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NOTES ON THE BREEDING BEHAVIOR  
OF LIZARDS

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In the course of the Crane Pacific Expedition of Field Museum, in 1928-29, opportunity was presented for occasional brief observations on the habits of amphibians and reptiles. Recent detailed studies of the breeding behavior of lizards by G. K. Noble of the American Museum of Natural History, have proved extraordinarily interesting and have focused attention on this field.<sup>1</sup> At Dr. Noble's request, I have drawn up the following account of my scattered observations, which are little more than suggestive leads, but which happen to include notes on two species of lizards of more than usual interest—the Marine Iguana, *Amblyrhynchus cristatus*, of the Galapagos Islands, and the Flying Lizard of Celebes, *Draco spilopterus*.

BREEDING BEHAVIOR OF THE MARINE IGUANA

During our stay in the Galapagos Islands, I had some opportunity to observe the breeding habits of the Marine Iguana, *Amblyrhynchus cristatus*, well known as one of the principal zoological peculiarities of the archipelago. Mr. Walter A. Weber, Mr. Frank C. Wonder, and I spent the four days from January 7 to January 10, 1929, at Mangrove Point on the east coast of Narborough Island. This situation was reached by launch from Tagus Cove on the opposite coast of Albemarle Island, where our yacht, the *Illyria*, lay at anchor.

The feral cats and dogs which are the persistent enemies of all the native animals of Albemarle are happily absent on Narborough, and this may be one reason for the notably greater number of Marine Iguanas on the latter island. The shelving plates of glassy lava which form the shores of Narborough are in any case a favorable habitat for the marine lizards, which rarely go more than forty or fifty feet inland.

<sup>1</sup>G. K. Noble and H. T. Bradley: The Mating Behavior of Lizards; Its Bearing on the Theory of Sexual Selection. Ann. N. Y. Acad. Sci., 35, pp. 25-100, 1933.

At our landing place at Mangrove Point there were about seventy-five Marine Iguanas within a space thirty feet square. The lizards lay in the hot sun, some sixty females and young massed together, often piled one on top of the other three deep, about thirty feet from the water's edge. The old males, much larger than the largest females, were scattered over the area between the massed lizards and the water, spaced from five to ten feet apart, each one keeping to his own sunning territory.

Trespass on the sunning terrain of a large male by another was invariably the occasion for a fight. Fighting was carried on by butting, each contestant endeavoring to get the rough horny knobs on his forehead beneath his opponent's chin. Injury to the lips from the butting knobs was made very evident by the appearance of blood in the puffs of spray emitted at intervals from the nostrils. The fights continued until the weaker contestant was driven off, whereupon the winner resumed his sunning position, or advanced toward the females. One pair of males engaged in combat across a deep crack in the lava, into which they fell as the fight progressed. The longest fight observed lasted for four minutes. The larger size of the males and their shortened massive heads, with heavy forwardly directed horny spines, appear to be correlated with this fighting habit.

The breeding season was apparently at its height at the time of our visit. Copulation was twice observed. In each case the male approached the massed females with a curious strutting gait, nodding his head and blowing jets of spray from his nostrils. Reaching a position parallel with an isolated female, he grasped her by the fold of skin at the nape of the neck, straddled her, and dragged her about over the rock, the female's legs hanging limp. This dragging was continued for a half minute in one case and for a full minute in the second. Copulation followed immediately upon this rough courtship, the tail of the male being curved beneath that of the female and one hemipenis inserted while the tail of the female was raised and curved over that of the male. In one case the hemipenis was everted before insertion. Copulation lasted about one minute in one case and two in the second, but both pairs were disturbed, one by a sea-lion, and one by another male iguana.

The large aggregations of individuals conspicuous on Narborough were not to be found at Tagus Cove on Albemarle Island, nor at South Seymour Island, nor at Academy Bay or Conway Bay on Indefatigable. At Conway Bay Marine Iguanas were found to be assorted in family groups composed of a single large male with from



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FIG. 4. Courtship of Marine Iguana, Narborough Island.



FIG. 5. Mating posture of Marine Iguana, Narborough Island.

