.

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In preparing this work numerous Institutions and numerous individuals associated with them have assisted me greatly by providing space and equipment for work, and the privilege of examining, studying, and describing certain specimens. I am especially obligated to Dr. Heinz Wermuth, Curator of Herpetology in the Berlin Museum; Dr. Josef Eiselt, and Dr. D. Kahsbauer of the Naturhistorisches Museum in Wien; Dr. Enrico Tortonese, Director of the Museo Civico di Genova; Dr. Robert Mertens, Director of the Senckenbergian Museum, and Dr. Konrad Klemmer, Curator of Herpetology in the same Museum. Dr. Giuseppe Scortetti, Director Institute of Biology, University of Genova; Dr. H. Boschma, Director, and Dr. M. Boeseman of the Riksmuseum van Natuurlijke Historie, Leiden; Mr. Hellenius, Curator of Herpetology, Zoologisch Museum, Amsterdam; Miss Alice G. C. Grandison and Mr. J. C. Battersby of the British Museum of Natural History, London; and Dr. Doris Cochran of the U. S. National Museum.

Friends in Thailand and Malaya who have been especially helpful are Prof. Dr. and Mrs. (Dr.) Georg Heuser of Chulalongkorn Uni-
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TAXONOMIC CONSIDERATION

AMPHIBIA

The amphibia, a very early vertebrate group of land animals, are probably less numerous than they have been in the past. Certain orders such as the Laibrinthodontia, Phyllospondyli, and Lepospondyli, are extinct.

Three orders of amphibia, however, are living. These are Caudata, Salientia, and Gymnophiona.

The Caudata have retained what we are wont to consider as generalized characters; retention of limbs (rarely lost), retention of the tail, and a moderately elongated body; and the retention of teeth in both jaws (occasionally absent).

The Salientia have, however, become greatly modified and are not generalized. The legs are retained in all cases but the body form has become especially shortened; the number of vertebrae greatly reduced; the legs greatly enlarged in proportion to the arms; the teeth have, with rare exception, been lost in the lower jaw and the tail has been lost in the adult.

Despite this great specialization, these animals must be regarded as plastic and while retaining these specialized characters, may otherwise adapt themselves to many varieties of habitats. They
Map No. 1.—Provinces (Changwats) of Thailand. The numbers refer to the numbered list of provincial names, and have no significance in themselves.
LIST OF THAI PROVINCES

(Corrected spellings as used by the U. S. Army Gazetteer, 1944)

1. Chainat 37. Lamphun
2. Sing Buri 38. Lampang
3. Lop Buri 39. Phrae
4. Sara Buri 40. Nan
5. Ang Thong 41. Uttaradit
6. Ayutthaya 42. Tak
7. Nonthaburi 43. Sukhothai
8. Pathum Thani 44. Phitsanulok
10. Phra Nakhon (Bangkok) 46. Phichit
11. Nakhon Nayok 47. Phetchabun
13. Samut Prakan 49. Uthai Thani
14. Chachoengsao 50. Kanchanaburi
15. Chon Buri 51. Suphan Buri
16. Rayong 52. Rat Buri
17. Chanthaburi 53. Nakhon Pathom
18. Trat 54. Samut Songkhram
19. Chaiyaphum 55. Samut Sakhon
20. Nakhon Ratchasima (Khorat) 56. Phet Buri
22. Surin 58. Chumphon
23. Khu Khan (Sisaket) 59. Ranong
24. Ubon 60. Phangnga
25. Nong Khai 61. Surat Thani
26. Loei 62. Nakhon Si Thammarat
27. Udon Thani 63. Phuket
28. Sakon Nakhon 64. Krabi
29. Nakhon Phanom 65. Trang
30. Khon Kaen 66. Phatthalung
31. Maha Sarakham 67. Satun
32. Kalasin 68. Songkhla
33. Roi Et 69. Pattani
34. Mae Hong Son 70. Yala
35. Chiang Mai 71. Narathiwat
36. Chiang Rai

As for the spelling of Thai names, I am using the scheme of transliteration from the Thai alphabet adopted by the Thai Government nearly two decades ago, and likewise used in the U. S. Army Gazetteer of 1944. This often is at variance with spellings encountered in European or older American maps, or in other reports. An effort should be made to stabilize the system of transliteration.
have been very successful and considerable more than two thousand forms are known and doubtless many are still undiscovered.

