Haematology and plasma chemistry of breeding olive ridley sea turtles (*Lepidochelys olivacea*)

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THE olive ridley turtle (*Lepidochelys olivacea*) is the smallest species of living sea turtle. It is primarily carnivorous and highly migratory, with a pantropical distribution in the Atlantic, Pacific and Indian oceans (Plotkin 2003). The species is classified as globally endangered (IUCN 2002).

Since the 1990s, there has been increasing interest in the health status of free-ranging sea turtles, but data are lacking for the olive ridley turtle. To the authors' knowledge, only fragmentary data are available on the haematology (Thorson 1968, Frair 1977) and biochemistry (Dessauer 1970) of this species. These data are important in the clinical evaluation of the health of free-ranging animals, the results of which could be used to evaluate the health status of captive animals.

In the Ostional National Wildlife Refuge (ONWR), (10°00′00′′N, 86°45′50′′W), on the Nicoya peninsula, north Pacific coast of Costa Rica, the olive ridley turtle shows a characteristic synchronous massive nesting aggregation, termed 'arribada', which occurs approximately once a month throughout the year (Chaves and others 2004). Off the coast of the ONWR, a permanent mating area exists, where large numbers of olive ridley turtles are accessible for study in a relatively small geographical area (Chaves and others 2004). This short communication presents haematological and biochemical blood values of breeding olive ridley turtles captured in this mating area.

Olive ridley turtles were sampled at the ONWR from November to December 2003. They were captured offshore, during breeding, by hand using snorkelling equipment from a motor boat. Blood was obtained from the dorsal cervical sinus (Owens and Ruiz 1980) within five minutes of capture, with manual restraint, using 21 G needles and 5 ml sterile plastic syringes (Terumo). Samples were collected into heparinised tubes and placed on ice. Following the sampling, the curved carapace length (CCL) was recorded and each chelonian was examined for signs of disease or trauma. The turtles were marked on the carapace using a yellow paint-stick marker (LACO Industries) to avoid re-sampling, and then released. Plasma for biochemistry was separated by centrifugation at 3000 *g* for five minutes, transferred into plastic vials and stored at –20°C. Only blood data obtained from turtles considered healthy by the external clinical examination (that is, no external signs of disease or trauma), were included in the study.

The packed-cell volume (PCV) and haemoglobin (cyanmethaemoglobin method preceded by centrifugation of lysate) values were determined using a micro-haematocrit centrifuge (MB centrifuge; Damon/IEC Division) and spectrophotometer equipment (Model 6/20 Junior II; Coleman), respectively. Mean cell haemoglobin concentrations (MCHC) were calculated from these values. Haematological analyses were made in duplicate and the two values were averaged. Biochemistry parameters, including glucose, sodium (Na^+), potassium (K^+), magnesium (Mg^{2+}), chloride (Cl^-), calcium (Ca^{2+}), phosphorus, urea nitrogen (BUN), creatinine, uric acid, total protein, albumin, total bilirubin, alkaline phosphatase, lactic dehydrogenase (LDH), aspartate aminotransferase, alanine aminotranferase, cholesterol, triglycerides, and iron (Fe) were obtained using a Synchron CX 5 chemistry analyser, series 4668 (Beckman Coulter). The effect of sex on the blood values obtained was calculated using a one-way analysis of variance. The minimum significant difference was evaluated at $P \leq 0.05$. Statistical analyses were performed using an Epi Info 1997 program, version 6.04b (CDC and WHO).

TABLE 1: Mean (sd) curved carapace length (CCL) and haematology values for breeding olive ridley turtles (*Lepidochelys olivacea*) from the Ostional National Wildlife Refuge, Costa Rica

	Female			Male		
Parameter	n	Mean (sd)	Range	n	Mean (sd)	Range
CCL (cm)	21	68 (2·2)	64-71	19	68·4 (2·5)	63-74
PCV (l/l)	18	0·31 (0·03)	0·25-0·37	19	0·30 (0·03)	0·23-0·36
HB (g/l)	18	95 (13·01)	77-126	19	92 (12·01)	72-112
MCHC (g/l)	18	310 (28)	260-359	19	300 (31·8)	259-377

PCV Packed cell volume, HB Haemoglobin, MCHC Mean cell haemoglobin concentration

The mean (sd) values and ranges for CCL, PCV, haemoglobin and MCHC are given in Table 1; Table 2 gives 20 biochemistry parameters. The blood variables presented a normal distribution according to a utilised test. The effect of sex was statistically significant for only 10 biochemical values. The female turtles had significantly higher uric acid ($P=0.004$), Ca^{2+} ($P=0.03$), albumin ($P=0.01$), total bilirubin ($P=0.05$), cholesterol ($P<0.0001$) and triglycerides ($P=0.02$) values. The levels of Mg^{2+} ($P=0.03$), BUN ($P=0.04$), LDH ($P=0.04$) and Fe ($P=0.02$) were significantly higher in the male turtles. LDH and total bilirubin values in both groups showed the greatest and the smallest range deviations, respectively.

