# ON BREEDING *Chelodina longicollis* (SHAW), WITH NEW CASES OF CAPTIVE BREEDING AND COMMENTS ON MORE THAN ONE ANNUAL EGG LAYING SEASON BOTH IN THE WILD AND IN CAPTIVITY

by Raymond T. Hoser

## ABSTRACT

Tortoises of the species *Chelodina longicollis* have been held in captivity by the author since 1968 and have been breeding with various degrees of success over the past twelve years. The frequency of breeding and the detail of records kept by the author in recent years has increased markedly and important discrepancies between these records and most relevant published literature have become apparent.

## INTRODUCTION

Although it is well known that animals in captivity often breed at times of the year not typical for their wild counterparts, this idea cannot be feasibly extended to include the situation encountered by the author for reasons obvious once the situation is outlined in detail. Records for the past eighteen months only are considered, as they are most detailed and involve the highest level of frequency of breeding by the author's tortoises. Relevant parts of the records are documented first, then there will be an attempt to show their significance with respect to other records in order to put into proper perspective the later conclusions.

### Origins of Tortoises and Housing

Seven adult *Chelodina longicollis* are held by the author, and it is assumed for various reasons that a majority of them are females although at least two are males. Their average straight-line carapace length is 20 cm. All tortoises were originally obtained as adults from the wild and originate from various localities including Bingara and Warren (N.S.W.), Gippsland (Victoria), and some from unknown localities.

For the past five years, since the author has lived in St. Ives, these tortoises have been housed in a walled, roughly

rectangular, pit with dimensions 24 metres long x 7 metres wide, with a few tortoises of other species, and some lizards sharing the same cage. The pit is completely outdoors, landscaped in a manner somewhat similar to local, very vegetated natural bushland and has three ponds in it.

The average dimensions of two of these ponds are 2 metres long x 0.8 metres wide x 0.8 metres deep. The third pond's average dimensions are approximately 3.5 metres long x 1 metre deep x 0.8 metres wide. The three ponds are at evenly spaced intervals in the pit roughly an average of 5 metres apart from one another. The quality of the water in the ponds ranges from clear to cloudy but is usually cloudy, and often the ponds may have up to 15 cm depth of debris on their bottoms.

Because the pit is located in Sydney, the tortoises in this pit would experience seasonal and climatic variations not unlike those experienced in the wild. (See Figs. 1 & 2.)

Fig. 1. Pit with *Chelodina longicollis*

Fig. 2. Pit #1, Main Pond

Recent Breeding Records

*Chelodina longicollis* held by the author are observed apparently copulating or attempting to copulate on infrequent occations at any time of the year. These copulation attempts have only been observed during the day and involve a male tortoise mounting a female tortoise in a manner similar to a male dog mounting a female dog from behind (see Fig. 3). Mating attempts have never been observed to occur on completely dry land although this possibility cannot be discounted. The male tortoise lowers his tail and penis towards the female's caudal region allowing copulation to proceed. The male tortoise holds himself in this position by a combination of balance, and by gripping onto strategic parts of the female's shell and the neck if he can reach that far. The number of mating attempts observed should, in theory, have produced more eggs and/or offspring than cited.

On 21 August 1979 a total of seven eggs was found deposited on the bottom of the largest pond in the pit. These eggs were

