Herbert Becker

Comments on keeping and breeding the Loggerhead musk turtle *Sternotherus minor minor* (AGASSIZ, 1857)

General

The genus *Sternotherus* is subdivided into the species *Sternotherus carinatus*, *S. depressus*, *S. minor*, and *S. odoratus*. The species *Sternotherus minor* further includes the subspecies *S. m. minor* and *S. m. peltifer*.

Reports on successful breeding of *Sternotherus* are known for *S. odoratus* (e. g. OLEXA 1969, SACHSSE 1977, POLDER 1978, HENDRISCHK 1979, BUDDE 1982, ZIMMERMANN 1983, GAD 1987, RÖDEL 1989, FELSNER 1999, HOFER & ARTNER 2001), and *S. carinatus* (BECKER 1992, 1995, BAUR 1995, FELSNER 2001, and others). In this article details about continuous breeding of *Sternotherus minor minor* from 1989 until 2001will be reported. From 61 clutches with 202 eggs a total of 162 turtles hatched.

Range

The natural range of *Sternotherus minor minor* is the southeast region of the USA, from the extreme southwest of Virginia and southern Tennessee down to central Florida, as well as from the Mississippi to the Atlantic coast of Georgia (NIETZKE 1969, 1973, PRITCHARD 1979, OBST 1985, IVERSON 1992, MÜLLER 1993, GUNTERMANN 1998, FELSNER 1999). GUNTERMANN points out that *S. m. minor* is absent from the Black Warrior River-system in Alabama. The threatened species *S. depressus* lives exclusively there.

Sternotherus minor peltifer occurs from eastern Tennessee and southwest Virginia to eastern Mississippi and Alabama.

Description

Sternotherus minor is a turtle that stays rather small and is strongly aquatic. My individuals leave the water only for egg laying or in situations of stress.

The colour of the carapace ranges from light to almost blackish-brown. The size also differs considerably. While the majority of my "*minors*" remain really small and hardly grow more than 11 cm (weighing between 150 g [male] and 270 g [female]), I also own a group that is clearly bigger and more massive, the so-called "maxi-minor". Here the male has a carapace-length of 12 cm and weighs 280 g and the females are just up to 14 cm in length and weigh 380 and 420 g. The plastron varies from yellowish to orange-red. In between the seams of the scutes are strips of connective tissue, which develop through regression of the scute. The individuals of this species have a single gular scute. This is an easy characteristic to distinguish *S. minor* from *S. carinatus* as the latter lacks this scute (FELSNER 1999). The neck and head are a yellowish-grey to olive-green colour with black spots. There are two barbels under the chin. The soft skin parts are a light-grey colour with black spots. The toes are webbed. *S. m. minor* has distinctively strong jaws that facilitate crushing snail shells. The sexes are easily distinguished by examining the length of the tail, as males have considerably longer tails.

Keeping

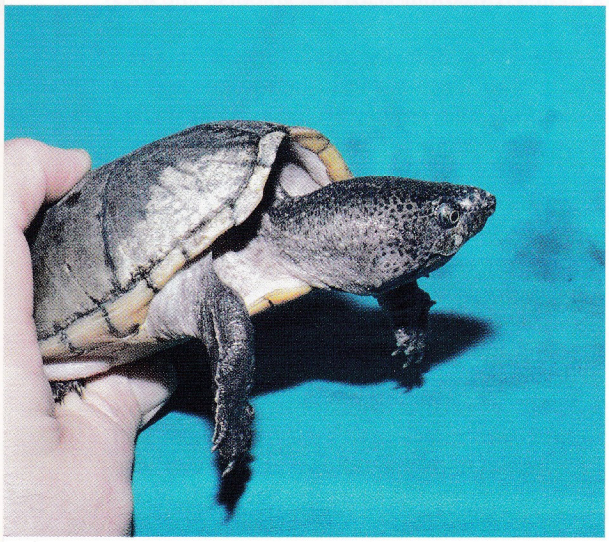
In each aqua terrarium I keep at most 1.1 or 1.2 *S. m. minor* together. The animals are kept under observation and are separated at the first signs of stress. Keeping two males together in one container is impossible in my experience as the males are very aggressive to each other. If it is possible in some cases to keep two males together one of them will be dominated by the other. Females can also be very aggressive to each other and there-

Ill. 1. The Loggerhead musk turtle *Sternotherus minor minor*.

