Near Kermanshah, on the eastern edge of the Zagros Mts. in west-central Iran (fig. 1), is a monument carved within a cliff during the Sassanian Dynasty (226-641 A.D.), which has two bas-reliefs of hunting scenes of interest to zoologists. This monument, Taki-Bustan (the spelling is variable), has been described and pictured in detail by several classical archeologists (see Vanden Berghe, 1959, for summary and bibliography), but their interest has been in the human history and culture of the period, with little note being taken of either the animals or of the techniques of the hunt.

Although the monument as a whole and the individual carvings within it were undoubtedly produced by order of, and in honor of, the reigning monarch of the time, the exact identity of the king involved is not known; Vanden Berghe (1959) has quoted the conflicting views of two different students of the subject to
Fig. 1. Map of part of western Iran and adjacent areas, showing localities mentioned in the text.
the effect that the reliefs are hunting scenes involving either the Emperor Peroz (457-483 A.D.) or the Emperor Khusrau II (590-628 A.D.). In any case, the interrelationships of the portrayed animals with the culture of Imperial Sassanian Persia are probably typical of the general area for the period of the fifth into the seventh centuries A.D.

The reliefs to be considered are part of a larger tableau, for which a particularly lovely spot was chosen, where a large spring gushes from beneath a limestone cliff, at the border between mountain wilderness and agricultural plain. The site for the hunting reliefs, and for several carvings of different kings and deities, was carefully prepared by the original artisans, who excavated a smooth-sided grotto into the base of a limestone cliff. As one walks into this artificial cave, he finds that a carved relief of an imperial deer-hunt is on the right wall, that of a pig-hunt on the left wall. In places, the limestone has weathered or cracked, destroying some features, and on some the finishing touches were never made, as several of the animals are shown in outline only, the fine details typical of most of the representations never having been begun.

In spite of these minor imperfections, the reliefs preserve a dynamic spirit, that of the pig-hunt being particularly full of individual life and action.

The main interest of the reliefs to students of natural history is the portrayal of a royal hunt of the period, with consideration of the effects of such hunts, and of other factors, on the survival of the animals from that day to this. The reigning monarch, as we shall see, hunted on a lavish scale, and we may imagine that if the Great King killed in such imperial quantities, as portrayed, many of the nobles were hardly less destructive in their own slaughter of the game animals available to them.

The Deer Hunt: The deer shown being pursued and killed are all Mesopotamian (Persian) fallow-deer, *Dama mesopotamica* Brooke, which can easily be identified by the details of the particular type of palmate antlers of the stags (Haltenorth, 1959, figs. 40-46; Bubenik, 1959). Since the Kermanshah area lies within the natural range of the red deer (*Cervus elaphus* Linn.) and since these larger cervids would presumably have been the game of royal preference, we can tentatively infer that red deer
Fig. 2. Upper portion of the relief of the deer hunt. The horse and rider in the lower center and some incised figures are later additions by lesser artists. The small scale shown in this photograph and some of the others is 10 cm in length.
had been exterminated from this part of Persia by at least the seventh century, and probably earlier. Figure 2 shows the main part of the hunt; more detailed views are seen in figs. 3-5.

As I interpret the bas-relief, the hunt occurred in an artificial compound, which consisted of a large central arena with surrounding corridors or holding pens. The whole compound was a temporary structure, the walls of which consisted of upright posts supporting cloth or matting. Each supporting post had a strong guy-rope tied firmly to a stake set outside. The deer had been driven together in advance and impounded in holding-pens to the right of the arena within which the main hunt occurred. Each of these holding-pens had a double gate into the main compound; in fig. 3 we see two such pens portrayed; the lower one was closed and the inner gate was guarded by a net. The adjacent pen had had its gates opened, with a man to each side of each gate, and the deer were being urged out of the holding-pen by men on elephants. These latter were Indian elephants, *Elephas maximus* Linn., which was the only species used by the Persians.

The deer emerged in a single line, running. They were mostly

Fig. 3. The lower right portion of the deer hunt; two holding pens are shown, the upper of which has the gates open to the arena, with elephants and their mahouts urging the deer forward.
stags, but an occasional doe was present. As they came into the arena, rows of horsemen at the gallop kept the deer in line and guided them to the center of the arena, where the king awaited them.

Fig. 4. The left lower corner of the deer hunt; a doe with a neck scarf (or perhaps two does so marked) is being allowed to escape from the arena. The minor vandalism of the incised names and dates are later additions.