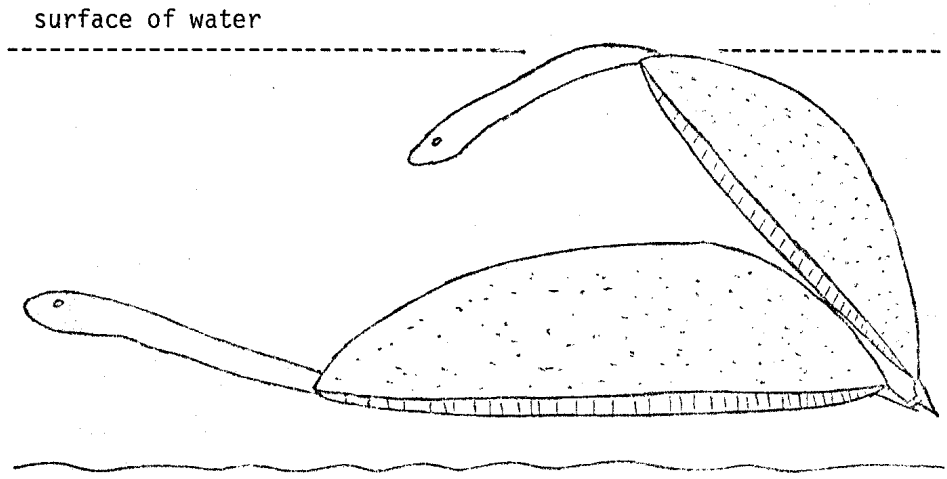


Fig. 3. Generalized diagram showing relative positioning of male and female *C. longicollis* during copulation, as observed by the author. Note that the female is the lower tortoise and that the bottom of the pond is immediately underneath her. Male tortoises in the author's possession tend to be smaller than females in the same collection. Limbs have been omitted from the diagram. Scale: 1 cm = 3 cm.

very fragile with outer shell layers starting to peel off and had obviously been deposited a few days prior to their discovery. On 3 April no less than four eggs were found in a slightly decayed state on the bottom of the largest pond in the pit. In both cases it is not known which tortoise produced the eggs although they were definitely *C. longicollis* eggs. On 25 August 1979 one hatchling *C. longicollis* was found concealed at the bottom of the largest pond in the pit. Inspection of the pit failed to yield further juvenile specimens. Like all juveniles or eggs found by the author, this tortoise was removed from the pit immediately. One 19 September 1979 two dead, slightly decayed hatchling *C. longicollis* were found floating on the surface of the larger pond; these had probably been dead for a few days. Inspection of the pit yielded an additional five live juvenile specimens, all resting in the larger pond.

On 6 October 1979 a single live newborn *C. longicollis* was found swimming on the surface of the larger pond. No others were found when the pit was searched thoroughly.

On 5 July 1980 a single live newborn *C. longicollis* was found swimming on the surface of the larger pond. Inspection of the pit failed to yield further specimens. On 26 August 1980 one hatchling *C. longicollis* was found swimming on the surface of the larger pond. Inspection of the pit yielded a further two specimens resting in the larger pond.

All tortoises held by the author often travel overland in their enclosure, dig holes, make burrows through soft material and carry out similar types of activity. Although it is obvious that these tortoises have carried out nesting activity in the pit, an actual nest has never been located despite thorough searching, indicating that the pit is in many ways similar to natural habitat and that *C. longicollis* is excellent at concealing its nests. In addition, no tortoise has ever been observed carrying out actual nesting activity.

By guessing the exact days that the juvenile tortoises found by the author emerged from their nests, and by checking the climatic features around those times, certain distinct trends appear. It seems that juvenile tortoises emerge from their nests only in seasonally mild to warm conditions after or during heavy rain such as a thunderstorm. This indicates that the newborn tortoises do not emerge from their nests as soon as they hatch from their eggs, but rather they wait until optimal conditions occur before leaving their nests.

In the cases where dead juvenile *C. longicollis* were found in the larger pond in the pit, the causes of death could not be determined. Live juveniles found not actually swimming on the surface of the larger pond, but resting, were always found at the bottom of the pond; they were in debris in shallow parts or amongst grass and grass roots growing down the sides of the pond but which are permantently submerged. No juvenile tortoise was ever found more than 30 cm below the water surface of the pond, despite apparently suitable resting points below this depth. This could possibly be due to unsuitable conditions such as lack of light or oxygen.

