

Visual courtship display by the male Coastal Peacock Spider [Araneae: Salticidae: Euophryinae: *Maratus speciosus* (O. Pickard-Cambridge 1874)]

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Abstract: The visual courtship display of male *Maratus speciosus* (O. Pickard-Cambridge 1874) is described, based on video recordings of the behaviour of males in the presence of females. This includes a distinctive, assymetrical semaphore signal not reported for other *Maratus*.

Introduction

For more than a century after the description of a male *Maratus speciosus* (O. Pickard-Cambridge 1874), and its subsequent redescription by Keyserling (1883), this spider received no attention apart from its appearance in several catalogs. The original description (O. Pickard-Cambridge 1874; republished in Hill 2009 and Otto & Hill 2012a, 2012b), clearly described and figured the transverse bands and heavy lateral fringes of the male opisthosoma, but provided no other characters of use for identification. O. Pickard-Cambridge correctly recognized the relationship of this spider to *M. volans* (O. Pickard-Cambridge 1874), but as in that species he misinterpreted the role of the extended opisthosoma:

... these fringes are very characteristic; and, from their appearance in the six examples that have come under my notice, I suspect that the living spider has power to raise and depress or expand them as a peacock does its train, and that when so expanded they assist to sustain the spider in its leaps. The slightly projecting lateral margins of the upper epidermis appear also to connect this spider with *Salticus volans* (last described); and there is a general similarity in the colouring of the two species ...

Keyserling's later redescription (1883), based on a specimen in the collection of E. Simon, included a highly stylized drawing that completely misrepresented the opisthosomal fringes, and an even less useful description of a preserved and yellowed specimen with colours altogether different from those of the living spider.

More recently (Hill & Otto 2011), we identified both male and female specimens of *M. speciosus* collected in Western Australia (Rottnest Island, Geraldton) by P. J. Darlington and W. M. Wheeler during the Harvard Australian Expedition of 1931. These had been identified simply as "*Maratus (Saitis) volans*, cf." in the Harvard collection. Our recent description of both males and females (Otto & Hill 2012a, 2012b) was based on living spiders found on plants (e.g. Sea Spinach, *Tetragonia decumbens*) in coastal sand dunes near Perth, and the present study is based on video recordings of these (Perth coastal suburbs of City Beach and Hillarys, 4 SEP 2012, D. Knowles coll.). In recent years *M. speciosus* has been found only in the narrow coastal region to the north and south of Perth. O. Pickard-Cambridge reported this spider from Swan River (Perth), a locality that he associated with "New South Wales" at the time, and Keyserling appears to have incorrectly interpreted this location as "Sydney" when he redescribed a specimen.

Most, but not all, *Maratus* males appear to laterally expand (or flatten) their opisthosoma and raise it as they display to females. Many, like *M. volans*, and to an even greater degree members of the *mungaich* group (Otto & Hill 2014), have prominent lateral extensions (folding flaps) of the dorsal plate of the

opisthosoma (fan) that can be extended during display. Instead of flaps, male *M. speciosus* have long bicoloured setae that are normally concealed under the margins of the dorsal plate, but can be extended to reveal their bright yellow to orange basal colour on either side of the fan (Figure 1). The result is a spectacular display that can be observed directly in a recent video production by one of the authors (Otto 2013). Apart from the brilliant colours of the fan, one of the most distinctive features of display by male *M. speciosus* lies in their asymmetrical semaphore signalling with raised and extended legs III.