The king was on horseback, and, according to my interpretation of the scene, is portrayed thrice¹. He is shown first entering the arena in the upper right; a parasol was held over the royal head by a person on foot. Trumpeters and other musicians announced the royal entrance while to the upper left singers and harpists occupied a high stand complete with ladder. Both the king and his horse, in correlation with their imperial being, are

Since I and several companions observed the reliefs at Taki-Bustan without prior knowledge of them or of the publications concerning them, our idea of the events portrayed were our own. Our interpretations, we note, coincide essentially with those of Vanden Berghe (1959), particularly with regard to the duplication of the figure of the king, whereas de Morgan (1896-1897) had thought that the king was figured but once in each relief, with the other larger-than-life figures representing other members of the royal family or high court dignitaries.
shown larger than are other horses and men; the deer are shown more in proportion to these latter, lesser mortals.

The deer were driven across the arena at a gallop, to pile up against the left side. The king is there shown a second time, riding at full gallop and shooting the deer with arrows. Due to his heroic size plus the general limitations of space in the composition, the king would appear to have been shooting the deer as they fall and pile up at the far left wall, but probably no imperial monarch would have done so, and we can imagine that the deer were pursued and shot in whatever open space the center of the arena afforded.

In the lower left a doe with a scarf around her neck is shown twice, galloping to freedom through a gate which seemingly had been purposely opened for her by two men. One wonders if this doe, so carefully marked by the scarf, had not somehow had a role as a Judas-doe (i.e., a traitor), and if she would subsequently be caught, to play that role again.

In the bottom center (not here figured) the king is shown again, not galloping this time, as if returning with empty quiver in hand after the hunt. He may, however, have been following the doe with the scarf, but if so I have no explanation of this incident.

The scenes to the left of the arena depict the activities immediately following the hunt. One man was lifting the cloth covering the barrier, much as one would lift the wall of a large tent, while another dragged out the deer, several of which were lying about dead while one was still vainly trying to rise. At the top (fig. 5) is a scene of the deer being loaded on dromedaries and carried away, probably to have been the main dish at a great feast of the king and his nobles.

The Pig Hunt: The relief of the pig hunt shows more detail, is more carefully finished, and in some ways is more interesting than that of the deer hunt. The scene again shows the activities which occurred in an arena, this time of a swamp with a lake in the center (fig. 6). The artificial walls of the arena were held in place by upright posts, each of which was carefully braced by a guy-rope tied to a clump of swamp vegetation (fig. 7). No gates or holding pens are shown, but both must have originally been present as the pigs (Sus scrofa Linn.) were driven from left to right by elephants (fig 8). Certainly such an aggregation of pigs
Fig. 5. The upper left corner of the deer hunt; dromedaries carry away the dead deer.

would have had to be driven together and penned before release, even though the pens are not indicated.
Nov. 5, 1965  Sassanian hunting of pig and deer

Fig. 6. The main scene of the pig hunt.
Fig. 7. The upper left corner of the pig hunt, showing details of the structure of the compound, with elephants driving the pigs forward into the swamp.

Fig. 8. Portion of the upper left corner of the pig hunt, with pigs being driven by elephants. The oblique crack, which drips water at times, is natural to the rock and is not part of the composition.
The elephants drove the pigs across the marsh or into the lake; a torrent of pigs on the gallop is shown across the top of the relief. From this group, where each boar or sow is carefully delineated by the proper size and curl of canines, the king was able to shoot several pigs.

The king hunted from a boat, which was followed by another boat containing lady harpists. A third boat, in the upper left, facing a swamp bird, may have contained singing maidens. The king is again shown larger than his retainers, and in correlation the pigs he had just shot with his arrows are portrayed as giants. Two are shown thus, falling out of the upper group, and a third either just shot or about to be, is shown turning from the ongoing group, to follow the two already shot.

At the bottom of the relief were portrayed numerous dead and dying pigs, some of which were being picked up by elephants (fig. 9). To the right, outside the arena (fig. 10) were more dead pigs; here men tied their legs together, and in an adjacent scene (fig. 11) the dead pigs were carried off, again possibly to a feast, since the Persians of the Sassanian period, being Zoroastrians,
Fig. 10. The lower right corner of the pig hunt; dead pigs have been dragged out of the compound and men are tying their legs.

had no taboos against the eating of pig as did their Moslem successors.

