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**CARAPACE PITS IN THE THREE-TOED BOX TURTLE,
TERRAPENE CAROLINA TRIUNGUIS
(CHELONIA-EMYDIDAE)**

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ABSTRACT. Specimens of *Terrapene carolina triunguis* in a large population near Norman, Oklahoma, exhibited the presence of carapace pitting, involving both horn and bone, which was associated with the anterior border of the third costal scutes. Pitting was more abundant in females, with an increasing tendency to be present, in both sexes, with increasing carapace length. The cause of this pitting is not known.

While recording scute and other variations of a three-toed box turtle (*Terrapene carolina triunguis*) population, frequent note was made of peculiar pits on the carapace. The persistent occurrence of these pits and their consistent location at certain positions on the carapace led me to keep records of the presence and degree of pitting.

The carapace of the three-toed box turtle very frequently has scars and other irregularities, but these marks are not consistent in their appearance nor restricted to a particular region of the carapace. The carapace pits, with which this paper is concerned, are almost invariably associated with the suture between the second and third costal carapace scutes on either side of the carapace. They are usually either in the groove of the suture line or immediately posterior on the anterior margin of the third costal scutes. Only very rarely have similar pits been found near or in other carapace scute junctions. They are confined to the central half of the suture area between the junction with the marginals and the vertebrales (Fig. 1).

The size and structure of the pits is variable, ranging from only slightly distinguishable indentations to extremely obvious holes penetrating deep into the carapace. The small pits merely appear on the horn of the scute, but the deeper ones penetrate into the bony plates of the carapace so that these bones also show the pitting. The horn of the scute lines the pit down into the bone. The pits may be present on only one side, but are generally on both sides. The arrangements of pits on both sides show no tendency for bilateral symmetry. The number of pits will vary from one to as many as seven or eight on a side.

The population of *Terrapene* studied is found on the Oliver Wildlife Preserve of the University of Oklahoma, 2 miles south of Norman, Cleveland County, Oklahoma. The preserve is a 60 acre plot of flood plain forest along the South Canadian River. Other species of turtle

