

Field observations of mating in Coastal Taipans (*Oxyuranus scutellatus*) (Elapidae)

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Abstract

Two field observations of mating in the Coastal Taipan *Oxyuranus scutellatus* involving the same female, but with two different males on consecutive days, are described and their significance is discussed.

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Introduction

The Coastal Taipan *Oxyuranus scutellatus* (hereafter "Taipan") is a large (mean total length 2 m), diurnal, highly venomous elapid snake that occurs in a wide variety of habitats from tropical wet sclerophyll through to dry sclerophyll forest and open savannah woodland (Thomson 1935; Worrell 1958; Cogger 2014). It is a common inhabitant of the sugar cane fields of coastal north Queensland, where it preys on rats that feed on this crop (Gow 1973, 1980; Shine & Covacevich 1983; Mirtschin *et al.* 2017). Taipans are very alert, have a nervous temperament, and their first reaction to perceived danger is to retreat (Slater 1956; Worrell 1963; Gow 1976; O'Shea 1996; Wilson 2015). These characteristics probably account for the lack of observations relating to their natural behaviour in the wild. Nearly all species of large dangerously venomous elapids occurring in south-eastern Australia have been the subject of field studies (Greer 1997; Mirtschin *et al.* 2017), but Taipans (as for most northern species) have not been studied in the wild and much of what is known about their ecology has been determined from museum specimens (see Shine & Covacevich 1983). While Taipans have been successfully maintained and bred in captivity for many years (Peters 1973; Fleay 1981; Banks 1984; Burns 1985; Barnett 1986; Mirtschin 1988), a description of their mating behaviour has not accompanied these accounts and it seems that

published field observations of this behaviour are entirely lacking. Here, I describe the two field observations of Taipans mating at the edge of a sugar cane field in north Queensland.

Site description

Observations occurred in a sugar cane field near the town of Silkwood (17°45' S, 146°00' E), 118 km south of Cairns, known historically as a region where Taipans are common (Jones 1977). The 5-acre sugar cane field (40 m asl) was situated atop of a steep-sided plateau elevated 8-10 m above the surrounding floodplain and valley of Liverpool Creek. The plateau had a very slight gradient sloping gently down to its lowest point on the south-east edge (where the observations occurred). The steep sides supported a mixture of regenerating rainforest, remnant riparian vegetation and patches of Guinea Grass *Megathyrsus maximus*. The floodplain below supported more extensive fields of sugar cane and banana plantations. The habitat in the immediate vicinity of where observations occurred had a middle and upper-story consisting of Ivory Basswood *Polyscias australiana*, Pink Euodia *Melicope elleryana*, Bleeding Heart *Homalanthus novoguineensis*, African Tulip Tree *Spathodea campanulata*, Parasol Leaf Tree *Macaranga tanarius*, Brown Salwood *Acacia mangium* and Umbrella Tree *Schefflera actinophylla* while at

ground level on the slopes and edges of the headlands were dense, low, thickets of Old World Forked Fern *Dicranopteris linearis*. On the 4 – 5 m wide headlands were a variety of low grasses and stands of the weed *Praxelis Praxelis clematidea*.

Methods

With Taipans typically quick to retreat when approached, observer movements were kept to a minimum, were deliberately slow, and where possible, limited to times when the head of the snake(s) was pointing away from the observer (rather than side-on or front-on). In this way it was possible to stand within a few meters of snakes that were either basking or mating. Disturbance of snakes was most likely to occur in approaching the site because of the uncertainty of where exactly snakes were situated on any given day. Despite a cautious approach it was largely a matter of chance as to who detected who first. I observed Taipans retreating even when carefully approached at distances of up to 12 m on flat ground and at the particular site where the mating occurred I observed them retreating at distances from 3 to 10 m (n = 11) in previous years. While observing, still photographs and videos were taken using an Olympus Stylus TG-4 mostly with zoom at or beyond the optical zoom (× 4). Air temperature

(in shade) and humidity readings were recorded on-site.

Observations

Mating observations occurred on the 30th and 31st of July 2017. On the day prior to the observations at 10:30 AM I observed two adult Taipans for about 20 mins. They were located 20 m from where the first observation of mating occurred and only 2 – 3 m away from where the second observation occurred. The two snakes observed matched in both size and appearance the pair observed mating the next day (Observation 1). At a distance of about 15 m, I heard, but did not see, a snake retreating through low ground cover into Guinea Grass. When within 5 m, I observed a second snake retreat down into Guinea Grass at the edge of the scrub while another Taipan remained basking only 2 m away from it and 3 m from where I stood. It was lying in an overlapping loop in a shallow ground depression with its head concealed beneath part of the body. After about five minutes of observation, the second of the two snakes returned and quickly looped its body back on itself and assumed a fairly open basking posture in full sun. It was very close to where it was initially seen basking and 1.5 m from the other snake (Fig. 1). At about the same time, the Taipan that



Figure 1. Two adult Coastal Taipans basking the day before the first mating.