As in the relief of the deer-hunt, the king is shown a second
time, here resting after the hunt; he was still in his boat and still followed by his harpists. Details of fish and a waterbird below
the king's barge (fig. 12) add to the aquatic spirit of the scene.

While both dromedaries and elephants were involved in the deer hunt, only elephants are shown in the scene with the pigs, probably because of the marshy nature of the terrain.

Of interest is the remarkable fidelity with which these Persian artists of many centuries ago depicted many aspects of both the wild and domestic animals. Particularly skillful are the pigs shown in full face. However, the movements of the animals, although vividly portraying action, are mostly not true to life, but such inaccuracies may not be apparent to many observers any more than they were to the Sassanian artists. The most obvious error is the picture of a fast-galloping ungulate mammal (horse, deer, pig) with all four legs extended and the feet off the ground at the same time. This was the near-universal artist's concept, particularly in scenes of galloping horses, until Muybridge in the 1870's.

2 De Morgan (1896-1897) assumed that such pig-hunts must have occurred in 'Chaldée,' presumably in the lower Tigris-Euphrates basin, where the marshes do abound with wild pigs. However, the scene could easily have been local, as large springs which outflow from their mountain bases onto marshy areas of the adjacent flat valleys are still present in the Kermanshah area.
set up a series of cameras on a farm (later to become the grounds of Stanford University) at Palo Alto, California, and sequentially photographed horses and then other animals as they ran past. It is true that cats and dogs at full speed (Muybridge, 1957, Pls. 119-121, 127-128) assume this extended position, and a fallow-deer in its initial leap may appear to do so, although seemingly no deer ever has the four legs fully extended and off the ground at the same time (Muybridge, 1957, Pls. 147-159). A horse at the gallop, contrary to the portrayal by the Sassanian artists at Taki-Bustan, never extends all of its legs at the same time; instead, during the phase that all of the feet are off the ground the legs are bunched beneath the animal (Muybridge, 1957, Pls. 67-72).

Some people are now familiar with the fallacy of the horse shown running with legs extended, and to them such a picture on an old print or on the bas-relief at Taki-Bustan has a quaint look about it. However, the footfall sequences of walking animals, such as dromedaries and elephants, are not so familiar. The representations of these animals walking do portray vigor of action, and appear to be accurate, but actually most of these walking animals—for all of their esthetic fulfillment in the eye of artist and beholder—are shown in poses not assumed by the living mammals. The elephants are thus figured with one front foot lifted and flexed at the carpus; this pose is accurate for one front leg, but in the living animal, whether walking or ambling, the hind leg of the same side is invariably moving forward during this phase of the stride, so that the two feet of the same side come near each other (Muybridge, 1957, Pls. 110-112). In other words, the artist appears to show the elephants pacing (racking), a gait which they have not been observed doing.

The walk of the two dromedaries in the top panel of fig. 5 is accurate for one particular phase of a camel's walk, but that of the most posterior of the three below is not, as the two legs on the same side of a walking camel are never extended at the same time (Muybridge, 1957, Pl. 104).

Aside from such technical errors of locomotory detail, the animals are portrayed in accurate detail. In contrast, the plants are so stylized as to be unrecognizable. Professor Jack Harlan, of Oklahoma State University, was making a botanical study of
the area around Kermanshah at the time of my visit in the spring of 1960, and observed these reliefs with me. He could find no diagnostic feature in any of the marsh plants or in the trees to the left of the deer-hunt by which they could be identified. The hunt was the important matter being portrayed; the king, his courtiers, his maid-servants and their instruments, and the animals are portrayed with fidelity, but the plants were obviously mere background, probably filled in with scant regard to any actual models.

The Great King is gone; the slaughter of his hunts is known only by the reliefs at Taki-Bustan. Yet he and all Great Kings, with their multiple nobles, and all who have hunted for personal prestige and satisfaction of ego, have left their mark upon a ravaged and decimated fauna. Of the two animals considered here, the wild pig fares today much better than the deer, due probably to the pig’s more prolific production of young, which is 4-5 annually for each adult female (Hatt, 1959), as compared with only one offspring per year for the doe of the Mesopotamian fallow deer Zucker- man, 1953; Löfler and Walther, 1961).