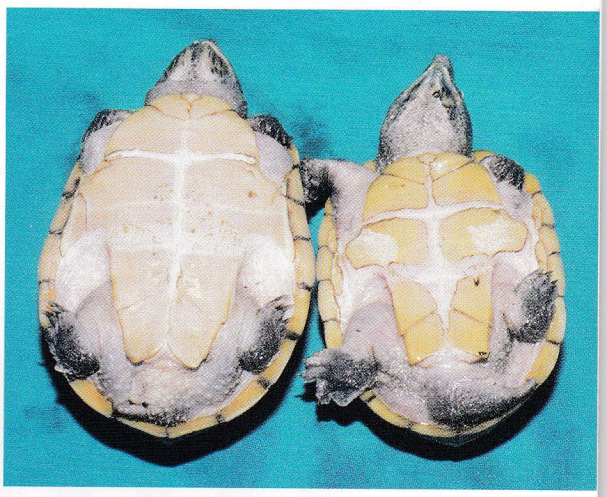
fore careful and continuous observations are very important to avoid losses.

I give each of my groups an aqua terrarium of 100 × 40 × 40 cm (length, wide, height). At a height of about 10 cm, I glued a land-part of 40 × 33 × 17 cm (length x wide x height) into the basin where the animals can hide under for protection. The land-part is filled with a mixture of sand and peat in proportion 2:1 and I keep this substrate humid as long as the animals are active. For this I pour on between 0.5 to 0.75 litre of warm water on this part of the enclosure and I repeat this as soon as it has become dried out. I completed the land with an oval sandstone of about 13 cm in length. Onto this stone, I pointed an 80 W-spotlight (Osram Concentra) for heating. Depending on the natural daylight, these lights are on from 8 to 14 hours per day. The water-temperature should be adapted to the seasonal conditions. However, temperatures exceeding 28 to 29 °C are not suitable during the summer. A nightly temperature decrease to 22 or 24 °C is desirable.

The water is filtered through a submersed Eheim filter. The set-up in the water consists of a lava-rock that is provided to help the turtles easily to reach the surface for breathing. Since musk turtles are a bottom-walking species and do not belong to the active swimming turtles like *Graptemys* or *Pseudemys*, they have to have the opportunity to reach the surface by walking. A curved piece of cork reaching into the water from the land part also provides another hiding place and



Ill. 2. Portrait.



Ill. 3. Comparison of sexes: the male has a noticeable longer and thicker tail.

makes it easier for them to climb to and from the land-part (BECKER 1992). Some plastic plants complete the set-up. There are no lights above the water area because the animals avoid the light and would only come to the illuminated part to breathe.

The common commercial turtle-pellets (PENK, Rüsselheim) and a gelatine food (BECKER 1992) serve as food. The latter is made out from beef and chicken hearts, whole sardines, bananas, apples, spinach, soaked rice, tomatoes, eggs with shells, Vitakalk, Tricrescovit, vitamin-D_3-powder, DL-a-Tocopherol (vitamin E) and ß-carotin (10 % powder). This mash is thickened with gelatine and frozen in portions.

I sometimes give my turtles also snails with shells. Those are eaten very greedy.