All photographs were taken by the author.

had remained motionless up to this point, lifted its head. Both snakes remained motionless for the rest of the observation period. I retreated without disturbing either snake. The snake that was first to retreat did not reappear. Conditions were slightly overcast and cool (23 – 24°C). I returned at midday and saw no snakes at the site but when visited again at 3:15 PM I observed the tail of a Taipan disappearing into an Old World Forked Fern thicket in exactly the spot where a pair of Taipans were observed mating the next day (Observation 1). I also located the fresh slough (< 2 days old) of an adult Taipan less than a metre from where the snakes were basking earlier in the day; it had been dismembered by Green Tree Ants *Oecophylla smaragdina* and pieces of it were being carried away by them.

Observations of mating

1. **30/7/17** Three observation periods- 3:40 – 4:15 PM, 4:30 – 4:45 PM, 5:05 – 5:25 PM (total time 70 mins.). Taipans were sighted in a dry drainage channel approximately 1.6 m deep at the edge of the headland. The sides of the channel were covered in Old World Forked Fern thicket (about 0.5 m high) but the bottom of the channel had a thin layer of leaf litter. When I initially peered over the embankment, I could see at least two snakes entangled and partially concealed at the edge of the thicket. I was able to observe snakes from the top of the embankment and they were unaware of my presence. Unusually for that time of day, given the relatively cool conditions, the snakes were in shade rather than in direct sun, although the channel would have been in sun only an hour earlier. I noticed slow writhing movements of the tail of one of these snakes and after some minor movements in two of the snakes could see that there were three adult Taipans, two of them copulating. The sexes of these snakes was established a short time later when their tails came into view: the orientation of female's tail and tail base were normal (up-right), but with a very noticeable pre-anal bulge. The male's tail was kinked at the base and twisted laterally and typically held clear of the ground. The pair were of similar size (total length (TL) \approx 1.8 m) with their bodies overlapping but otherwise maintaining a fairly open loop

(Fig. 2). The female was easily distinguished from the other two, being a paler dorsal brown anteriorly with a small patch of abraded dorsal scales (probably a piece of adherent skin from a recent slough) approx. two-thirds along its body length. The male involved in the mating was alert, exhibited sporadic head movements, tongue flicker and occasional twitches of various parts of the body and tail. At times it appeared restless, but its movements were quite limited and its head exhibited small vertical vibrations when doing so. On several occasions the male's tail writhing culminated in rapid, spasmodic, body twitching followed by a period of quiescence. By contrast the female was very subdued and its head was mostly concealed, resting at ground level for nearly all of the observation period. The female would sometimes make slight movements in response to the male's twitching. On one occasion the joined vents and tail were raised several centimetres clear of the ground.

The largest of these three snakes (TL \approx 2.0 m), which subsequently proved to be a male, was not involved in the mating but was nonetheless in direct body contact with the pair at various times. It was observed on four separate occasions to move away from the pair, but only a small distance (1.0 – 1.5 m), where it assumed an open loop in the shade. It then returned to the pair and twice was seen with its head < 0.1 m from the joined vents of the pair, raised above the ground and tongue flicking. At other times its head was a similar distance from the head of either female or male (Fig. 3). There it would pause for several minutes, tongue flicking and proceed to move slowly around and in between the pair. There were no overt signs of aggression displayed by this male.

At the start of the second observation period the large male was seen 4 m away, where it lay loosely coiled and exposed in leaf litter. By the third observation period it could not be located. The mating pair appeared to have moved very little between the second and third observation periods but the male always appeared alert and continued to exhibit sporadic body twitches and tail



Figure 2. Two adult Coastal Taipans mating (see Observation 1).



Figure 3. Two adult Coastal Taipans mating (see Observation 1).

A third snake (a larger male) appears at the bottom of the photo with its head close to that of the female.

writhing, though less frequently. At the end of the second observation period the temperature was 23°C and relative humidity (RH) 65%. The snakes could not be located on a final visit to the site at 6:05 PM; temperature 21°C and RH 66%.