It is unlikely that any juvenile *C. longicollis* which emerged from their nest and reached a pond in the pit were eaten by

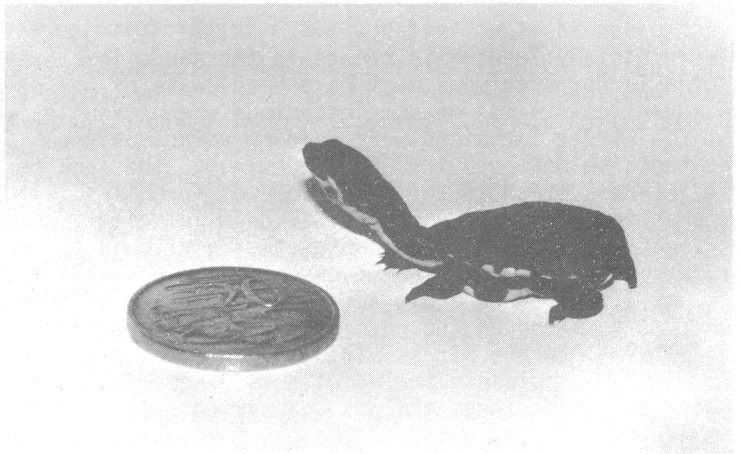

Fig. 4. Newborn C. *longicollis* captive bred March 1981, dorsal surface.

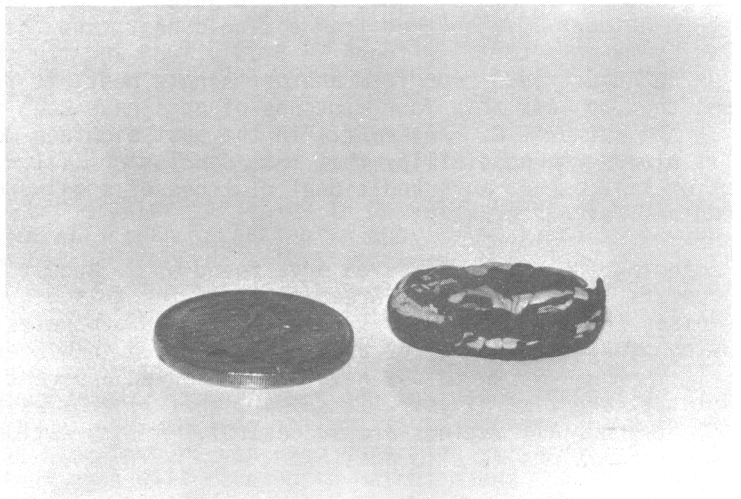

Fig. 5. Newborn C. *longicollis* captive bred March 1981, ventral surface.

other tortoises as at no instance was a larger tortoise ever seen to express any feeding interests in the juveniles, even though the larger specimens must have been aware of the presence of the juveniles. Also, on some occasions when juveniles were present the larger tortoises were feeding voraciously on chopped kangaroo meat provided by the author. The lack of feeding interest by adult tortoises towards juveniles is further emphasized when one realizes that dead juveniles, which always float on the surface of the pond, are allowed to decay rather than be eaten. One cannot discount the possibility, however, of lizards in the pit acting as predators of juvenile *C. longicollis*, although the possibility of any predators from sources external to the pit is virtually eliminated by the fact that the pit is completely sealed with 1-cm-square holed wire mesh held 1.8 metres above the pit and buried 0.45 metres below ground level in the pit, and the pit's entrance is also kept locked.

### Inferences Drawn From Records

From these records it appears that more than one female *C. longicollis* has been producing eggs. Assuming that the single juvenile tortoise found on 25 August 1979, the seven found on 19 September 1979, and the single juvenile specimen found on 6 October 1979 emerged from a single nest, and that the single new-born tortoise found on 5 July 1980 and the three found on 26 August 1980 came from another single nest, it is apparent that no less than four clutches of eggs have been produced by the author's *C. longicollis* in the past eighteen months. There is always the possibility that this conclusion is incorrect or that one or more additional clutches of eggs were produced and failed to hatch.

Excluding the clutch of seven eggs found on 21 August 1979, there appears to be a dominant breeding cycle for this group of tortoises in the author's possession. This incorporates the laying of eggs in summer or autumn which hatch in winter and early spring. As tortoises have been observed apparently copulating at any time of year, it appears that 1) females store sperm, and 2) not all matings are successful. A combination of these two suggestions is also possible.