Hibernation

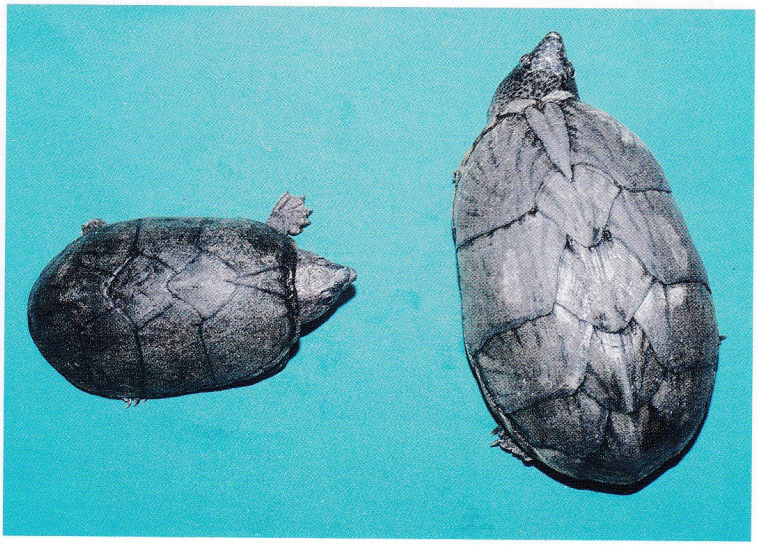
At the beginning of November the standard adjustable glass aquarium heater is turned off or the heating in the entire terrarium room is turned down. At the same time I stop feeding the animals. After two to three weeks, the 80 W-spotlight is turned off and the aqua terrarium is completely darkened by a cover. In this way, the turtles hibernate for about two months at 10 to 12 °C. After this, the optimal temperature and light conditions described above are restored in the same way over three weeks. After that the animals resume their activities and feed well.

Mating

Mating can be observed throughout the year, but it is extremely intensive after hibernation. During this time particular attention should be paid to females sitting out of the water. Those flee from mating attempts of the males and if they are not separated, losses can occur.

Egg laying and incubation

During the last 13 years 61 clutches containing a total of 202 eggs were laid. Egg



Ill. 4. Comparison of the "little" and "big" variants.

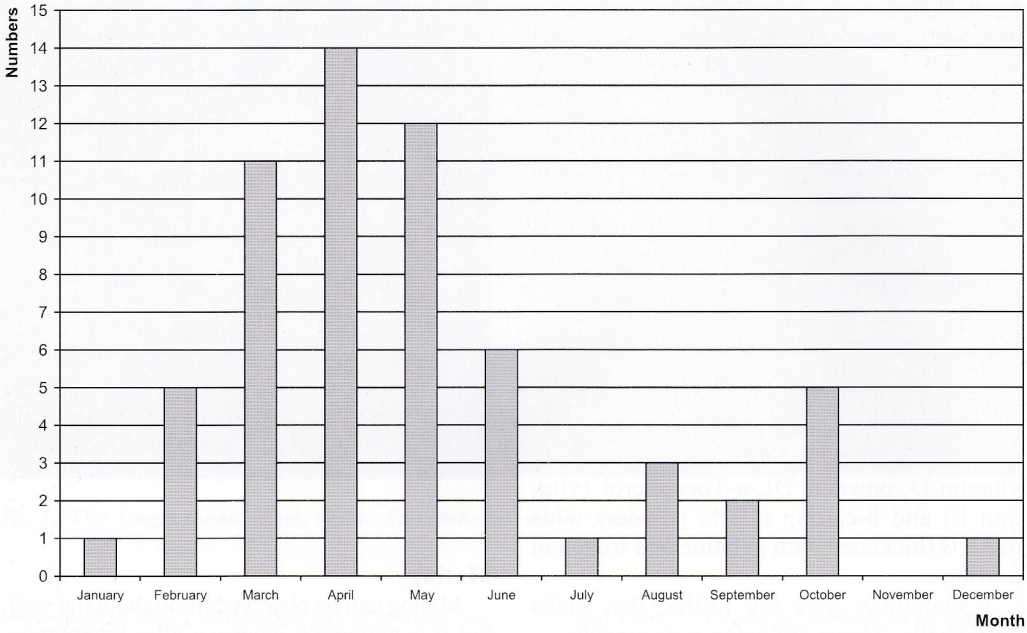
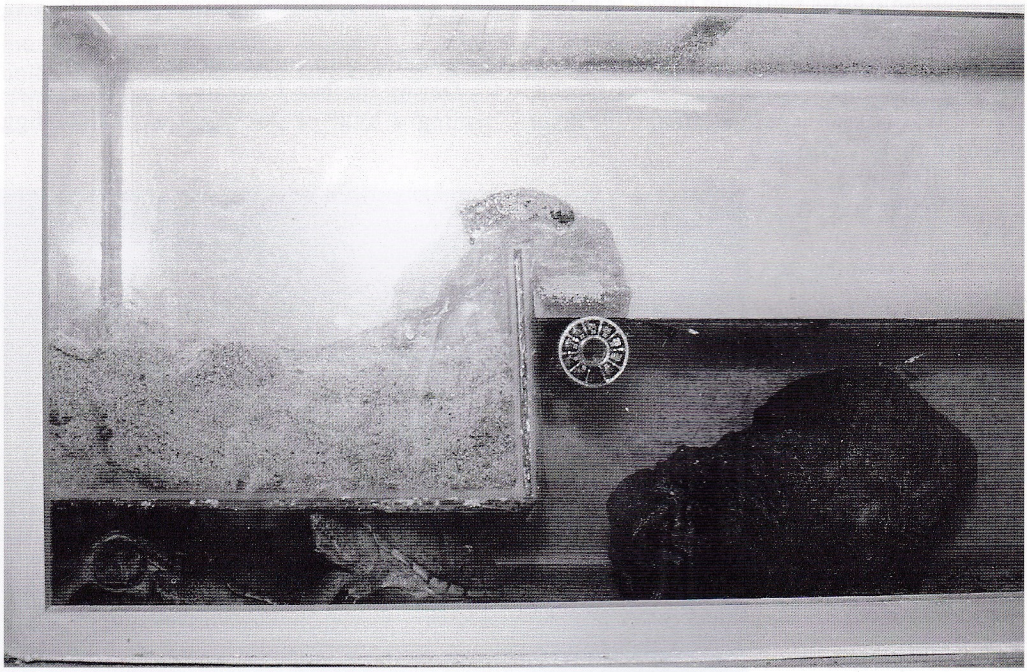