The life history pattern in many forms has been varied and while normally the amphibian requires a free swimming stage, very many forms pass the larval stage entirely in the egg, the young emerging with arms and legs developed and the tail reduced or lost. There is a world of variety in the life histories of this group. The eggs are deposited in water, in masses of foam, in shrubs and trees, or on the ground in holes in the earth, in pockets on the body, in vocal sacs, in trees above small pockets of water or retained in the "uterine" oviduct where a type of placentation occurs.

A few forms have developed a certain tolerance to sodium chloride, even going into the sea to feed.

The Gymnophiona also have become highly specialized through the loss of both arms and legs, the total, or almost total loss of the tail, the increase in the length of the body, and the development of serpentine locomotion, the transverse folding of the skin and loss or concealment of scales, the reduction of the eye, and the retention of teeth in both jaws (two series in the upper jaw and one or two in the lower).

This group, too, has been successful. It has distributed itself throughout much of the tropical and subtropical areas of the world.

Perhaps as many as 125 species are known and I suspect many are still undiscovered. The fact that at the present time only a single family is recognized, is suggestive that they all originated from and have diversified from a monophyletic group.

**Caudata**

The world-wide distribution of this order of Amphibia follows an unusual pattern. They are wide-spread in the Northern Hemisphere, but completely absent in the Southern Hemisphere except for a few plethodontid salamanders that follow the Andes south to Bolivia and perhaps one species, that has been reported from the Amazon Basin. While present in Siberia, China, and Japan, they are absent in much of southern Asia. None are not known from Arabia, Iran, and India, while in Burma, Thailand, and Indo-China they are known only in the northern parts. They are again absent in Malaya, the Philippines and the Indo-Australian Archipelago.

Only a single genus and species has been found in Thailand. This is *Tylothorax verrucosus* a form entering from the north and as yet known only from high elevation in mountainous areas in the
province of Chiang Mai. There is, of course, a possibility of finding other species of salamanders since but little exploration has been undertaken in the higher areas. Yunnan, lying to the north of Thailand, has Cynops, another genus represented, while in the Indo-Chinese area another genus, Paramesotriton, is present, and Tylototriton is represented by a different species, T. asperrimus.

A species of Ambystoma reported by Gray from Siam in 1859 was found to be actually a mislabeled American species, A. jeffersonianum.

While most Caudata have retained the generalized pattern, certain forms have become burrowers with the consequent reduction or loss of digits and limbs; others live entirely in water.

Many forms have become neotenic, attaining sexual maturity and reproducing in the larval state or at least before the complete transformation to a terrestrial form takes place. Sometimes the larval condition retained may be that of external gills. Sometimes it is the fins or the larval condition of the teeth that is retained; and in the case of Thorigus the bones of the skull appear to remain in the larval condition.

Gymnophiona

The Gymnophiona are less familiar to most persons than are the frogs, since they are subterranean in habitat and often when one is seen it is likely to be regarded merely as an earthworm, which they resemble superficially.

This group has undergone a remarkable evolution since we must postulate that these animals came from four-limbed ancestors as is true of all the terrestrial vertebrates. The loss of digits and limbs are the end result of mutations selected by the burrowing habitat.

The method of locomotion has changed and a curious change has taken place at the surface of the body. This is the "folding" of the skin as if by a system of "tucks." The "seams" are indicated by the small grooves that separate one fold from another and the curious scales, if present, are covered by the fold. The number of the grooves may exceed 400. Sometimes the number of scuterows exceeds 1,000.