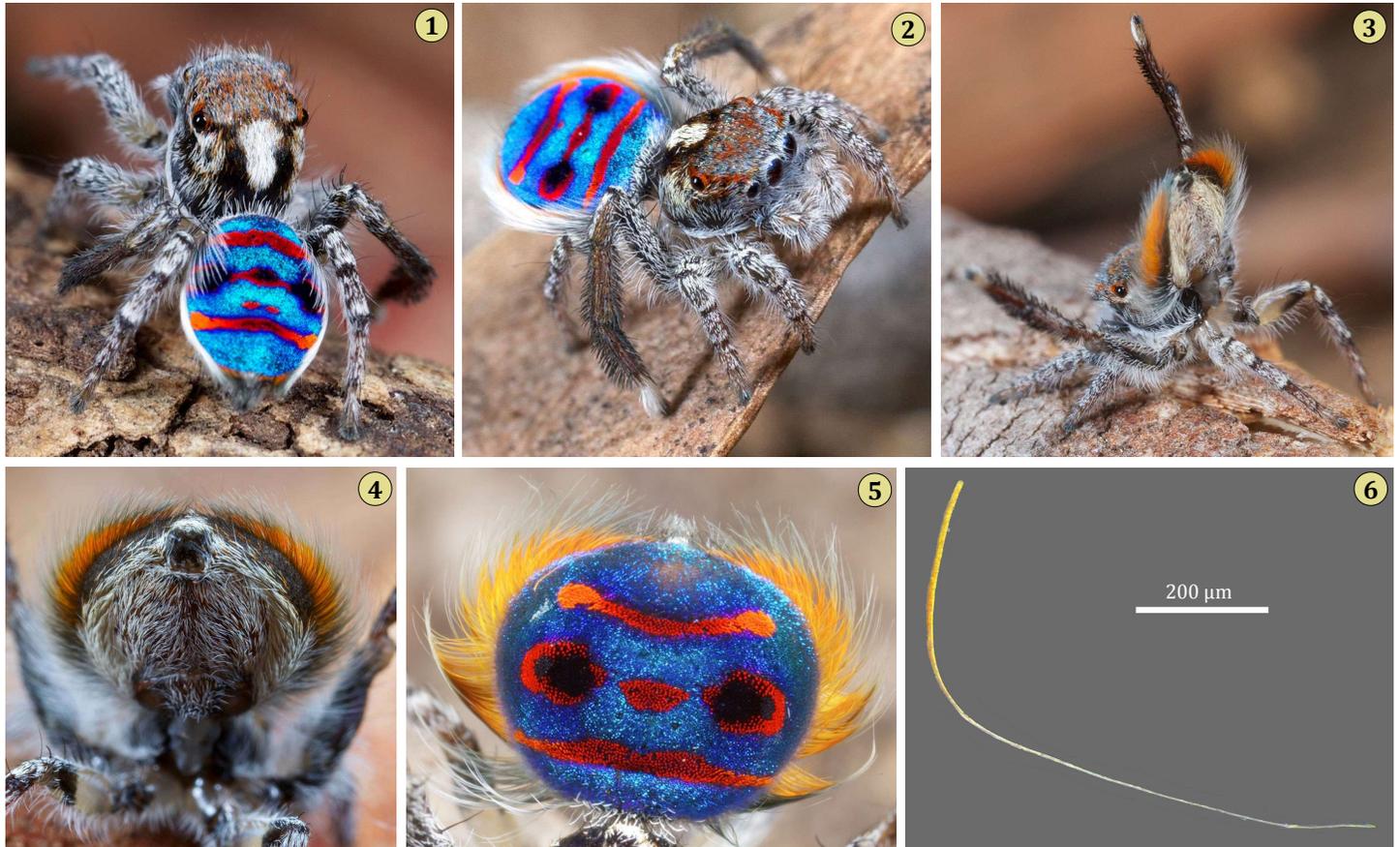


Figure 1. The fan of male *Maratus speciosus*. **1**, When not displaying, the fan is compressed laterally and the bright yellow to orange colour of the lateral setae is not visible. Long white fringing setae extend over the anterolateral margins of the fan. **2**, Male with fan raised slightly and expanded to reveal some of the orange colour of the lateral fringes. **3**, Posterolateral view of male with opisthosoma flattened and fan elevated, revealing bright orange lateral setae. **4**, Rear view of expanded opisthosoma. **5**, Dorsal (front) view of fully extended and elevated fan. **6**, Detail of a single bicoloured seta from the lateral margin, showing the yellow-orange colour and greater thickness of the basal portion.

Visual courtship display by male *Maratus speciosus*

The most impressive components of visual courtship display by a male *M. speciosus* (Figure 2) include extension and rapid movement of legs III, and expansion, elevation, and rapid movement of the fan. Here we describe *bobbing*, *semaphore*, *fan dance*, and *two leg wave* behaviours taken from a series of video recordings of males displaying to females. We have not rigorously studied the sequence of these behaviours in the context of a male-female interaction, but it appears that the vigorous two leg wave may attract the attention of a more distant female, the semaphore and fan dance may serve to maintain this attention during the approach, and bobbing may produce vibrations that become more important in close proximity to the female.



