CAPTIVE REPRODUCTION IN THE SOUTH-WESTERN CARPET PYTHON, *MORELIA SPILOTA IMBRICATA*, INCLUDING AN EXCEPTIONAL FASTING RECORD OF A REPRODUCTIVELY ACTIVE FEMALE

By Brian Bush, 9 Birch Place Stoneville WA 6081
Email: bush@iinet.net.au

INTRODUCTION

The only published data on reproduction in this subspecies is the unsuccessful record by Bush (1988) and a successful record referred to in Barker & Barker (1994) and Bush *et al.* (1995). Maryan (1994) and the Western Australian Department of Conservation and Land Management (CALM), in its Policy Statement 29, both emphasise the need for more research into all aspects of this poorly known subspecies' biology. Pearson (1993) correlated observations from naturalists, amateur and professional herpetologists and CALM employees to determine the distribution and abundance of WA pythons. Along with Bush (1981) and Smith (1981), he suggested that *Morelia s. imbricata* numbers have declined since European settlement. Personal communications with several elderly, long-term residents of the Wheatbelt and Bunbury Regions of Western Australia reinforce this hypothesis. They reported that carpet pythons were often seen in their younger days but not, or only rarely in recent times.

Here I report further successful captive reproduction in this subspecies, as well as an exceptionally long period of fasting demonstrated by a reproductively active female.

CAPTIVE HISTORY OF BREEDERS

Two females and one male had been together for at least five years before the observed reproductive behaviour reported here. The male in this study came from Lort River (33°44'S, 121°17'E) in October 1977. It had been with the larger female (Female 1) since her removal from a mineshaft near Norseman (32° 15'S, 121° 45'E) in December 1984. The smaller female (Female 2) came from Woodvale (31° 48'S, 115° 46'E) as a damaged hatchling in June 1988. Two additional males with snout-vent lengths of 96 cm (Mount Helena, 31° 55'S, 116° 16'E) and 108 cm (Wooroloo, 31° 45'S, 116° 20'E) were included in January 1992 and March 1993 respectively. This increased the number housed together to five (2 females, 3 males). These new males have not demonstrated any reproductive activity themselves, but may have stimulated the oldest male.

The 1977 male was the only member of this group to display any reproductive behaviour before September 1993. This occurred in 1984 and is reported in Bush (1988): it moved over the body of a female (kept at that time but not involved in this study) simultaneously with another male (released shortly after at Lort River), with both stroking her with their respective outstretched cloacal spurs. This was apparently stimulated by the introduction of the second adult male, and appeared to be a direct imitation of that male's behaviour. Only the recently introduced male was successful in inseminating the female.

Apart from an increase in the number of snakes housed together in this study, no other changes in husbandry preceding mating could be identified as the stimulus for observed reproductive behaviour.

I have never consciously attempted to breed *M. s. imbricata* as I use all my specimens of this python as tactile aids during my work educating people on reptiles. Almost daily during my lectures one individual or another is handled by many people. I thought that this alone would discourage reproduction. However, as this was not the case, it suggests that human-tolerant snakes suffer little stress from handling (see also Kreger & Mench, 1993).

Medical -
In early December 1991 the male and small Female 2 had blood removed from the tail for biochemical analysis. They had this procedure done again in July 1994 along with all the other carpet pythons in my care. Nembutal was administered subcutaneously as a local anaesthetic during the first bleeding but not the second. I believe this procedure has reduced the prehensile strength of the tail in Female 2. Some difficulty in locating a blood vessel resulted in the tail being punctured several times with the needle, possibly damaging blood vessels, muscle or caudal vertebrae vital to adequate prehensility. Caution is therefore necessary when obtaining blood samples from caudal veins.