## DISCUSSION AND CONCLUSIONS

### Egg laying

Despite the common occurrence and observations on egg

layings and hatchings in *C. longicollis*, both in captivity and in the wild, very little has been recorded about any aspect of breeding biology in this species. It has been almost universally recorded that *C. longicollis* has a single egg-laying season. For example, Cann (1978), Cogger (1975) and Goode (1967) all state that the egg-laying season for *C. longicollis* is spring or early summer. Most documented cases support this conclusion. Cases and exact times of egg laying include Armstrong (1980) November laying, Hill (1979) November, Kennerson (1979) December, and Wells (1973) December. No cases of *C. longicollis* producing eggs in April or even autumn have ever been previously documented.

Autumn egg laying has been recorded in other Australian species of tortoises. For example, Cann (1978) states that the egg-laying season for *Chelodina rugosa* is in March, with this species being able to produce more than one clutch of eggs in a season. This latter possibility has never been investigated in *C. longicollis* to my knowledge, although this possibility appears very likely when one considers the fact that both species belong to the same genus, and the present lack of research into the biology of *C. longicollis*. Sea turtles commonly lay several clutches of eggs in a season (Bustard, 1972; Worrell, 1963). Whether or not any tortoise held by the author has produced multiple clutches of eggs is unknown.

## Incubation and Hatching

Far greater variation in hatching times of eggs of *C. longicollis* than variation in egg-laying times is encountered in published records. This is almost certainly due to the variation in incubation times of different clutches of eggs and in some cases even eggs from the same clutch. It is a well-known fact that eggs kept at relatively high temperatures will develop and hatch more quickly than eggs kept at lower temperatures. Factors that can influence incubation time of a nest of eggs include soil moisture, hardness and temperature. These same factors can even determine whether or not a given nest of eggs will develop to hatching and they also play an important role in deciding when the young tortoises emerge from

the nest. Except in unusual circumstances it appears likely that tortoises emerge from their nests shortly after hatching, probably within a month. Cann (1978) documents a case of extremely delayed emergence of young tortoises from nests or death of hatching tortoises in nests during an exceptionally dry season in 1970 at Patho (Victoria).

Most authors give the average incubation period for eggs of *C. longicollis* at around three or four months. Cann (1978) gives a 130-180 day range for the species, depending upon conditions. Other ranges given include 8-10 weeks (Cogger, 1967) and 2-4 months (Goode, 1967). Cann (1978) gives a range of incubation periods for Australian chelids of 130 days to two years, although other authors including Cogger (1967) and Worrell (1963) give shorter possible incubation times for Australian chelids. Most documented cases of incubation of *C. longicollis* eggs both in the wild and in captivity seem to show an average incubation period longer than three-to-four months. Some selected examples include Armstrong (1980), 5 months, and Kennerson (1980), 10 months. Mincham (1964) documents a case of incubation of tortoise eggs of unspecified species from South Australia which took seven months. It is probable that the species involved was *C. longicollis*, as Mincham makes a remark about the bad smell emitted by the mother tortoise when agitated, a characteristic unique to *C. longicollis* amongst South Australian tortoises.

Using the criteria outlined above it is obvious that the eggs of *C. longicollis* which hatched in the author's pit could have been laid at almost any time during the twelve months or so prior to the detection of the juveniles. Because the location of the nests in the pit are not known, one cannot judge or estimate incubation times of the eggs which hatched and subsequently emerged, on the bases of mean incubation temperatures, humidity, etc.

Assuming that the hatchlings found in the pit are the result of two single clutches of eggs it is significant that in both cases young emerged from their nests over a two month period. This could point to rapidly differing incubation rates within single nests, a phenomenon not previously observed to this extreme. An alternative hypothesis is that up to five separate nests had young *C. longicollis* emerge from them over the eighteen month period which is documented. This possibility

is unlikely as it is hard to imagine the low fertility or hatching rates possibly implied here.