An intromittent organ has developed from the posterior part of the gut, an organ that is extruded by infiltrating it with blood, making possible internal fertilization of the eggs. The loss of the tail or almost complete loss of the tail, would permit copulation between male and female even if only the ends of the two bodies were together.
When I have found these animals in burrows the diameter of the burrow is scarcely larger than the diameter of the body and while larger burrows may exist I have found none of a diameter that would permit two animals to copulate when their bodies were parallel side by side. The position in copulation must still be determined.

The inner wall of the male gut is modified posteriorly by thickened areas forming a more or less symmetrical pattern, that at least in many cases, may serve as a distinguishing specific character. In various genera the character may likewise serve to distinguish genera.

The mode of life history varies in the Gymnophiona. Eggs are usually if not universally fertilized internally. They may be deposited in moist places under rocks, in moist burrows near streams, directly in the water, or they may be retained in the oviduct, the young being born in an advanced larval stage.

Most of the species spend a part of their larval life as free swimming larvae, breathing through gills, although a very considerable part of development will have taken place within the egg itself.

In the larval state the lateral-line system may function if the animal is aquatic. It may appear only in the earlier larval stages or it may be retained until the larvae undergo transformation to the adult form. It may be presumed that if so retained the animal is an inhabitant of deeper river water.

One behavioral feature in the sole Thai genus Ichthyophis is the parental care bestowed on eggs, at least in certain species. The female of Ichthyophis youngorum places the eggs under a rock near the edge of a stream, the eggs being fastened together by threads two or more centimeters in length, like so many diminutive toy balloons. The following illustrates this behavior.

A rock was turned. The female did not attempt escape but remained with the eggs. When the eggs were transferred to a container partly filled with earth the female was picked up gently. Her struggles were negligible and when placed in the container with the eggs she found them and by placing her head under them, turned each egg so that it attained a different position. This was continued perhaps ten or fifteen minutes then she became quiescent.

In this case the eggs contained embryos about 40 mm. long and the movement of the material in the eggs always left the embryo uppermost in the egg regardless of the position in which it was placed; at least the position of the embryo did not change when the egg was rotated.
There is a surprising specific constancy in many of the characters. The arrangement, number, and distribution of the scales; the characteristics of the vent, the number of folds on the tail, its shape and length, and the position of the teeth.

The numbers of the teeth vary from youth to age, and often the larvae will have specialized teeth that are lost during larval existence. Some of these teeth may appear outside the lips and in one case have been reported as serving the larvae in rasping off parts of the uterine surface in order that it may feed upon it.

Salientia

The Salientia, by far the largest living amphibian group, are generally familiar to the people. They have developed a voice and in the case of the males of many species, vocal sacs that open into the mouth through one or two openings.

The sac may be under the skin of the throat and when inflated may form a large pouch on the throat. There may be two sacs that push out through the skin of the floor of the mouth or behind the angle of the jaw on the side of the head.

The openings to the vocal sacs, seen on the inside of the mouth may be elongate slits, short slits or small puckered openings. They may be easily visible in the mouth lying close to the lower jaw, or they may be far back in the mouth near the jaw-angle and difficult to discover. Many species lack the sac in the male. It is not present in females.

Determination of the sex of a specimen is not always easy save by dissection and even then hermaphroditic individuals still offer problems in sexing.

Usually in adults the presence of a vocal sac or sacs or the presence of a nuptial pad on the first finger or specialized groups of spines, which may extend on to second and third fingers, betoken the male.

In most species the female reaches a larger size than the male. Rarely there is a difference in the amount of webbing on the fingers or on the toes. Occasionally marked sexual differences are evident in the two sexes as regards color and marking (see Pedostibes).

The nuptial pad of the first finger may be absent. Often glands on the inner part of the arm seem to serve the same purpose as the nuptial pad or groups of spines. If the forms are large and arboreal the male may develop a conspicuous bony spine on the insideside of the first finger that may serve as a safer clasping organ.