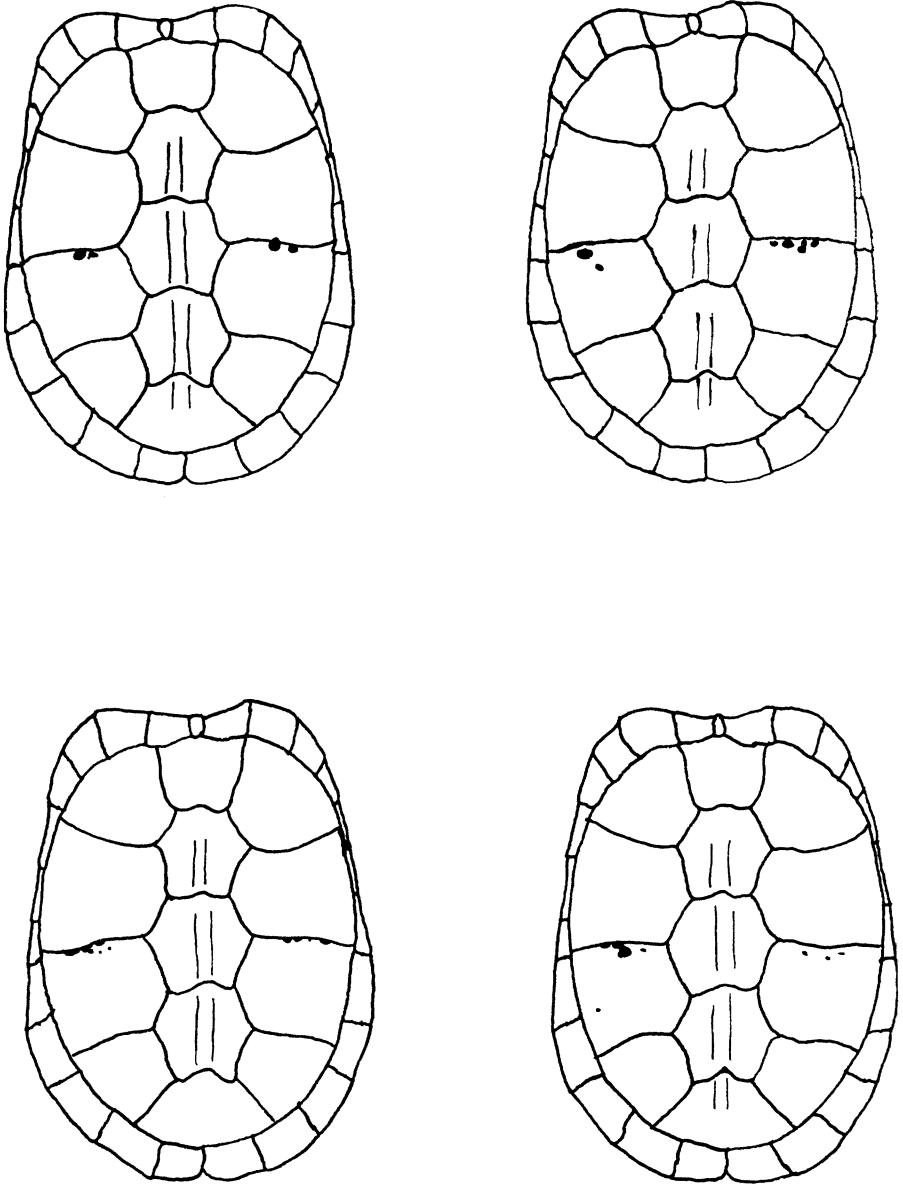


Fig. 1. Some variations in carapace pits of *Terrapene carolina triunguis* near Norman, Oklahoma.

Carapace Length (cm.)	Number of individuals without pits (%)		Number of individuals with pits (%)	
4.0 — 4.9	0	0	0	0
5.0 — 5.9	1	(100%)	0	0
6.0 — 6.9	1	(100%)	0	0
7.0 — 7.9	19	(100%)	0	0
8.0 — 8.9	33	(100%)	0	0
9.0 — 9.9	34	(100%)	0	0
10.0—10.9	35	(95%)	2	(5%)
11.0—11.9	41	(60%)	27	(40%)
12.0—12.9	29	(28%)	74	(72%)
13.0—13.9	7	(11%)	56	(89%)
14.0—14.9	0	(0)	12	(100%)

Table 1. Relationship between pitting and carapace length for *Terrapene carolina triunguis* near Norman, Oklahoma.

present on the preserve are *Terrapena ornata*, *Kinosternon f. flavescens*, *Chelydra s. serpentina* and *Pseudemys scripta elegans*. None of these showed the pitting apparent for *Terrapene carolina triunguis*.

Four hundred and sixty living individuals of *T. carolina triunguis* have been captured and marked on the preserve since July 1953. Additional records have been obtained from frequent shells of dead individuals also present on the preserve. Recording of the pits did not start until late 1954, so that many records were missed. However, a large number of individuals marked before this time were later recaptured and the pitting recorded. The presence or absence of pits was recorded for 312 living individuals, and 63 shells, or a total of 375.

Of the 375 individuals examined 174 (46%) had pits present and 201 (54%) had no pits. Of those with pits, 147 (84%) had pits on both sides, 20 (12%) had pits on the right side only, and 7 (4%) had pits on the left side only. Six individuals also had pits at the area of junction of costals one and two.

The smallest individual for which pits were recorded was 10.83 cm. (carapace length). Three hundred sixty two of the 375 were sexed (sex determination is subject to error due to their great variability, but the errors would probably be equal for the two sexes). Of the 200 males, 66 (33%) had pits and 134 (67%) were without pits; of the 162 females, 100 (62%) had pits and 62 (38%) were without pits.

When the presence of pitting is compared to turtle age (assuming that carapace length is an expression of age) a definite trend is seen (Table 1). There is a continuous increase in the proportionate numbers if individuals with pits as the carapace becomes longer. The largest individuals all have carapace pits present. This trend certainly appears to be significant. Another feature, apparent with growth in size, is an increase in the definition of the pits, the deepest and most numerous pits being present on the largest individuals.

The pitting is not limited to the population of *Terrapene* on the Oliver Wildlife Preserve, for I have observed it on specimens from widespread areas of Oklahoma.

The cause of the carapace pits is not known. No mention of them has been found in the literature concerning this turtle or its eastern races. Possible causes are many, but none seem to be satisfactory explanations. Some pits appear as though parasitic fungi might have been present and the infected area later healed, but others do not seem to fit this theory. It was thought that perhaps a parasitic mollusk or some other invertebrate might be causing them, but there is no evidence to support this. Because of their inconsistency in being present and variation in position with respect to the suture line, it does not seem likely that they are genetic. The most logical cause might be erosion of the shell. When those pits associated with deep sutures are examined, they often appear to be due to this, yet others, in which the sutures are very shallow and the sculpturing of the carapace is very slight, may show very deep pits 1 to 2 mm. posterior to the suture line. It was thought that the damp retreats and hibernacula used by these turtles might have some relationship, but there is no proof of this.

From the evidence indicated by the population at the preserve, there is obviously some relationship to the size of the carapace. The evidence that they are slightly more frequent in females is not conclusive, and there probably is no direct correlation between sex and pitting. The fact that almost half of the individuals in the population, and by far the great majority of the adults, have these pits, does not indicate accidental occurrence.

At the present time it is apparent that some causal factor is responsible for the pitting of the carapace, and that this pitting is related to certain positions on, and the size of, the carapace. No conclusion has been reached as to what this causal factor, or factors, may be.