2. **31/7/17** One observation period: 5:03 – 6:10 PM (total time 67 mins.). A mating pair was located about 20 m away from the previous pair at the edge of the scrub in leaf litter with over-hanging branches of an African Tulip Tree and the low branch of a Parasol Leaf Tree that was just above the ground. Conditions were cool and completely

overcast (initially 22°C and RH 78%). I was able to observe the pair at a distance of five metres on gently sloping ground and in clear view of them due to the low ground cover. Both the male and female were the same snakes sighted the previous day as indicated by the size, colouration and patch of abraded dorsal scales on the female. It was, however, the larger male that was involved in mating on this occasion. The pair lay in an open loop copulating, with the male's body encircling the female. The female's head was concealed beneath the body loop of the male for almost all the observation period

(Fig. 4). The male was restless and alert. As it moved, its head was often seen to exhibit small vertical vibrations (of only a few mm). It was also seen to exhibit sporadic involuntary-like twitching or jerking movements of the mid and posterior body and tail. This was nearly always preceded by slow writhing movements of the tail. A twitch in one body region often 'triggered' twitches in other regions (up to eight twitches were counted) occurring before a period of inactivity. Twice the joined vents of the pair were raised clear of the ground (approx. 0.1 m) and the swollen preanal

region of the female was then clearly visible (Fig. 5). There was no decrease in the male's activity despite the conditions cooling over the observation period. In the minutes between movements, the male would sit idle with its head raised just above the ground, often resting on a body loop. Towards the end of the observation period, the male's body movements exposed the head of the female and she then became active and within minutes initiated a retreat into the scrub, slowly dragging the male with it. At this time the temperature was 21°C and RH 82%.



Figure 4. Two adult Coastal Taipans mating (see Observation 2).
The head of the male is visible (towards the rear) as is the preanal bulge of the female's tail (towards the front).



Figure 5. Two adult Coastal Taipans mating (see Observation 2).
A sudden upward twitch by the male resulted in joined vents and tails being lifted into the air and then lowered immediately after.

No further mating activity was witnessed in more than 20 follow-up visits to the site during August and September. On two separate occasions single snakes were seen retreating into long grass at distances of 7 and 10 m; the identity of individuals could not be ascertained. The first two days of significantly warmer post-‘winter’ temperatures in the region (day-time max. 28°C) on 17 – 18th of August evidently stimulated activity in Taipans with two road-killed males (TL 1.92 m, ≈ 2 m) recorded in the area.

Video analysis

Almost 9 minutes of video (13 separate sequences: five of the first mating, eight of the second) were recorded, and while of variable quality, provided an adequate representation of observed snake movements. Each sequence was recorded at random intervals during the observation period and varied considerably in duration (12 secs to 1 min 34 secs). Five of these sequences recorded no movements by snakes at all (23% of the total recording time). In a further two sequences only minor movements were recorded (slight head movement and one lateral body twitch by a male) and combined with the previous sequences amount to 42% of the total time in which there were no significant movements recorded. In sequences where movements occurred, they varied in number from 2 to 20 individual movements and male movements accounted for almost all of these (95%; $n = 37$). The average time between movements in the sequences varied from 4.7 to 23.1 sec.

Discussion

I was unable to locate any other published accounts of mating behaviour in Taipans with which to compare the observations above and field observations of elapid snakes mating are generally uncommon in the literature (Greer 1997; Mirtschin *et al.* 2017). For these reasons, it remains unclear as to whether there are species-specific behaviours that occur during mating. Combat between male snakes is frequently confused with mating, and snakes that engage in male combat (such as Taipans) tend to be conspicuous (to human observers) because of their vigorous activity. They are often so engaged in fighting that they are either oblivious to nearby observers or else are emboldened. Hosmer’s (1953) supposed account of mating behaviour in a pair of Taipans at

Freshwater (near Cairns) is completely at odds with the observations above. In his account the Taipans are described as being entwined with their anterior bodies raised about three feet above the ground, with each snake attempting to ‘reach higher’, their forebodies swaying and with one snake seen to rub its head along the neck and temporal region of the other. None of these behaviours was observed in the mating pairs. Reports of male combat behaviour in other species of Australian elapids published since this time (see Greer 1997), describe very similar, stereotypical behaviours indicating that Hosmer’s account is clearly one of male combat rather than mating (although the sex of the snakes involved was not determined). Likewise, Jones’ (1977) brief description of mating in Taipans as ‘harsh climactic writhing as though this was an act of mutual hostility’ is again very likely a case of male combat. Worrell (1963, Pl. 59 caption) stated that fighting/wrestling between males occurs in Taipans but no details are given. Worrell (1958) makes passing reference to ‘a pair of taipans were mating or fighting in the middle of the road surrounded by people for twenty minutes or more’. This would almost certainly be a case of male combat given the circumstances described. Masci & Kendall (1995) describe mating in Taipans as a ‘passive event’ (with no further details given) consistent with the observations of this work. Mating in elapids, and snakes generally, is a subdued event in contrast to the often vigorous combat and courtship behaviours that precede it (Shea *et al.* 1993; Greer 1997). Despite Taipans being successfully bred in captivity for many years, there is little (and more usually, no) details given concerning either courtship or mating behaviour. Burns (1985) describes ‘jerking and twitching’ by the male in the lead-up to mating but no accounts describe mating behaviour itself.

