

Testosterone is associated with harem maintenance ability in free-ranging grey-headed flying-foxes (*Pteropus poliocephalus*)

(Stefan M. Klose, Justin A. Welbergen, Elisabeth K. V. Kalko)

'Researchers have discovered a secret of sexual success for flying-foxes in harem maintenance abilities, which may lead to many answers in connection with other mammalian taxons.'

Males of many vertebrate species monopolize females thus increasing their copulative success and protecting severely their reproductive interests. The 'challenge-hypothesis' predicts that the testosterone level in their blood rises to make males capable of facing social challenges easier in their population. The highest testosterone levels can be examined, when for example territories are established or defended, when aggression between males (challenges to a male's social status) is common and in times of peak female receptivity. According to the hypothesis scientists can explain several patterns of testosterone secretion in many vertebrate species - mainly avians - but it still remains a secret concerning mammals.

With the leadership of Stefan M. Klose a group of scientists studied 'Circulating plasma testosterone levels (T)' in relation to the harem maintenance of grey-headed flying-foxes in the wild. They conducted their observations at Dallis Park colony near Murwillumbah, New South Wales, Australia. This endangered species forms seasonal breeding colonies containing thousands of bats. Males attract and protect aggressively their harem of up to six females in mating territories. In a flying-fox colony males which maintain central position are larger and have more mating opportunities than the peripherally located ones, who also have to cope with the common territorial aggression, which often results in serious injuries associated with interstifies around the mating period, which is in between March-May (T peak around this time).

Researchers assumed that if T shows how a male is able to withstand competitors' attacks, then T should also be in connection with the ability of successful harem maintenance. It is also known, that a higher level of T has many fitness costs by its benefits. High T may facilitate and grease the skids of access to mates through social dominance and territoriality, but it may also quell immunity and parental efforts. As a test they provisionally took away males from their harems before and during the short mating period, recording their harem sizes both before removal and after their recurrence. Males removed *before* the mating period usually managed to reclaim their territory and a harem but in case of those ones, who were taken out of their harem *during* the mating period, level of T was the dominating factor in their success or failure. Males with higher T reobtained harems closer to their original size and as a consequence males with lower T suffered a reduction in their harem size.

Details of the experiment:

At the beginning of the reproductive season 36 adult (>2 years old) male *P. poliocephalus* were randomly chosen and caught with a capture noose device, thus taken away from the central area of the mating territory (dominant ones were known to be centrally located) pre-ordained to one of the two study periods and tested independently. The number of females in each

male's harem (easily recognizable, because they form comparatively tight swarms/clusters) was recorded at least twice over 72 hours. Parallel to this, males in captivity were examined too. Within 180 seconds of captivity **T** level was measured in their blood by using a special isotope. After this procedure they were marked and put into individual houses for 72 hours with ad-libitum access to fruit and water. Stefan Klose and his associates released them in the late afternoon and started to follow each released bat heading back to its colony. As it arrived, they counted the number of females in its territory. 24 hours after the return to the colony researchers again recorded the number of females in the original territory of each male. The harem size change, which was approximately the difference of the number of the original and the reobtained harem in each male's case showed how dominant they are. If a male failed to return to its territory that was counted as a complete loss of the harem.

Results:

Experiments show, that **T** is purposefully higher in the mating period than in the pre-mating period so it varies from what according to the 'challenge-hypothesis' could be expected. As it was suggested **T** was an important factor and had a significant effect on the harem size both before and after the removal of males. Higher level of **T** meant a larger harem in both cases. According to the experiment as soon as focal males were removed, the territories were either divided among their neighbours, occupied by another new males or remained unoccupied. However, as they were released they headed straight back to the colony and they often landed comparatively close to their original territory, rarely they even arrived to their original tree. The majority of the focal males managed to reoccupy their harem (3 failed to return, 1 returned without re-establishing a harem) within 24 hours which shows that researchers hypothesis about the relationship between **T** and the harem maintenance ability is true.

The species of grey-headed flying-foxes (*Pteropus poliocephalus*) is at the edge of extinction. Their natural habitat is diminishing quickly and the increasing number of urban flying-foxes is also an annoying factor. According to this experiment they fly back home even after days of capture so relocation attempts are unlikely to be successful. Alternative, suitable forest patches should be developed to attract bats upon return from annual migration.



sources: **1.** Testosterone is associated with harem maintenance ability in free ranging grey-headed flying-foxes, *Pteropus poliocephalus*, Stefan M. Klose, Justin A. Welbergen and Elisabeth K. V. Kalko, *Biol. Lett.* 2009 **5**, 758-761 first published online 18 August 2009, doi: 10.1098/rsbl.2009.0563 **2.** How a flying fox keeps his harem: Flying foxes with high levels of testosterone are better able to maintain a "harem" of females, say researchers. Full story: <http://news.bbc.co.uk/go/em//1/hi/sci/tech/8208381.stm>