Table 1. The numbers of *Sternotherus minor minor* clutches per month during a 13 year period.



Ill. 5. Terrarium with land part glued and fixed.

laying occurs all year round, but each female has her individual laying period, which lasts for two to five months – producing up to five clutches. None of my females has had two different nesting periods in one year. The number of eggs per clutch varies from one to six eggs, and is usually between three and four.

The oval and hard-shelled eggs are transferred from the nest in the land part to a box filled with moist vermiculite. After a few days one can already determine if they are fertile by the appearance of a pale opaque band. If this does not appear, the eggs can be discarded. The band develops in the middle of the egg and spreads out towards the poles during the early stages of incubation.

From 1989 to 1994 I incubated the eggs at 28 °C and in 1995 and 1996 at 29 °C. From literature on the influence of temperature on the sex of *Sternotherus odoratus* (VOGT & BULL 1982, CLARK et al. 1986), I learned that at a temperature of 28 °C or above only females would develop and at a temperature of 25 °C about 80 % of the offspring would be males – in the temperature range in between, both sexes would hatch. Therefore it was obvious why almost all offspring turned out to be females during the captive husbandry between 1989 and 1996. From that time on, I selected a temperature gradient with a temperature decrease at night. Now the temperature varies from 24.9 to 29.3 °C. Early results seem to indicate a balanced number of both sexes. However changing of temperature did not have any significant influence on the length of the incubation-period.

