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## Rearing the Olive ridley

*Lepidochelys olivacea*

### in artificial sea water

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The Olive ridley *Lepidochelys olivacea* is a marine turtle which occurs in an uneven distribution along the tropical mainland shores of the Pacific and Indian oceans; on rare occasions it may also be found in mid-ocean or close to oceanic islands (Pritchard & Trebbau, 1984). The species is characterised by its triangular head, relatively wide carapace, olive green dorsum and unusually large number of costal scutes (typically five to nine on each side). The neck is short and thick, being only slightly retractile. The Olive ridley is the smallest of the sea turtles, the adults having a carapace length of c.65-70 cm although ranges of 52.5-75 cm have been reported from different parts of the world (Pritchard & Trebbau, 1984). Few data are available on adult weights but Pritchard & Trebbau (1984) quote an average weight of 35.5 kg for 21 ♀♀ from Surinam. Tikader (1983), however, gives adult weights of 40-55 kg for Indian specimens. The sexes do not differ markedly in size although ♀♀ tend to grow larger than ♂♂. Hatchlings are c.4 cm long and dark grey-black in colour with three dorsal and two ventral keels.

Marine turtles are particularly difficult to maintain and rear in captivity because of two major problems: (1) food and feeding methods and (2) the provision of constantly clean and clear sea water (Birkenmeier, 1972; Pritchard, 1979). Procedures for the successful maintenance of clear sea water, such as those described by Foster & Chapman (1975) for Leatherback turtles *Dermochelys coriacea* and by Pritchard (1979) for sea turtles in general, appear complex and laborious. At the Arignar Anna Zoological Park in Madras we have developed a simple and successful way to rear the Olive ridley in artificial sea water. The method has the advantage of ensuring that no harmful contaminants have been introduced, and can be used at locations where no natural sea water is available.

Olive ridleys have been reared in natural sea water to the age of ten and 21 months by Whitaker (1979a, b) and to about ten months by the Forest and Fisheries Department of Madras (pers. comm.). In all cases a fungus infection, sometimes resulting in death, was reported.

In January 1985 we initiated an

experiment in which four Olive ridleys aged ten months were to be reared in artificial sea water. The turtles had been hatched after artificial incubation at the State Forest and Fisheries Department for the purpose of studying their early growth before releasing them into the sea. It was hoped that by rearing them further in captivity we could obtain data on their growth rates to supplement those recorded by Whitaker (1979a, b), while at the same time monitoring the suitability of artificial sea water for the rearing and exhibition of larger specimens over a prolonged period.

#### MAINTENANCE

Two outdoor concrete tanks, one rectangular 180 × 130 × 45 cm deep and the other circular 140 cm diameter and 45 cm deep, are presently in use. The first is used as a feeding tank and the second as an exhibit tank. No special lining has been added to soften the hard inner concrete walls, as suggested for Leatherback turtles by Pritchard (1979), but the floors and walls are kept smooth. Visitors view the turtles by looking into the exhibit tank from above.

The feeding tank contains salt water (26 g ordinary table salt per one litre of fresh water) to a depth of 15 cm while the exhibit tank contains artificial sea water to a depth of 30 cm, prepared by mixing commercial grade salts with pure fresh water in the following proportions: 26.518 g sodium chloride, 4.470 g magnesium chloride, 3.303 g magnesium sulphate, 1.141 g calcium chloride, 0.725 g potassium chloride and 0.202 g sodium bicarbonate per one litre of water (based on data on the constituents of sea water, reported by Sverdrup *et al.*, 1961).

All the water in the feeding tank is filtered through a 15 cm deep layer of sand every second day and is changed completely every third day. If the same water is used for more than four or five days, even if it is filtered every day, it becomes pinkish in colour and starts to give off a bad odour. All the water in the

exhibit tank is changed every 15 days, by which time it has become turbid and looks dirty because of the accumulation of turtle excreta and dust from outside, and is filtered completely one week after it has been changed.

#### FEEDING

The Olive ridley appears to be a generalised and opportunistic feeder in the wild, consuming fish, shellfish, snails, jellyfish and other invertebrates; as adults they may also eat algae (Pritchard & Trebbau, 1984). Since their arrival at the zoo our turtles have been fed on nothing but the freshwater fish *Tilapia mosambica* which they accept without difficulty. They are kept in the exhibit tank all day and transferred to the feeding tank at night where they are given small pieces (c.2 cm) of fresh fish. For the first month the turtles had been kept night and day in a single tank of artificial sea water where they were provided with 50 g of fish per turtle at some point during the day. The water had to be changed frequently because of the additional contamination resulting from leftover food and this proved to be a laborious process because artificial sea water had to be prepared so often. An additional tank was therefore constructed in which the turtles could be exhibited during the day, providing them with a deeper and cleaner environment, and we switched over to our present system of feeding at the same time. After the first month the amount of fish given was increased to its present level of 200 g for each animal; this appears to be slightly more than is required since there is always a small quantity left over each day. We have found that food consumption per 24 hours remains the same irrespective of whether it is given only at night or in the daytime. If the amount left over is larger than usual it means that at least one individual is not feeding normally; to identify which this is we usually partition off part of the feeding tank temporarily and feed each of the turtles there in turn. If, as has