Although is it hard to ascertain what actually stimulates hatching, it appears that eggs are likely to hatch as soon as the embryo is fully developed. It is likely, though, that tortoises remain in their eggs or nests until suitable external environmental conditions are present. In all the cases documented here it appeared that emergence was stimulated by seasonally warm conditions, and more importantly excess moisture in the form of rain. Cann (1978) and Goode (1967) also find rain as a major factor in stimulating young tortoises to emerge from their nests.

From published records and from the observations presented here, it appears that *C. longicollis* commonly produces eggs at times of the year other than spring and summer. Eggs produced in late summer or autumn would naturally undergo slower incubation than eggs produced in spring, and consequently many eggs produced in late summer or autumn may not hatch until late winter or spring. The records provided here indicate that eggs may hatch in the middle of winter and young emerge from nests if their embryonic development is completed at that time of the year, even though environmental conditions for the immediate survival of young tortoises would appear to be unfavourable. For example hatchlings found by the author in the pit referred to above emerged from their nests from mid-winter to early spring, and Goode (1967) documents a case of large numbers of newly-hatched *C. longicollis* appearing in pet shops in July 1965, allegedly from somewhere in South Australia.

## Mating

Less has been documented regarding mating in Australian tortoises than probably any other aspect of their breeding biology. As far as is known, mating in *C. longicollis* or any other long-necked species for that matter has not been previously documented. Worrell (1963) describes a case of mating in a pair of short-necked tortoises in the Waterhouse River (N.T.) in 1945. The tortoises were "belly to belly and more or less upright," swimming as they mated. The swimming motions of the two tortoises were described as being in perfect "co-ordination." This author has never observed copulation of this nature in *C. longicollis*, although it may likely occur in this species where suitable conditions exist. The actual matings observed

by this author are not unlike those recorded by Bustard (1972) for *Chelodina mydas*. "Ceremonial dance" or pre-mating courtship in *Chelodina longicollis* as outlined by Ivor Noël-Hume and Audrey Noel-Hume (1954) in tortoises and Bustard (1972) in turtles has only been observed by this author a few times, and has always been observed only when the tortoise pond had very clear water. Basically, it amounts to the male tortoise swimming "majestically" around the female tortoise in circles prior to his mating her. This "ceremonial dance" can last anything from a few seconds to over an hour. It seems likely that male tortoises would often copulate with female tortoises without carrying out any pre-mating displays. This seems particularly likely if copulation were to take place in very cloudy water or on land, though copulation was never observed to occur on dry land. This aspect of tortoise biology seems similar to that of many other reptiles, including the death adder (*Acanthophis antarcticus*); this author has observed on some occasions males having elaborate pre-mating displays lasting up to several hours whilst on other occasions males simply mount and commence mating immediately.

The disparity in size between mating *C. longicollis* can be quite large as the most sexually active male held by this author is also the smallest specimen of the entire collection. Unfortunately it is not known if this tortoise has ever successfully copulated with any much larger females and if so, whether any matings between this small male and the females have directly resulted in production of offspring.

## SUMMARY

From the observations and records described here about the breeding biology of *Chelodina longicollis* in captivity, and from published literature, it appears that this species may lay eggs at more than one time of year, and possibly at any time of the year, both in the wild and in captivity. It also appears that new-born *C. longicollis* may emerge from nests at any time of year as incubation of eggs may range from two to twelve months, depending on conditions.

Unfortunately, due to the difficulty experienced by this author in obtaining complete breeding records of *Chelodina longicollis* in captivity (such as being unable to locate nests) and due to the lack of published literature on the biology of *Chelodina longicollis*, many aspects of the breeding biology

of this species are still uncertain. Further research should lead to a clarification of the picture of the reproductive biology of C. *longicollis*. Possibilities such as multiple clutches of eggs within a short period of time, regional breeding seasons or lack thereof, and simple analysis of reproductive potentials of male and female C. *longicollis* all need to be investigated.

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RAYMOND T. HOSER
170 LAWSON STREET
REDFERN N.S.W. 2016
PHONE: (02) 698-3807

60 Arterial Road
St. Ives N.S.W. 2075
Australia