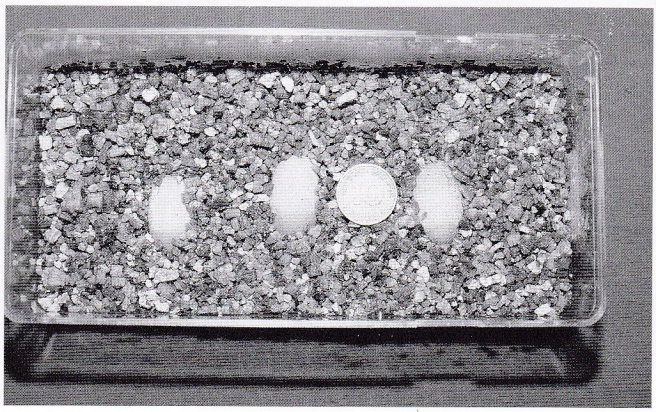
Hatching of the juveniles

The incubation period takes between 74 and 107 days. However, most of the juveniles hatch after 83 to 89 days. The weight of the hatchlings is between 2.1 and 5.07 g (mainly 3.3 to 4.8 g). The egg is opened at one pole. The hatching procedure can take up to three days. From one female of the "maxi-group", juveniles with an almost orange-red plastron always hatched. These juveniles are an image of their parents, but more intensively coloured. The carapace has clearly three longitudinal keels.

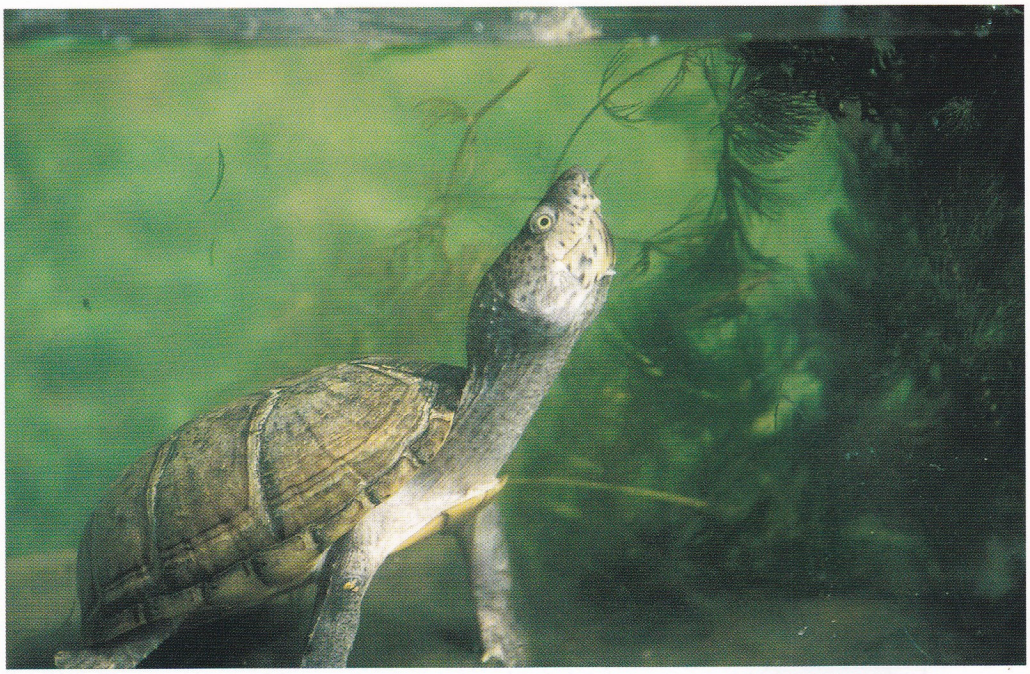
Rearing the juveniles

I keep groups of juveniles from one clutch in a plastic aquarium measuring 40 × 20 × 20 cm. The water is about 4 cm deep and the water temperature is 25 to 29 °C by day and 22 to 24 °C by night. I do not use any special lights. Some stones and plastic plants are placed in the water so the animals are able to reach the surface for breathing. Those additionally serve as refuge and hiding place. Common commercial pellets, red mosquito larva and the gelatine food described above, serve as food. With that the animals grow fast. The depth of water is always adapted to the growing turtle babies, increasing about 2 cm per month. I always pay attention that the animals can easily reach the surface.