In late December 1991 all three pythons lost their appetites and began shedding mucus and blood in their faeces. This followed the introduction as food of a dead bronze-wing pigeon found on the road. The other snakes mouthed it before the oldest female eventually swallowed it. Believing an amoeba was involved I drenched them all with Metronidazole (Flagyl Suspension™) at the rate of 6 ml/kg and sent of a faecal sample to the pathologist. A flagellate, *Trichomonas* sp., was found in small numbers and the medication was changed to Dimetridazole ('Emtryl' Soluble™ 400g/kg). This was added to their drinking water at the rate of 4.5 g to 7.5 litres. Within four weeks they were feeding and their faeces had returned to normal with no sign of micro-parasites. However, to be sure, I continued treating with the latter medication for the next four weeks. The pigeon is implicated as the source because *Trichomonas* causes 'canker' in these birds. It may reside in the crop without the manifestation of this disease (David Edmonds, pers. comm.).

Cage and furnishings -
The snakes are kept in a glass-fronted wooden terrarium measuring (cm) 150 wide, 120 deep and 100 high. The furnishings are simple, consisting of two solid logs placed on a newspaper substrate, an electric blanket folded once as a heat source, an elevated hide-box and an eight litre plastic bucket of water. The electric blanket is permanently available as a refuge and is on from the beginning of May to December. All the pythons shuttle between the blanket and the hide-box. The cage sits directly on the surface of a 10 cm thick concrete floor out of direct sunlight in a steel colourbond shed. The natural photoperiod is continually interrupted by the intermittent opening and closing of the shed's sliding door.

No competitive male/male interaction was observed. A tolerance of other males at mating time occurs also in the subspecies *spilota* (Barker & Barker, 1994; Shine, 1991; pers. obs. at Kangaroo Valley, NSW) and *M.s. metcalfei* (Shine & Fitzgerald, 1995), but not so in *M.s. variegata, M.s. cheynei* and *M.s. mcdowelli* (Barker & Barker, 1994, Shine, 1991). Male/male combat also occurs in *M. bredli* and *M. viridis* (Bumgardner, 1985; Fyfe, 1994; Walsh, 1977).

Feeding and fasting -
Most of the food provided was defrosted laboratory mice and rats. These are bought frozen from the Animal Resources Centre at Murdoch University, where they are reared in a sterile environment and fed a high protein, low fat diet. The only other food given, both alive and defrosted, were young rabbits and day-old cockerels bought occasionally from chicken hatcheries.

Food was offered every two or three weeks. The general pattern displayed by all my adult carpet pythons is to feed regularly for several months and then not eat for 3-10 months. When an individual is feeding food is provided ad lib.

Female 1 displayed exceptional fasting. After feeding on 27 August 1993, she was observed mating for the first time on 24 September. Two clutches of eggs were laid before this female next ate, on 7 January 1996, an interval of 28 months between feeds. The end of fasting occurred soon after a period of brooding behaviour, despite earlier removal of the second clutch of eggs.

During the fasting period, weight loss of the female was minimal, and when egg production is included weight gain occurred. In December 1991, female mass was 2.5 kg; in January 1994, immediately after depositing the first clutch, mass was 2.1 kg, and in December 1995, immediately after the second clutch was deposited, mass was 1.9 kg. Total mass of the two clutches was 1.449 kg.

Presumably the apparent increase in mass reflects weight gain between December 1991 and the laying of Clutch 1 in January 1994, and/or water intake during fasting. Further, it demonstrates that normal metabolism is not a rapid drain on fat reserves.

This example of fasting does demonstrate the resilient nature of the animal. In especially harsh times, even when these are of considerable duration, the large adults within the population are able to persist and continue to reproduce, however, it is probable in extreme cases of famine, that there would be a low survivorship of any offspring. Alternatively, offspring would be feeding on much smaller prey, which may not be as scarce as that required by adults. In either case the species would be able to survive locally for considerable periods during food shortages.