The pigs survive, and are often a nuisance to the villagers and their crops in several areas of western Iran and the adjacent swamps and mountains of Iraq (Misonne, 1959; Hatt, 1959), where I have observed them and collected them for study. These wild pigs are wary and sagacious animals, with considerable ecological tolerance; they can and do live from timberline down to brackish delta marshes, wherever there is some cover, some food, and a lack of overwhelming hunting pressure. Reduction in the populations of bears and leopards in these regions has undoubtedly been a boon to the pigs, although wolves still thrive throughout the mountains and adjoining plains of parts of the borderland. The pigs, thus, are in no immediate danger of extermination, except locally where army camps, both Iranian and American,

3 For instance, such unimportant objects as ropes and paddles, to pick but two examples, are reproduced in meticulous detail. Obviously, the artist was familiar with such objects, and presumably used models of them in his work.

4 At the time of our study in west-central Iran, a U.S. Army contingent was stationed in Kermanshah, as part of a training program for the Iranian Army. The large deep-freezers of the U. S. Army were often filled with wild game, shot in meticulous observance of the local game laws but certainly not in the best interest of the survival of the wild animals. The discrepancy here was that the game laws were based upon the situation that normally few people in the area had rifles.
provide rifles, ammunition, and bored officers. The latter correspond ecologically to the Great King of many centuries ago; what they may lack in beaters and game compounds is more than compensated by greater mobility, both by wheel and wing. The Great King of the Sassanian Empire would, as a hunter, consider himself a minor noble compared to a strong-armed captain of today's army post in the hills of western Iran, equipped as the latter is with jeep, helicopter, and repeating rifle with telescopic sights. Yet the pigs survive and at least for now are in no immediate danger of extermination.

Different are the deer; by the nineteenth century *Dama mesopotamica* was so rare as to be one of the last of the larger Asiatic mammals to become known and be named scientifically (Brooke, 1875). At that time the population must have been almost entirely limited to the riverside jungles of Khuzistan, with one or more isolated groups in northern Iraq (Brooke, 1876; Hatt, 1959). Their subsequent history has been most recently summarized by Pepper (1964).

Long thought to be extinct, Lee Merriam Talbot in 1955 heard of their survival in a sparsely inhabited area along the Iraqi-Iranian border between Maidan and Halabja, where the Shirwan River crosses the border. To the best of my knowledge, the presence of deer has never been verified in this particular area, but in the same year, 1955, Herr Werner Trenze, a student of Prof. Dr. Theodor Haltenorth at the Zoologisch Sammlung des Bayerischen Staates, Munich, heard in Tehran of these deer being present on the banks of the Dez and Karkeh Rivers in Khuzistan. A meeting in Munich a few months later between Talbot, Haltenorth, and Trenze further stimulated interest in trying to locate the deer, so that in 1956 Trenze journeyed to Khuzistan to investigate. To him goes the honor of being the first scientist to find a population of *Dama mesopotamica*, which animals were then subsequently studied in the area by himself and by Prof. Haltenorth. These studies, including a survey of the paleontological and most of the historical literature, have been reported by Haltenorth (1959, 1961).

These deer are known to survive today only in isolated pockets of river-edge jungle along the Karkeh and Dez Rivers in Khuzistan, southwestern Iran (fig. 13). Herr Trenze thought the distri-
Fig. 13. Area in Khuzistan where Mesopotamian fallow deer are known to be. The capture of deer by the Iranian Game Council has been in the same region where they were seen in 1960.

...bution to be limited to an extremely small area adjacent to the rivers and estimated the population to be not more than 20-30 animals. Haltenorth himself subsequently investigated the area, revised upward the amount of river-bank forestland supposedly available for deer populations, and estimated the surviving population to be between 200 and 400 animals. He concluded that
Dama mesopotamica is not now endangered in the area where it survives.

My own experience for two weeks in the spring of 1960 in this general area of the lower Karkeh and Dez, where these rivers wind across the plain of Khuzistan, does not lead me to such optimism, either as to the number of deer or their chance for survival in these last few pockets of natural environment. I walked some of the west bank of the Karkeh River, south of the ancient ruin of Shush (Susa) and west of the modern town of Haft Tapeh, and drove through or adjacent to considerably more of this stretch of the river, all of which is mapped by Haltenorth (1961, p. 23) as potential occupation area for these fallow deer. Most of it is not suitable environment; the area is partially cultivated and partially woodland pasture, with cattle, water-buffaloes, goats and dromedaries grazing and browsing, but with no sign of deer. Additionally, the natives of the local villages did not recognize a picture of the deer, but thought one meant wild sheep instead, which they say (quite rightly) must be hunted in the mountains to the north. Only when I got to a few square kilometers of dense jungle in an ox-bow of the Karkeh, almost directly west of Haft Tapeh, did I find deer. I think none occurred on the Karkeh to the north, and the local natives—who at this one place knew their deer well, seeing it almost daily—stated firmly that none occurred further south on that river. The truth of this, unfortunately, I had no chance to investigate; also, I had little chance to investigate the possible areas of distribution of these deer in the jungles along the edges of the Dez River.