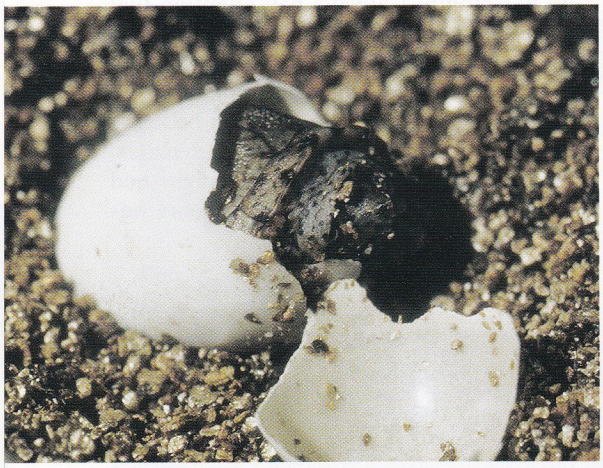
During rearing the weight gain should be observed carefully. If one hatchling does not grow as fast as the others, it has to be separated. Often those are two or more males, which surely cannot yet be distinguished from females, but react obviously more aggressive to each other.



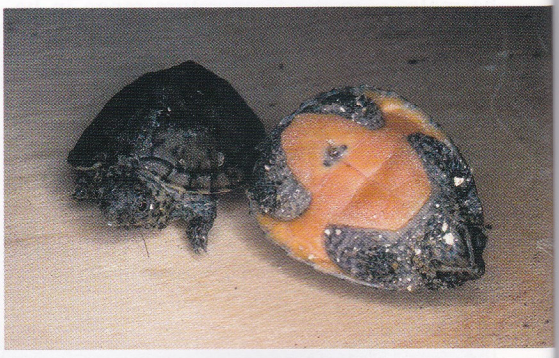
Ill. 6. A *Sternotherus minor minor* clutch – noticeable the banding on the egg that indicates that it is fertile.



Ill. 7. *Sternotherus minor minor*. Photo: T. VINKE.



Ill. 8. A Loggerhead musk turtle hatching. Photo: B. EIDENMÜLLER.



Ill. 9. A *Sternotherus minor minor* that had just hatched.

Ill. 10. Differently coloured plastrons of newly hatched Loggerhead musk turtles.

Ill. 11. ***Sternotherus minor minor*****. Photo: T. VINKE.**

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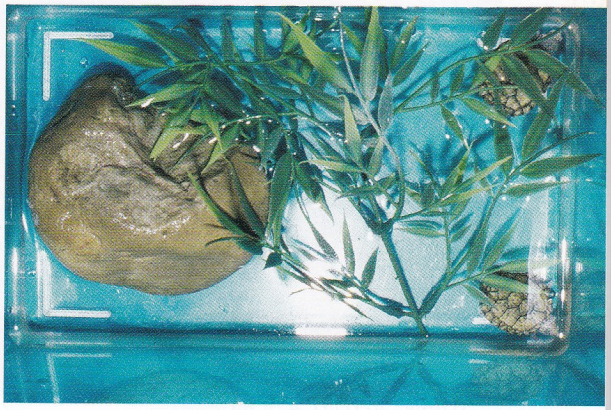
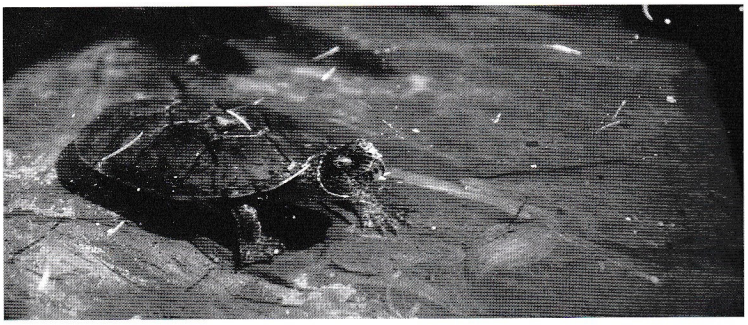


Ill. 12. Rearing container.



Ill. 13. *Sternotherus minor minor*. Photo: T. VINKE.

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Author

Herbert Becker
Bahnhofstraße 97
D-65795 Hattersheim
email: herb.becker@t-online.de
www.clemmys.de

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