It is well known that methods of analysis (Bolten and others 1992), sample handling (Jacobson and others 1992) and physiological conditions (Christopher and others 1999) may affect the blood values of healthy chelonians. The PCV values obtained here were similar to those published for the same species by Thorson (1968) (0·32 [0·010] l/l) and Frair (1977) (0·31 [0·013] l/l). Sex exhibited a significant effect on only 10 of the biochemical parameters examined. Significantly higher albumin, Ca^{2+}, cholesterol and triglycerides plasma levels in the female turtles were associated with vitellogenesis and egg production (Christopher and others 1999, Hamann and others 2002). Plasma Ca^{2+} levels increase significantly

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TABLE 2: Mean (sd) plasma chemistry values for breeding olive ridley turtles (*Lepidochelys olivacea*) from the Ostional National Wildlife Refuge, Costa Rica

	Female			Male		
Parameter	n	Mean (sd)	Range	n	Mean (sd)	Range
Glucose (mmol/l)	21	3·5 (0·7)	2·2-5·5	18	3·8 (0·7)	2·6-4·9
Na^+ (mmol/l)	21	149 (3·4)	144-158	18	146 (7·2)	121-153·5
K^+ (mmol/l)	21	4·7 (1·3)	4-10	17	4·6 (0·5)	3·8-5·8
Mg^{2+} (mmol/l)	21	1·6 (1·2)	0·5-3·5	18	3·05 (0·4)	2·3-4
Cl^- (mmol/l)	21	119 (4·7)	113-134	18	119·2 (4·6)	103·6-124
Ca^{2+} (mmol/l)	21	2·05 (0·9)	0·8-13	15	1 (0·2)	0·5-1·4
P (mmol/l)	21	2·8 (0·6)	1·8-3·8	18	2·5 (0·4)	2-3·8
BUN (mmol/l)	21	6·3 (2·4)	3·2-11·8	18	7·8 (3·1)	5·3-14·6
Creatinine (µmol/l)	20	35·3 (23·2)	17·7-97·2	18	35·3 (11·8)	8·8-53
Uric acid (µmol/l)	9	0·04 (0·02)	0·01-0·1	11	0·02 (0·01)	0·01-0·05
Total protein (g/l)	21	39 (9)	29-55	18	40 (5)	31-50
Albumin (g/l)	10	7 (0·9)	6-9	13	4·1 (0·4)	4-5
Total bilirubin (µmol/l)	21	5·1 (4·1)	1·7-15·4	18	1·7 (0·6)	1·7-3·4
ALP (U/l)	21	29·5 (30·2)	11-137	18	53·6 (55·1)	9-224
LDH (U/l)	21	710·4 (266·8)	278-1488	18	1242 (451·1)	104-1939
AST (U/l)	21	73·4 (29·3)	30-143	18	61·2 (40)	16-154
ALT (U/l)	21	8·2 (5·5)	2-23	18	4·8 (1·1)	3-8
Cholesterol (mmol/l)	21	5·5 (1·1)	2·6-7·1	18	2·9 (0·8)	1·84-5·1
Triglycerides (mmol/l)	16	5·4 (3·4)	0·1-11·5	17	0·2 (0·06)	0·1-0·3
Fe (µmol/l)	16	37 (36·1)	3·4-119·6	18	66·8 (34·6)	21·5-162·9

Na^+ Sodium, K^+ Potassium, Mg^{2+} Magnesium, Cl^- Chloride, Ca^{2+} Calcium, P Phosphorus, BUN Urea nitrogen, ALP Alkaline phosphatase, LDH Lactic dehydrogenase, AST Aspartate aminotransferase, ALT Alanine aminotranferase, Fe Iron

for shell egg formation, due to calcium mobilisation from the bones during folliculogenesis, and plasma cholesterol and triglycerides concentrations increase for mobilisation from adipose tissue reserve for the growing oocyte. Both these mechanisms are under oestrogen activity (Dessaeur 1970). The lower Mg^{2+} levels observed in the females compared with the males might be due to the use of magnesium for egg production. Compared with serum electrolyte values reported by Dessaeur (1970) (Na^+ 163 meq/l, K^+ 6·6 meq/l, Cl^- 108 meq/l) for olive ridley turtles, the sodium and potassium values in the present study were lower, while the chloride levels were higher.

In the present study, the female turtles exhibited significantly higher uric acid levels and the males had significantly higher BUN levels. Taken together, these data suggest that the male turtles had not been actively consuming food during breeding. This is in agreement with the hypophagic behaviour exhibited by breeding sea turtles (Owens 1980). Uric acid appears to increase in reptiles after eating (Maixner and others 1987), and the BUN increases in dehydrated chelonians (Christopher and others 1999).

Little is known about the physiology of the olive ridley turtle. The data in this report are specific for mating adult males and females, but the blood values obtained could be helpful in the evaluation of physiological and pathological changes in free-ranging and captive breeding olive ridley turtles.

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