Mating (and combat) in the Inland Taipan *O. microlepidotus* has been observed in the field based on an hour-long observation of a single pair (McRae & Covacevich 1997). In this account, behaviours are described that are very similar to those observed in the Coastal Taipan. In particular, the presumed male *O. microlepidotus* exhibited infrequent (every 5 – 10 minutes) ‘quivers’ along the length of the body culminating in a short, sharp, series of contractions which would appear to be equivalent to the ‘twitches’ and ‘jerking’ movements recorded in this work. One point of

difference in mating behaviour between the two species is the positioning of the male. McRae and Covacevich (1997) observed that the male lay on top of the female, whereas in both pairs of Coastal Taipans males maintained an open, overlapping loop or else the male encircled the female. Though not explicitly stated, it is evident from McRae & Covacevich's (1997) description that the male was the more active of the pair. In mating pairs of the Coastal Taipan the male was far more active and alert during mating, while the female lay passively until, in at least one instance, she initiated a retreat. Common to both the observed matings of the Coastal Taipan were tail writhing, body twitching and vibratory head movements of the male. In captivity, mating in Coastal Taipans has been recorded as lasting up to 6 hrs (Peters 1973; Barnett 1999) and so the matings described in this work may have been initiated as early as midday.

The behaviour of the large male around the mating pair of Taipans in the first observation was curious given that 24 hours later it was observed mating with the same female. There was no threat display or physical aggression shown by the large male despite its obvious size advantage. The ability of the large male to disrupt the mating was probably quite limited and might only have caused the pair to move elsewhere. I could only locate one other account describing the behaviour of an additional male being present during mating in Australian elapid snakes and this involved Red-bellied Black Snakes *Pseudechis porphyriacus* (Shine *et al.* 1981; Shine 1991). This account involved three snakes, two of which were mating and moved very little, while the third (a male) was constantly exhibiting 'abrupt, jerky movements' with its chin often pressed against the female's dorsal surface, its body aligned and draped over the female's body attempting to mate. A fourth snake, a male, who approached the mating pair (after displacing the male just described) was observed to behave in the same manner, but at one stage bit the copulating male (who did not react). The behaviour of the two *P. porphyriacus* males seemed to be aimed at disrupting the mating pair whereas the behaviour of the male Taipan may have been associated with monitoring the location and/or availability of the female. Mate guarding is a known reproductive tactic in males of some snake species (Shine 2003).

Receptive female snakes are known to sometimes attract multiple males (Shea *et al.* 1993), as evidently occurred in the observations above. Ramsamy (in Jones 1977) observed a female Taipan cross a clearing and half an hour later two males were seen following her trail. Polygyny (males mating with multiple females) is the most prevalent mating system among snake species. There is, however, evidence indicating that polyandry (females mating with multiple males) is more common than previously recognised (Rivas & Burghardt 2005). The typical practise of maintaining more female than male snakes in captivity for breeding purposes, and hence using the few males to mate with multiple females (including Taipans; Banks 1984; Barnett 1999) is consistent with a polygynous mating system. However, because sexes are typically segregated and a male is introduced to the female (then removed once mating has occurred), there is typically no opportunity for polyandry to occur. Consequently, is it not possible to draw any conclusions about the mating system of Taipans from the published results of captive breeding. Irrespective, the observations in this work suggests that polyandry does occur in Taipans. Only through multiple paternity testing of the progeny of wild-caught females can it be established whether polyandry is the norm among Taipans.

Both sites where mating occurred were at the edge of dense ground cover and were semi-secluded, but open enough to receive afternoon sun. The second observation occurred on a day when Taipan activity was not expected due to cool, overcast conditions persisting all day. It is the only time I have seen the species away from cover in such conditions. Taipans are known to be mainly diurnal, emerging in the morning and late afternoon and avoiding the heat of the day (Thomson 1935; Gow 1973). The Papuan Taipan *O. s. canni*, however, may be active throughout all hours of the day 'even while rain is falling' (Slater 1956). Incidental observations of Taipans over five years at the site are consistent with early morning and late afternoon activity. In addition, I have recorded Taipans active mid-afternoon in summer when conditions were overcast.

The timing of the mating observations is consistent with what is known of the species reproductive cycle. Mating in captive Taipans has been recorded to take place from March to December, with a

peak from July to October (Banks 1984; Barnett 1986, 1999; Mirtschin 1988), closely corresponding to the timing in the field. A mating pair of Papuan Taipans were collected in late August (Slater 1959). Ovigerous females have been recorded from August to November and post-ovipositional females from September to March (Thomson 1935; Shine & Covacevich 1983). Within 40 km of the site where mating observations occurred, two ovigerous females containing large shelled eggs were recorded in early October and mid-November (pers. obs.).

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