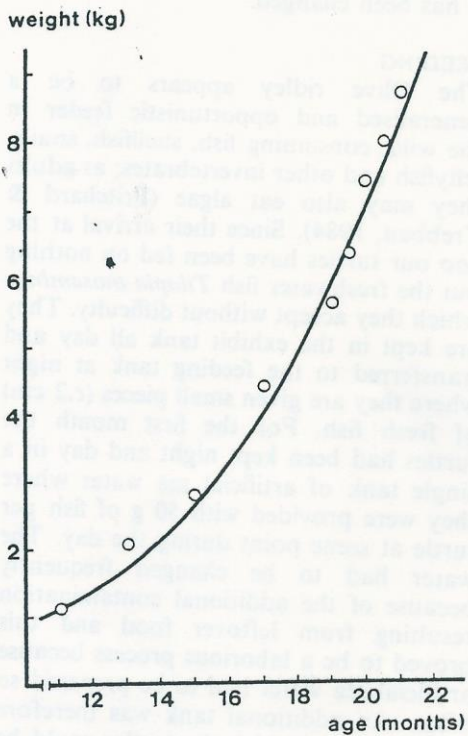


Fig. 1. Increases in the average weight of two Olive ridleys *Lepidochelys olivacea* reared in artificial sea water at the Arignar Anna Zoological Park. The curve  $y = 7.022 - 1.173x + 0.059x^2$  fits the data with a correlation coefficient of 0.975.

happened once so far, food is refused for three consecutive days then the animal is removed for treatment. On only three occasions has self starvation occurred in all three turtles at the same time, the maximum period having been three days. The reasons for this behaviour are not understood, however, because on each occasion feeding was resumed without treatment.

In order to allow the turtles the freedom of movement required to search for food easily a minimum depth of about twice the height of the animals was found to be necessary.

#### GROWTH

To make identification easier different notches were made on the marginals of each turtle. Starting when the animals

DATE (1985)	WEIGHTS OF TURTLES (kg)			
	1	2	3	4
4 Feb	0.90	1.35	1.30	1.25
2 Apr	1.80	2.30	2.30	2.15 <sup>1</sup>
3 Jun	2.35	3.05	3.15	
30 Jul	4.20	2.40 <sup>2</sup>	4.60	
5 Sep	5.30	3.00	5.95	
19 Sep	5.90	3.20	6.80	
8 Oct	6.90	3.65	7.90	
29 Oct	7.50	3.90	8.45	
8 Nov	8.10	4.10	9.30	

<sup>1</sup> died of unknown causes on 1 May 1985.

<sup>2</sup> decrease in weight was due to self starvation which was treated after three days (see text).

Table 1. Weight increases between February and November 1985 in four Olive ridleys *Lepidochelys olivacea* maintained in artificial sea water at the Arignar Anna Zoological Park, Madras. The turtles were 11 months old when first weighed.

were 11 months old records of weight, accurate to within 50 g, were at first taken every two months but the increase each time was found to be so great (Table 1) that the interval was changed to 15 days. The turtles did not struggle unduly when handled. Birkenmeier (1972) reports that in the Leatherly turtle the carapace length increased gradually and did not keep pace with the increase in weight; we did not consider it necessary, therefore, to take regular measurements of length. One of the four Olive ridleys died of unknown causes three months after arrival and another turtle showed a 20% decrease in weight five months after arrival (Table 1). Although it recovered after treatment and ate well, it always remained smaller than the other two neither of which suffered from prolonged ill health. As can be seen from Fig. 1 the data from these two, which are presumed to demonstrate relatively normal growth, show a curved linear relationship; a standard curve was fitted statistically following the formula  $y = a + bx + cx^2$ .

#### HEALTH AND TREATMENT

When one of the young Olive ridleys refused food for more than three days,

and was found to have lost considerable weight between one month and the next (Table 1), it was given five drops of Liv. 52 (a treatment for liver disorders) each day, one hour before being placed in the feeding tank, for 36 days. It resumed feeding shortly after treatment was begun and the lost weight was regained within a month (Table 1) after which it increased slowly but steadily.