Figure 2. Positions assumed with fan fully expanded during the visual display of a male *M. speciosus*. 1, Legs III elevated, fan centered. 2, Legs III depressed, fan rotated (waved) to the side. These spiders generally hold their relatively inconspicuous pedipalps in place in front of the chelicerae and do not move them as they display.

Bobbing. Rapid up-and-down movement of the opisthosoma was observed in several different contexts, either as part of a stand-alone display (Figure 3), or as an interruption in a longer sequence of semaphore display. In a study of *M. volans*, Girard *et al.* (2011) found that all vibrational signals that were recorded coincided with opisthosomal bobbing.

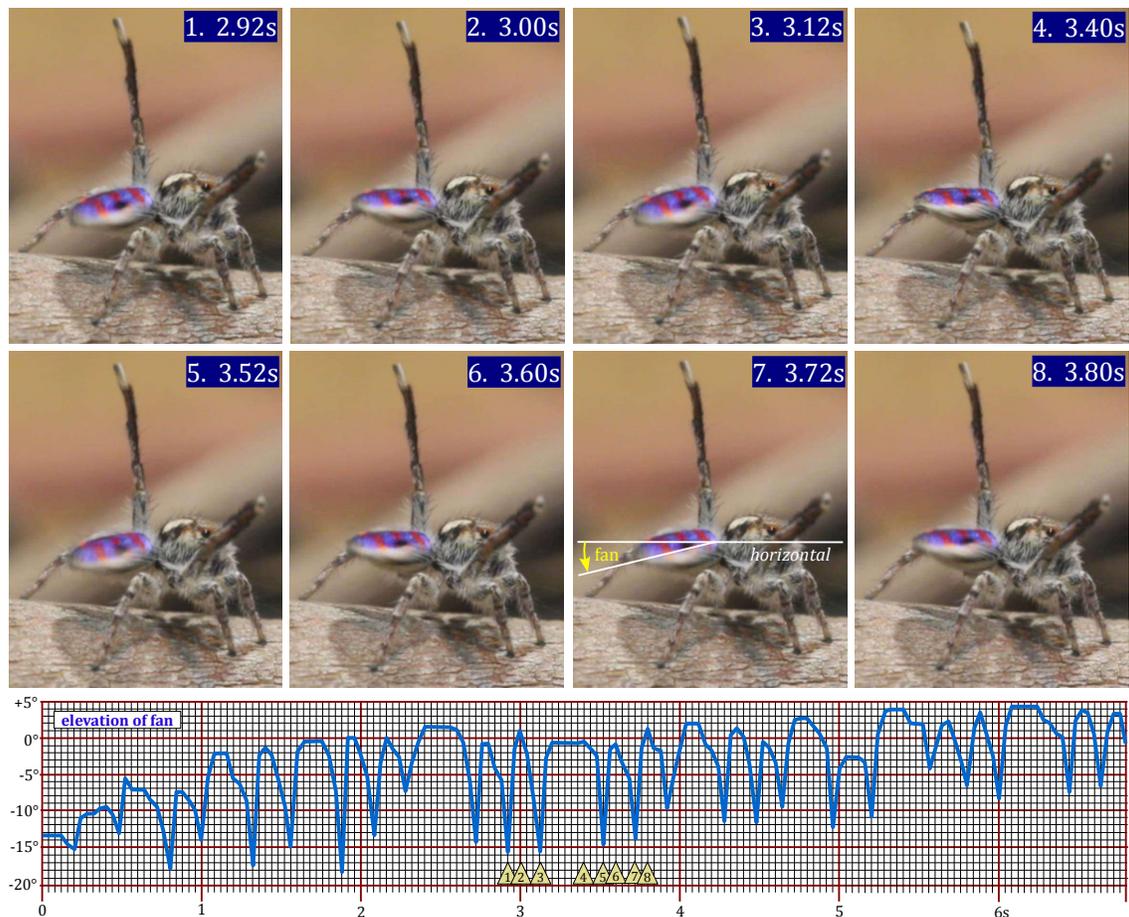


Figure 3. Sequential frames (1-8, position indicated by triangles at the bottom of the chart) from a 25fps video record of bobbing, as viewed from the side. To produce the chart, spanning 6.8s of this behaviour, relative elevation of the opisthosoma was estimated for each frame as shown in (7). Although this measurement was of limited precision, comparison of adjacent frames ensured that the movement of between frames shown here is an accurate representation.