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two to four females, these groups separated by twenty to fifty yards of shore-line without iguanas.

These observations indicate that a simple form of polygamy is normal to the Marine Iguana when the population is small and sparse, and that when the concentration of individuals is greater, promiscuous polygamy replaces the simpler form. The massed sunning females on Narborough form a joint harem for the adjacent group of sunning males. It is evident that this curious lizard offers an especially interesting subject for further and more detailed observation, and that a complete study of its life history will contribute important information in the general fields of animal behavior and animal aggregation.

### COURTSHIP OF SKINKS

During a casual visit to the cottages of Mr. Zane Gray, on the island of Tahiti, my attention was attracted to the abundance of the small skinks, *Ablepharus poecilopleurus*, in the brilliant sunshine on the roofs and gables of the buildings. The numerous crevices afforded by the clapboard siding where it was overlaid by the diagonal boards beneath the gables were used as retreats by the lizards. While I watched one of these lizards climb slowly toward the peak of one of the houses, another individual rushed out upon it from a crevice, grasped the first one by the neck, and shook it with the utmost violence. Thinking that an unequal combat between two males was in progress, I was surprised to see the violent shaking immediately followed by copulation, which continued for at least half a minute. Although the observations of Noble and Bradley show that verification of the sex of the passive individual is necessary, it seems likely that this is the normal breeding procedure in this species.

### NUPTIAL DISPLAY IN FLYING LIZARDS

The rather open forest on the steep slopes of Lembah Island, off the extreme northeastern corner of Celebes, presented an unusual opportunity to observe flying lizards. This was the only place where we saw these creatures near the ground and in great abundance. In Borneo, on flat terrain, we did not obtain or see a single specimen. In the Philippines a species of flying lizard was observed in coconut plantations near Zamboanga. Observation of these creatures is favored when they occur on steep slopes, since the observer can be at the level of the lizards when these are well up on the trunks of trees situated below his station. This was notably the case on



FIG. 6. Courtship display of Celebes Flying Lizard, Lembeh Island, Celebes. From painting by Walter A. Weber.

Lembeh Island, where *Draco spilopterus*, the common species of this genus in Celebes, is especially abundant. No flying lizards were observed at this locality until, on the last two days of our stay (June 21 and 22, 1929) sunshine succeeded the previous cloudy and rainy weather.

On these days *Draco spilopterus* was abundant in the rather open hardwood forest which clothes the slopes of Lembeh. The longest glide observed was perhaps thirty feet, there being no occasion for longer flights. These lizards glide at a low angle and alight without shock after only a very slight upturn. Mr. Walter A. Weber, the expedition artist, and I were fortunate in witnessing what appeared to be the courtship display of these lizards. A female, with wings folded at her sides, clinging head upward on a tree trunk a dozen feet distant from our station and twenty feet from the ground, was approached from above by a male, who advanced to within a few inches of the female, halted, and went through bobbing motions like those familiar to American herpetologists in the genus *Anolis*. As the anterior part of the body was raised, the colored dewlap was distended to its fullest extent, and at the same time the brilliantly colored wings were extended to the greatest possible degree. In this posture the bobbing display was continued for perhaps a minute. At this juncture a second male flew from a tree near us to the tree on which the courtship was in progress, ran up the tree and engaged the first male in combat. This struggle was so violent that both animals fell from the tree. They disengaged in mid-air, and sailed off to separate trees. The recovery of balance in mid-air and the ability to direct the flight to a suitable landing place is an interesting testimony to the perfection of gliding flight attained by these lizards.

Whether the bobbing motions and display of the colored wing and throat membranes are for the attraction and excitation of the females or solely for sex recognition, it seems clear that the brilliant coloration of the wings is correlated with this secondary use. There is even the interesting possibility that these unique structures originated as a secondary sex character, and that their use in gliding flight is secondary. More detailed observation and well-planned field experiments on *Draco* like those of Noble and Bradley on the American fence lizards might be especially illuminating for the problems of lizard courtship behavior.

Our attempts to obtain a photographic record of *Draco spilopterus* were failures. Mr. Weber has embodied our joint observations in a painting, here reproduced.













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