Soon after its arrival one of the turtles received a scratch which became infected. At the time the depth of water in the feeding tank was kept very low and it is thought that the secondary infection was a direct result of this practice. To avoid the recurrence of such infections the water depth was increased to 15 cm, which is considered to be a minimum requirement for young Olive ridleys. The injured turtle was removed from the water for 15 minutes while the scratch was cleaned with Cetramiol (cetrimide tincture) and dressed with salicylic acid ointment. The treatment was repeated once a day for a week after which time the wound had healed completely.

On the whole the turtles have not suffered from abrasions or scratches as a result of the concrete enclosure walls. No fungus infection has ever been observed, and we are certain that this did not cause the early death of turtle 4 (Table 1).

#### CONCLUSIONS

We would maintain that our rearing of the Olive ridley owes its success to two main factors: (1) the provision of a separate feeding tank, the water of which is filtered once a day and changed every two days; (2) the use of an artificial sea water formula which is devoid of any harmful contaminants. A number of additional factors should also be taken into account. The circular exhibit tank is sufficiently large for the number and size of turtles maintained and the depth of water is never less than 30 cm to allow them plenty of exercise throughout the day, an important requirement during the early growth period. A sufficient depth of

water in the feeding tank is important also because the animals must be able to search for and find food items easily, thus ensuring that satiation is reached during the night. In addition it helps to reduce the likelihood of secondary infection occurring in any cuts or scratches since no part of the body is exposed to air for any length of time.

The growth rate of our Olive ridleys in artificial sea water has been most satisfactory, the weights of the two whose growth was not interrupted by illness increasing exponentially within the time period measured (Fig. 1). If this rate continues it can be assumed that the two turtles will reach the size of mature adults (40–55 kg (Tikader, 1983)) at the age of c.40 months. It is possible, however, that the rate will slow down after a time since Rajagopalan (1984), observing growth in captive Olive ridleys from the Indian Ocean, found that the fastest growing individuals reached 52.8 cm and 19.5 kg at 47 months. Our turtles are now aged c.21 months and the two larger specimens have average measurements of 8.7 kg weight (8.1 kg and 9.3 kg), 56.4 cm head-to-tail length (54.3 cm and 58.5 cm) and 39.3 cm width (38.8 cm and 39.8 cm). The smallest specimen (turtle 2 in Table 1) now weighs 4.1 kg, has a 47 cm head-to-tail length and 32.7 cm width. All measurements of body size have been taken using a tape-measure curved over the animal's shell.

Marine turtles present a number of maintenance problems in captivity and are not often reared successfully to maturity. It is hoped that the husbandry and rearing methods described here will be of value to others working in the field.

#### AUTHORS' NOTE

The three turtles continued to feed and grow steadily until the end of March 1986 when they began to refuse food. On 8 April they were weighed, the measurements for turtles 1, 2 and 3 being 13.1 kg, 5.5 kg and 15.5 kg respectively; all were aged c.26 months. After a month of self starvation turtle 3 died on 23 April, followed by turtles 1 and 2 on 30 April and 1 May. Post-mortem studies

revealed liver problems in all three animals and showed that turtles 1 and 2 had been ♂ while turtle 3 (the largest) had been ♀. It is suspected that the particularly high temperatures which occurred during April (31–34°C), combined with the relatively shallow water in the tanks, may have contributed to the deaths since during roughly the same period mortalities were noticed by the first author in turtles of a similar age which had been reared in natural sea water at the Point Calimere Sanctuary 400 km south of Madras. Our studies on the Olive ridley continue with new specimens kept in larger tanks with deeper water.

#### ACKNOWLEDGEMENTS

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#### PRODUCTS MENTIONED IN THE TEXT

**Cetramol:** cetrimide tincture (composition: Cetrimide IP 0.5% W/V, average alcohol content 65.5% V/V), manufactured by Tamil Nadu Dadha Pharmaceuticals Ltd, Dadhanagar, Madras 74, India.

**Liv. 52 drops:** Ayurvedic liver corrective for treatment of liver dysfunction and Jamage, manufactured by the Himalaya Drug Company, Shivsagar 'E' Dr AB Road, Bombay 18, India.

**Salicylic acid ointment IP:** manufactured by Tamil Nadu Dadha Pharmaceuticals Ltd, Dadhanagar.

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## Captive reproduction of the New Guinea side-necked turtle *Emydura australis albertisii* at the San Antonio Zoo

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The Side-necked turtle *Emydura* is a member of the chelonian suborder Pleurodira, family Chelidae. The New Guinea subspecies, *E. australis albertisii*, inhabits the freshwater areas of southeastern New Guinea (Pritchard,

1967) where it feeds on insects, small vertebrates, crustaceans and molluscs.

The San Antonio Zoo obtained a pair of Side-necked turtles in May 1978. The morphology of the turtles is very similar to that described by Pritchard (1979) for