EGG, INCUBATION AND NEONATE DATA

All eggs were incubated on vermiculite moistened with one part sterilised water to two parts vermiculite by weight. Four or five eggs were placed on this medium in 2 litre plastic ice-cream containers. Cling wrap was pulled tight over each container and the lids replaced. These had a hole cut in the centre large enough to allow observation of all the eggs therein. Eggs were incubated at three temperatures (28, 29 and 30°C). Figure 1 shows a neonate emerging from egg. The failure of a sample of eggs in Clutches 1 and 3 may have been reduced if the eggs were incubated individually rather than as adherent clumps.

Data from three clutches are included here. Clutch 1 and 2 are from Female 1 and Clutch 3 is from Female 2. Pre-egglaying sloughs occurred 28, 21 and 22 days prior respectively. Post-egglaying sloughs occurred 46, 43 and 73 days after respectively. The reproductive effort, i.e. the clutch mass presented as a percentage of females' mass immediately after laying, was 37.7%, 34.6% and 38.7% respectively. Postnatal sloughs in all clutches occurred 15-23 days after hatching.

EGGS -

Clutch 1. Laid 15/01/94, N=17, female SVL 173 cm, weight 2.1 kg.

	Egg	Length (mm)	Width (mm)	Weight (g)
	1.	53	39	44.18
	2.	56	39	49.68
	3.	57	36	49.60
	4.	57	37	47.34
	5.	57	36	46.03
	6.	58	38	46.74
	7.	61	41	49.65
	8.	58	41	51.75
	9.	63	38	48.75
	10.	58	37	50.12
	11.	62	38	50.92
	12.	58	38	50.54
	13-17 (mean)			41.44
Means		**58.17**	**38.17**	**44.61**

Eggs 13-17 adhered in a clump and were weighed and incubated as such.

Clutch 2. Laid 27/12/95, N=17, female SVL 181 cm, weight 1.9 kg.

	Egg	Length (mm)	Width (mm)	Weight (g)
	1.	50	37	38.00
	2.	50	36	40.00
	3.	50	38	49.00
	4-8 (mean)	60	45	41.80
	9-11 (..)	50	35	38.18
	12-16 (..)	50	38	38.23
	17. undeveloped			14.70
Means		**53.13**	**39.44**	**40.11**

Eggs 4-8, 9-11 and 12-16 were measured as three adherent clumps. Egg 17 was an undeveloped yellow 'slug' and not included in mean calculations.

Clutch 3. Laid 18/11/95, N=17, female SVL 171 cm, weight 1.94 kg.

	Egg	Length (mm)	Width (mm)	Weight (g)
	1.	62	36	
	2.	54	40	
	3.	56	42	
	4.	54	36	
	5.	68	35	
	6.	63	36	
Means		**59.5**	**37.5**	**44.16**

All eggs were adherent making it difficult to obtain a complete set of individual measurements.

Hatching occurred in	Clutch 1.	after 63-71 days at	30°C.
	Clutch 2.	63-69	30°C.
	..	69-74	29°C.
	Clutch 3.	62-65	30°C.
	..	72-75	28°C.

Different temperatures were recorded at different levels in the incubator resulting in skewed incubation periods.

NEONATES -
Clutch 1. Hatching commenced 19/03/94, N=14

Neonate	SVL (mm)	Weight (g)
1.	350	25.68
2.	360	25.55
3.	345	26.74
4.	360	27.52
*5.	346	29.80
6.	372	30.50
7.	360	24.89
8.	355	24.14
9.	365	38.36
10.	345	26.82
11.	348	25.97
12.	353	26.52
13.	355	26.10
*14.	332	27.00
Means	**353.28**	**26.88**

* 5 and 14 died after slitting egg. The number of each has no relationship to the number adjacent to Clutch 1 eggs. Three eggs failed during the early stage of incubation.