Semaphore. The impressive semaphore display of *M. speciosus* (Figures 4-8) can be described as a sequence comprised of alternating semaphore movement and bobbing (or flashing) of the fan. The semaphore movement involved rapid elevation of legs III to a vertical position, followed by step-wise (3-5 steps) depression or lowering of both legs III in a transverse plane to a near-horizontal position. The most characteristic aspect of this movement was observed at the end of each depression phase, when legs III were moved assymetrically (one raised as the other was depressed, then the other raised and the one was depressed). In a near-vertical position, flexion at the tibio-metatarsal joint (*metatarsal flexion*) was frequently seen. The up-and-down movement of the fan (or bobbing) between semaphore movements could be described as *flashing* when the fan was elevated, as it greatly changed the observed brightness of the fan when viewed from the front. The degree of expansion and elevation of the fan varied during these displays, but the fan was never waved as it was during a fan dance, and it was not moved during semaphore movement. Pedipalps were held in place and were not moved during the semaphore display.

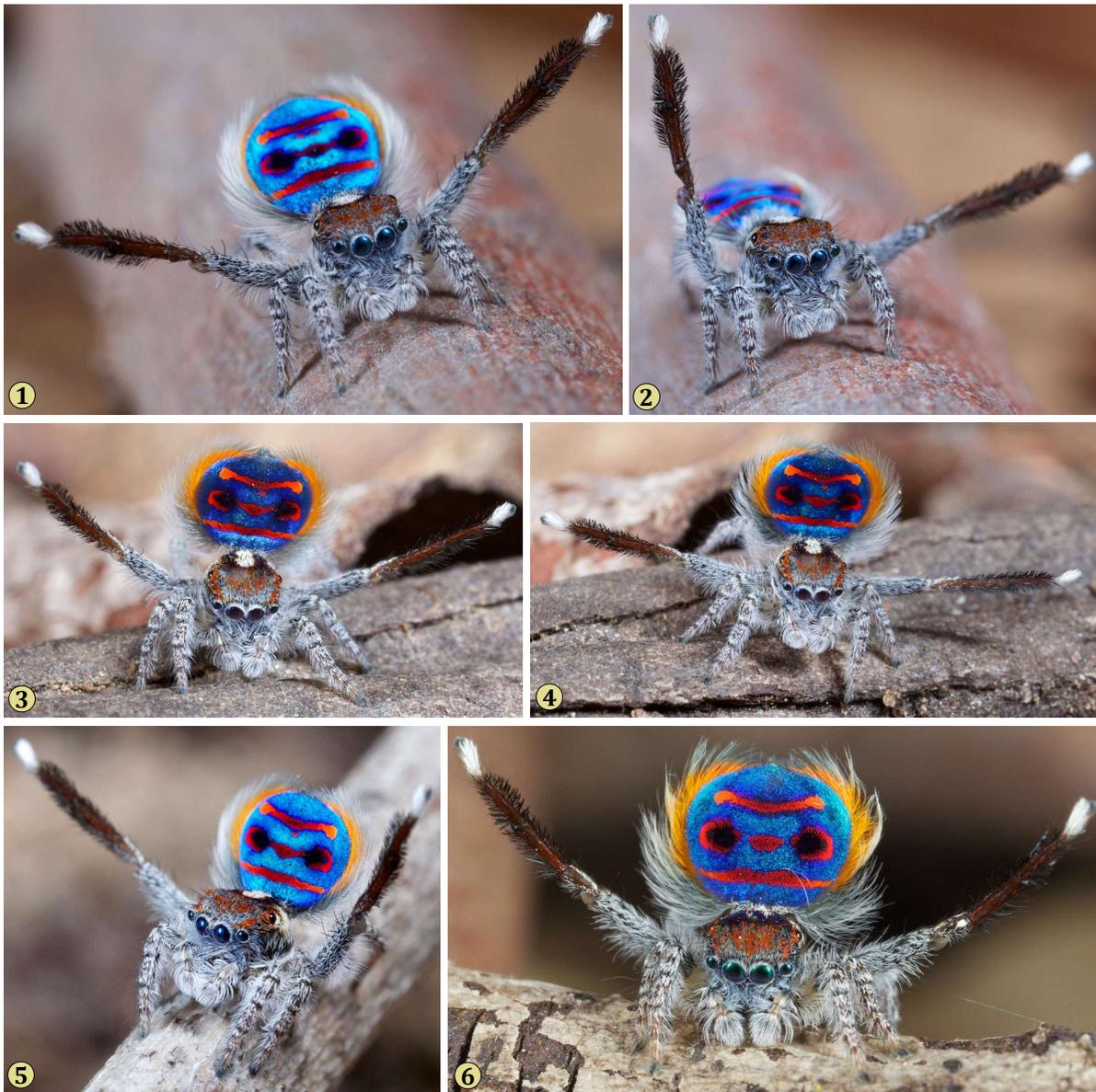


Figure 4. Positions assumed by three different male *M. speciosus* (1-2, 3-5, 6) during display with extended legs III. **1-2,** Elevation of the partly expanded fan varies during the semaphore display. Note the assymetrical positions of the extended legs III in (2). **3-4,** Two different levels of elevation of legs III. Here the fan was fully extended and this display may have included both semaphore and fan dance components. **5,** Typical semaphore position, with assymetrical elevation of legs III, and a partially elevated fan. **6,** Another semaphore or fan dance position, with fully expanded and elevated fan.