For the most part eggs are deposited in the water and are fer-
tilized by the clasping male as the eggs are extruded by the female. Some of the frogs have developed a technique of egg deposition out of the water. In certain tree frogs the eggs are placed on the underside of leaves close to or above water. When the young hatch they fall into water from the eggs. In other cases gelatinlike material extruded with the eggs is churned up by the legs of the male and deposited in the form of a ball of foam in plants, shrubs, or trees, occasionally as much as six meters above water.

ORDER CAUDATA (Salamanders)

Four limbs are usually present, rarely only two; young pass through a larval state in which they breathe by gills, followed by a complete (or partial) metamorphosis. Some forms remain in the larval state throughout life; tail retained, not absorbed at transformation; eggs placed in water for hatching.

Nine families are recognized: Hynobiidae, Cryptobranchidae, Amphiumidae, Ambystomidae, Salamandridae, Desmognathidae, Plethodontidae, Proteidae, and Sirenidae.

Only a single salamander species is known from Thailand. It is a high mountain dweller, as yet found in Thailand only on isolated mountain peaks, in the northern part of the country.

FAMILY SALAMANDRIDAE

Of the Caudata only the Family Salamandridae is represented in Thailand. A species described from Thailand as Plethodon perkinsi Gray, (1859), was placed in the genus Ambystoma family Ambystomidae by Boulenger. It has since been discovered by Noble, (1926), that the specimen so described actually originated in the United States and is a synonym of Ambystoma jeffersonianum.

Tylototriton Anderson


Diagnosis: Tongue small, subcircular, free laterally, and slightly so posteriorly; prevomerine teeth in two oblique series meeting anteriorly; a thick bony frontosquamosal arch; maxillary reaching quadrate; pterygoid applied to maxillary; four fingers; five toes; tail strongly compressed.
Tylostrotiton verrucosus Anderson


Diagnosis: Maxillary-premaxillary teeth 55, those on the premaxillary largest; vomeropalatine teeth in a continuous series lying parallel anteriorly and diverging posteriorly; tongue circular, free on sides, fastened anteriorly; crown of head flattened, depressed in frontal and interorbital areas; sides of head with bony and glandular areas elevated to level of upper eyelid; nostrils near tip of snout directed forward; body above with two series of rounded knobbylike tubercles; tail laterally compressed.

Description of species (from No. 36104; Doi Intanon, Chiang Mai, Thailand, 2000 m.; collected by Mrs. Birgit Degerbøl Hansen): Head bluntly oval almost truncate; strong canthal ridge begins at snout and passes back of eye, terminating in a thickened glandular area (resembling a parotoid gland) the end of which is narrowed and bent somewhat upward. A depression lies between these ridges; eye moderate, its length approximately equal to length of snout; nostrils directed laterally and somewhat forward; prevomerine teeth in two elongate series on inner edges of bones, at first nearly parallel and contiguous, then diverging, their posterior parts somewhat salient. Choanae situated close to orbit, with deep groove directed outwards and somewhat backwards; tongue relatively small; maxillary and premaxillary teeth present.

Dorsum with a median ridge beginning on occiput and continuing to tail where it narrows, becoming continuous with a rather high dorsal fin on tail; beginning above arm, series of rounded dorso-lateral knobbylike glandular tubercles extend to level of posterior end of vent; a slight ridge distinguishable beyond this, producing a slight thickening far onto tail near its ventral level.
Fig. 0.—Tylootriton verrucosus Anderson. No. 36164. Actual total length, 130 mm., Doi Intanon, *circa* 2000 m. elev., Chiang Mai, Thailand.
Arms rather short, with four digits, their tips darkened and rounded; legs pentadactyl, median digit longest; digits somewhat flattened, tips narrowed, somewhat rounded; vent swollen, its inner lips papillate. Tail with well-defined dorsal fin five millimeters high at base; ventral fin obsolete, indicated only by fine median ventral ridge.

Skin of body and tail finely granular; granules present on venter except in median area which has fine transverse folds; granules on underside of digits and on underside of tail.

Color: Above dark brown; glands on side of neck and dorsolateral region lighter brown; tail generally lighter brown than body, becoming cream on ventral surface; area about vent, rusty cream; underside of digits, palms, and soles dull cream; chin, venter, and sides nearly black.