Clutch 2. Hatching commenced 28/02/96, N=16

Neonate	SVL (mm)	Weight (g)
1.	365	24.54
2.	368	25.55
3.	325	20.74
4.	360	24.56
5.	346	23.88
6.	372	25.97
7.	343	23.49
8.	370	26.54
9.	365	24.54
10.	372	26.35
11.	353	24.70
12.	368	24.89
13.	365	23.45
14.	338	22.52
15.	335	21.30
16.	336	24.81
Means	**355.06**	**24.24**

The number of each neonate has no relationship to the number adjacent to Clutch 2 eggs.

Clutch 3. Hatching commenced 19/01/96, N=12

	Neonate	SVL (mm)	Weight (g)
	1.	350	23.67
	2.	340	25.78
	3.	355	25.33
	4.	353	26.46
	5.	365	27.72
	6.	350	26.65
	7.	360	28.00
	8.	355	27.57
	9.	350	28.12
	10.	340	26.78
	11.	345	25.73
	12.	353	26.26
Means		**351.33**	**26.51**

The number of each neonate has no relationship to the number adjacent to Clutch 3 eggs. Five eggs failed during the early stage of incubation.

ACKNOWLEDGMENTS

I thank David Pearson for his comments and suggestions on an earlier draft of the MS, Glenn Shea for his comments and assistance in obtaining additional reference material and Dr. David Edmonds (Eastern Hills Veterinarian Clinic) for information on canker in birds. None of this study would have been possible without the relevant licence and assistance provided by the Western Australian Department of Conservation and Land Management (CALM). Judy, my spouse, is a damn good person and deserves special mention for tolerating my passion and me for the past 30 odd years.

REFERENCES

Barker, D.G. and Barker, T.M. 1994. *Pythons of the World Volume 1, Australia.* Advanced Vivarium Systems Inc., California, USA 171pp.

Bumgardner, M. 1985. A review of Green Tree Python (*Chondropython viridis*) propagation and husbandry. *N. Ca. Herp. Soc. NL.* reprinted in Reptile Keepers' Assoc. Newsletter 1986 (19): 6-9

Bush, B. 1981. *Reptiles of the Kalgoorlie-Esperance Region.* Author, Esperance, WA 46pp.

Bush, B. 1988. An unsuccessful breeding record for the Western Australian Carpet Python, *Morelia spilota imbricata. Herpetofauna* 18 (1): 30-31

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 1995. *Reptiles and Frogs of the Perth Region.* UWA Press, Perth. 226pp.

Fyfe, G. 1994. The Central Carpet Python *Morelia spilota bredli* in the field and in captivity. *Monitor* 6 (2): 70-72

Kreger, M.D. and Mench, J.A. 1993. Physiological and behavioural effects of handling and restraint in the ball python (*Python regius*) and the blue-tongued skink (*Tiliqua scincoides*). *App. Animal Behavioural Sc.* 38: 323-336

Maryan, B. 1994. The Western Australian Carpet Python (*Morelia spilota imbricata*): How little we know about it. *Herpetofauna*. 24 (1): 30-32

Pearson, D.J. 1993. Distribution, status and conservation of pythons in Western Australia. Pp 383-95. In: *Herpetology in Australia: A Diverse Discipline*. D. Lunney & D. Ayers (Eds). Transactions of the Royal Zoological Society NSW. Surrey Beatty & Sons, NSW.

Shine, R. 1991. *Australian Snakes A Natural History*. Reed Books, Sydney. 223pp.

Shine, R. and Fitzgerald, M. 1995. Variation in mating and sexual size dimorphism between populations of the Australian python *Morelia spilota* (Serpentes: Pythonidae). *Oecologia* 103: 490-498

Smith, L.A. 1981. A revision of the python genera *Aspidites* and *Python* (Serpentes: Boidae) in Western Australia. *Rec. West. Aust. Mus.* 9 (2): 211-226

Walsh, T. 1977. Husbandry and breeding of *Chondropython viridis*. *National Assoc. for Sound Wildlife Programs.* 1 (2): 10-22