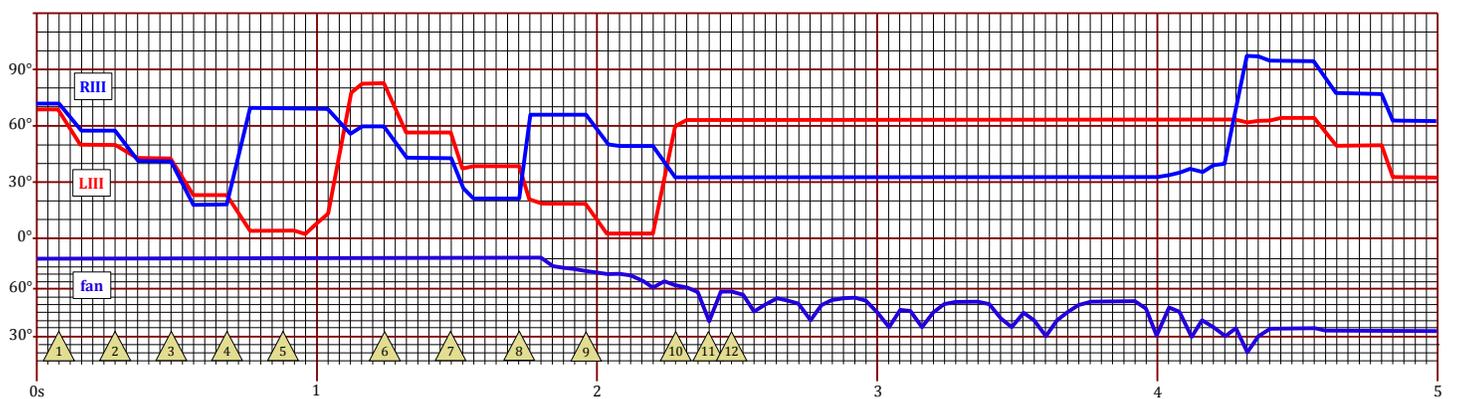
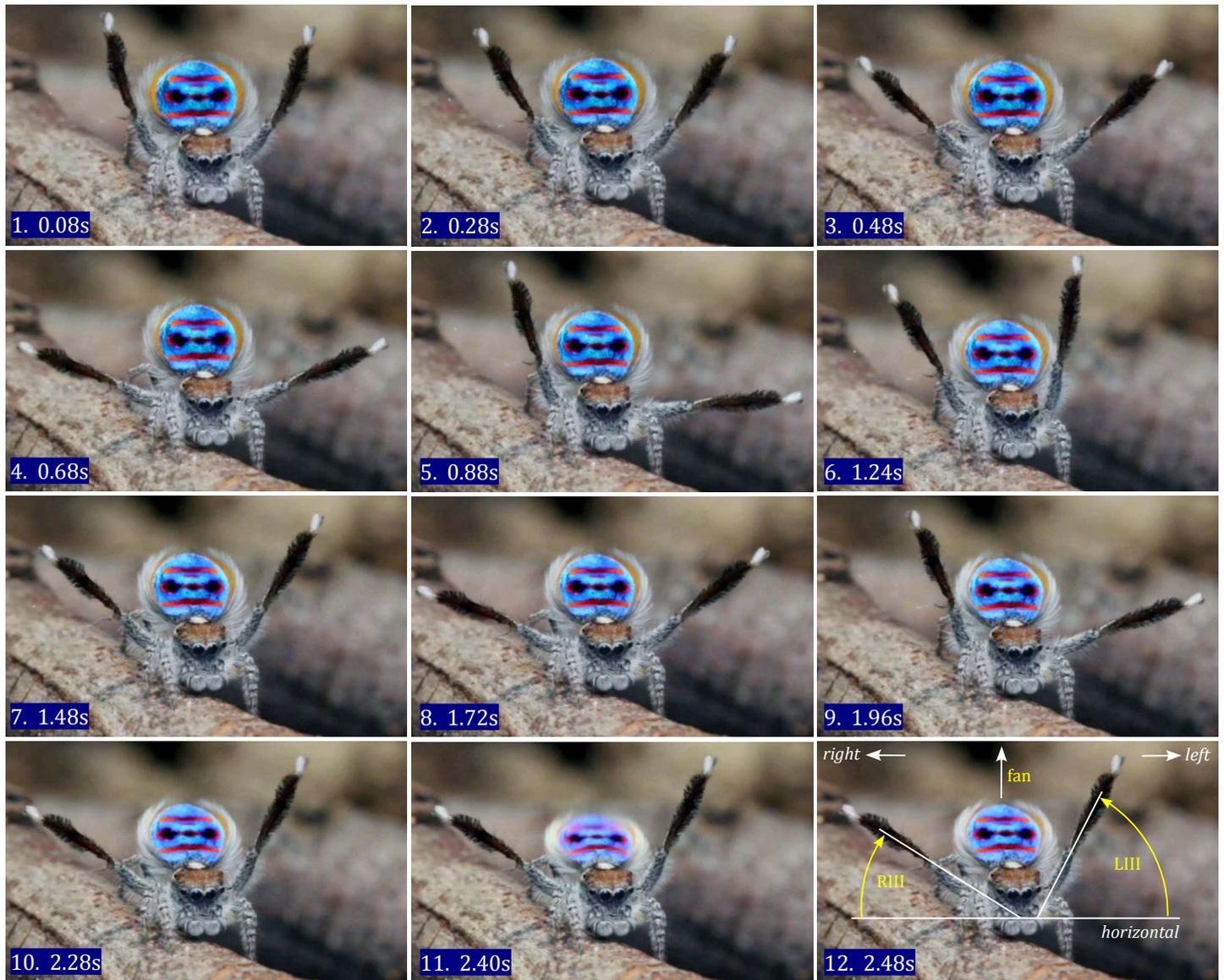


Figure 5 (continued on next two pages). Long (40s, 25fps) sequence of semaphore display by a male *M. speciosus*, showing alternation of semaphore movement with bobbing or flashing of the opisthosoma. Elevation of legs RIII and LIII was measured for each frame as the inclination of the tibia relative to the horizontal, and the elevation of the fan was estimated through comparison of adjacent frames (12). The position of frames (1-12) is indicated by triangles in the chart, below. Each episode of semaphore movement corresponds to movement of legs RIII and LIII, and each bobbing phase corresponds to an interval during which these legs were not moved. Semaphore display included not only step-wise lowering of the raised legs III (1-4), but also asymmetric movement of these legs (5, 9) at the end of step-wise depression, as the legs were once again raised. Note also depression of the fan at the start of a bobbing phase (11).