Measurements in mm.: Snout to termination of vent, 68; tail, 62; snout to arm-insertion, 21; axilla to groin, 30; width of head, 16.8; length of head, 16; arm, 20; leg, 21.5.

Variation: The color may be uniform blackish brown, paler on lips, snout, chin, throat, and undersurface of limbs, all of which are of a brownish-olive tinge. The undersurface of the tail may be dull orange.

Distribution: Aside from the single collection of larvae by Dr. Malcolm Smith’s collector [on mountain near] Chiang Dao at an elevation of 5000 to 6000 ft., the one recorded here from Doi Inthanon, is the only one known from Thailand. Both localities are in Chiang Mai Province. This species has a range from western Yunnan and northern Burma west to Sikkim. It reaches an elevation above 6000 ft.

Remarks: Concerning the development of the larvae, Smith (1924) writes: “The eggs of this newt are large although somewhat variable in size, measuring, when the gelatinous envelope is fully distended by the developing embryo, between 6 and 10 mm. in diameter. The young one on emerging is about 11 mm. long and is provided with well-developed external gills, with a pair of elongated ‘balancers’ originating from a point behind and below the eye and in a line with the continuation of the mouth backwards, with a crested tail and budding fore-limbs. These latter develop rapidly and all four legs, with their digits, are complete at quite an early stage in life. The ‘balancers’ apparently soon disappear, although a trace of them often persists in the form of a small tubercle at their point of origin.”
There are normally three gills on each side. The Thai specimens tend to lose the gills when they have attained a length of 52 mm. However, some retained the gills when they were 75 mm. in length.

ORDER SALIENTIA

Four limbs are universally present; tail absent in adults (except *Ascaphus*); vertebrae of adults reduced to less than 11; teeth absent from lower jaw (with rare exception), present or absent on maxillary and premaxillary; often absent from vomers. Progression normally made by leaping. A free-swimming stage is normal for larvae, but many frogs pass through the larval stages in the egg and are terrestrial when they leave the egg. Certain ones are known in which the young develop in pockets in the skin, in vocal sacs, or in uteri. In Thailand, the following Anuran families are known: Pelobatidae, Atelopodidae, Bufonidae, Hylidae, Ranidae, Rhacophoridae, and Microhylidae. Only a single species each of the Hylidae and Atelopodidae are known to occur, while approximately 40 species of the Ranidae are known.

**Key to the Families of Salientia**

1. Pectoral girdle arciferal
   Pectoral girdle firmisternal
   
   2. Terminal phalanges claw-shaped; maxillary (and premaxillary) teeth present; sacral diaphyses expanded; an intercalary cartilage or bone between the two terminal phalanges; arboreal

   Hylidae

   3. Terminal phalanges not claw-shaped; no intercalated bone or cartilage between two distal phalanges

   3. Maxillary teeth present; vomerine teeth present or absent; chiefly terrestrial

   Pelobatidae

   No maxillary teeth present; no vomerine teeth; chiefly terrestrial,

   Bufonidae

   4. Maxillary teeth present; usually vomerine teeth also; diaphyses of sacral vertebra cylindrical or at most only very slightly dilated

   Maxillary teeth absent (except *Caluella* in Asiatic species); sacral diaphyses expanded

   5. No intercalated bone or cartilage between last two phalanges on each digit; terrestrial

   Ranidae

   An intercalary cartilage or bone between the two distal phalanges on each digit; arboreal

   Rhacophoridae

   6. Slender species, not squat or toadlike; no maxillary or vomerine teeth; coccyx and sternum fused; no intercalary cartilages between distal phalanges, no omosternum; vertebral column procoelous; sternum slender

   Atelopodidae

   Squat toadlike species; without maxillary teeth (in Thai species) except *Caluella*; terminal phalanges simple or T-shaped; sternal apparatus variable. Tadpole without horny mandibles or external teeth

   Microhylidae