Definite signs of deer were present in one such patch of jungle on the Dez northeast of Haft-Tapeh, but such patches are spotty, not continuous, and the number of deer is difficult to estimate, without the aid of aerial maps whereby the total area of suitable habitat could be determined, and lacking any knowledge of the population density of the animals within areas of suitable habitat.

My own impression, and it is certainly no more than an impression, is that Haltenorth’s estimates of the present population are too high, as Trenze’s were probably too low. I regretfully disagree with Haltenorth, too, with regard to his conclusion that the deer are in no immediate danger of extermination in their native habitat.
I believe that they are in grave and imminent danger of extermination, but not because of hunting pressure. They were not being hunted at the time of my visit simply because they were so rare and lived in such dense patches of jungle that very few of the many visiting Americans and Europeans—even the most enthusiastic hunters of pigs, gazelles, sheep and goats—knew about them. The very few who did know of the deer were discreetly quiet, interested in preservation and not in hunting. I do not believe the existing laws created specifically to protect the deer have been of much importance, or that such laws (or any other) will be of influence in halting the eradication of *Dama mesopotamica* in its last native area. The basic factor assuredly doomng the deer in Khuzistan is that the pressure of a poor and growing populace lies heavy upon the land. With modernization of the area proceeding rapidly, by way of dams, irrigation, electric power, and machine agriculture, that pressure will be increased and, simply, the habitat available to the deer must inexorably disappear.

Even without the planned modernization of Khuzistan, which is destined to be the granary of Iran again as it was in the time of Darius, the deer's environment would disappear. The patches of pasture and ploughed fields grow larger; woodchoppers and charcoal-burners, simple men intent on wresting a livelihood from an inhospitable environment, penetrate daily deeper into the jungle patches, opening the way to herd-boys with buffalo, dromedaries, cattle, and goats.

The only hope for survival of *Dama mesopotamica*, in my opinion, is the transplantation of captured individuals to protected areas. This technique worked in the nineteenth century with Père David’s deer, and is working now with the Arabian oryx. Actually, the attempt has already been made twice; the first time two fawns, a male and a female, were captured and taken to the Georg von Opel Freigehege für Tierforschung, Kronberg im Taunus, Germany. Here they grew and seemingly did well; the buck mated, fathered two daughters by the doe of his own kind, and he also mated successfully with does of the European *Dama dama*. He died, however, without producing a purebred male of his own species (Löffler and Walther, 1961; Haltenorth, 1961).

The second effort, whose initial phases seem happily to be successful, is being made by the Iranian Government. In the
spring of 1963, an expedition under the direction of Khosrow Sariri, chief adjutant inspector of the Iranian Game Council, captured two adult males and two adult females, by employing local villagers to drive the animals into a long, heavy net. The area of capture was the same (fig. 13) where I had seen deer in 1960. During this game-drive, other deer were seen and the population for that area on the Karkeh River was estimated to be between 60 and 100 individuals. The four captured animals tamed down quickly and were successfully transported to the Dasht-e-Naz game park near Sari, about halfway between Babal and Beshahr on the southeastern coast of the Caspian Sea. One fawn was born there in the spring of 1965. During this same year, three more adults were captured, two males and a female. One stag was sent to the Georg v. Opel Freigehege f. Tierforschung in Germany and
the remaining pair were added to the group in the Dasht-e-Naz game park, making seven in all there at last report. (For the information in this paragraph I am indebted to Mr. Douglas Lay, mammalogist of the William S. and Janice Kengan Street Expedition to Iran of the Chicago Natural History Museum).

We applaud this effort of the present rulers of Iran to salvage a species so many ancient Iranians killed in vast numbers. While wishing them well, we also hope that breeding populations can be started outside of Iran, the attempt in Germany having proved that Persian fallow deer would live for several years and breed successfully in a colder and wetter climate than that of their native area.

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ful, through personal correspondence, in outlining to me the history of the discovery in 1956 of populations of deer surviving in Khuzistan.

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