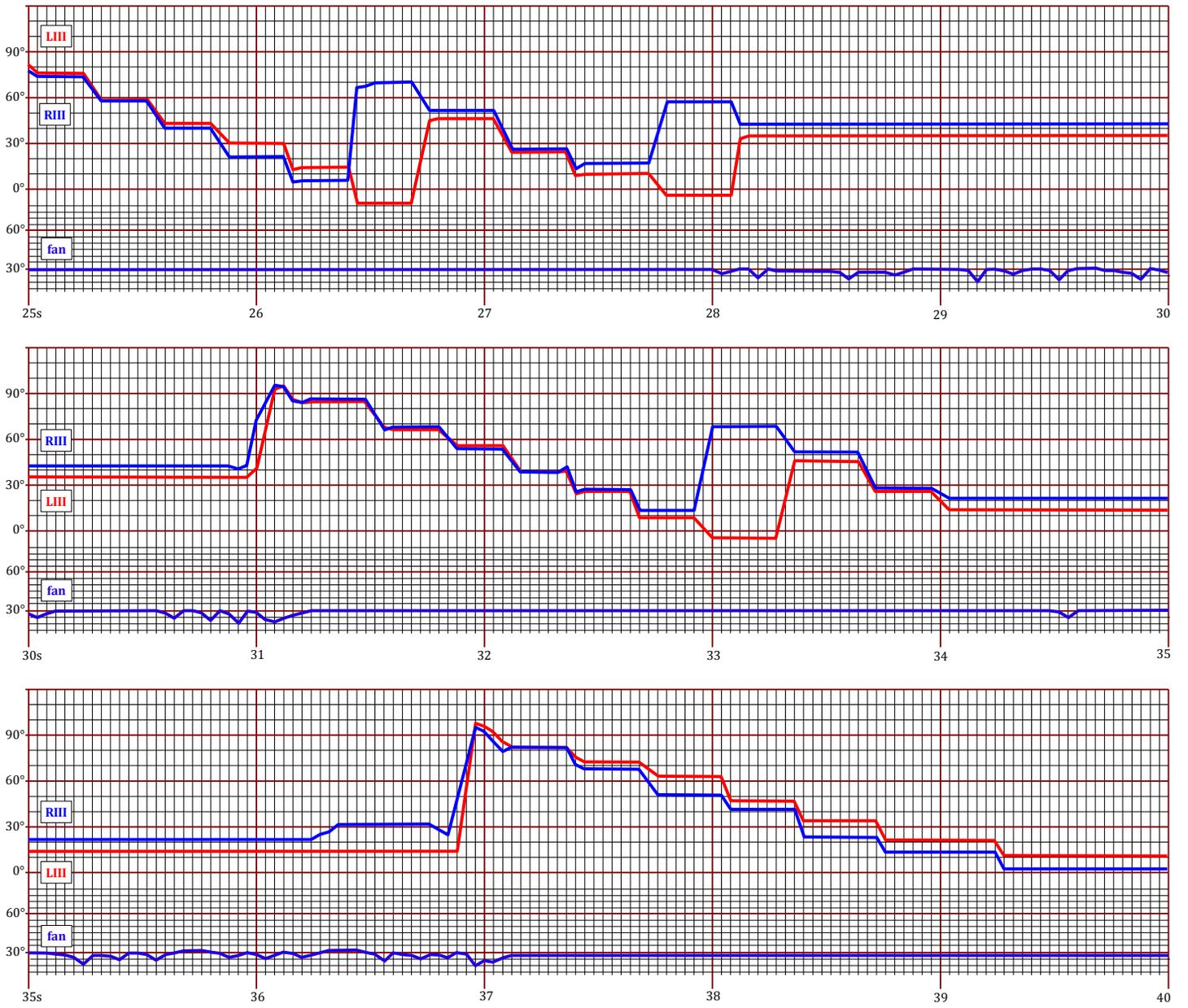


Figure 5 (continued from previous page).

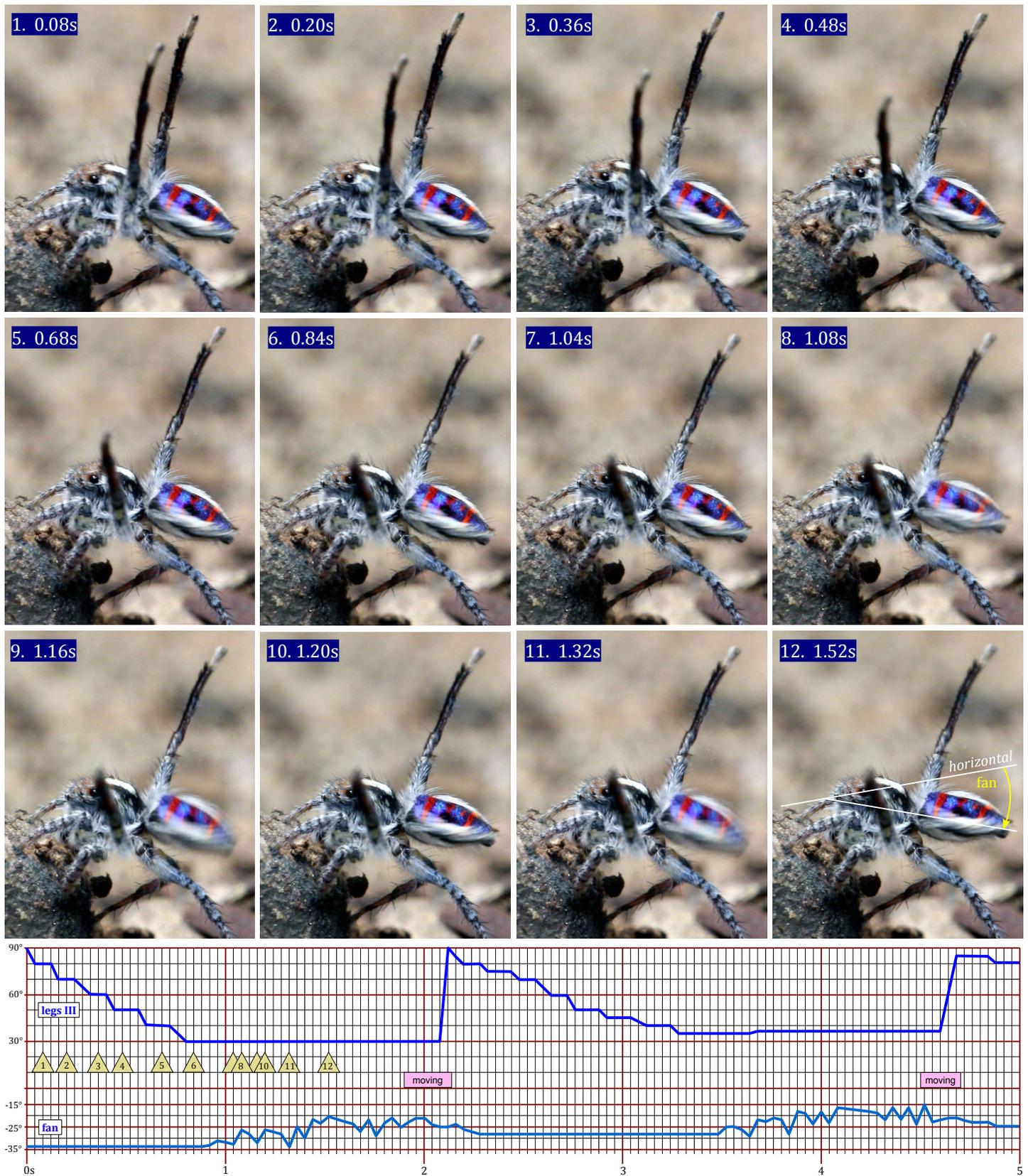


Figure 6. Lateral view of semaphore display (5s, 25fps). Elevation of legs III (inclination of tibiae) was estimated for each frame with comparison of adjacent frames to ensure that changes in elevation, if not the absolute elevations, were recorded accurately. Elevation of the fan was measured relative to an arbitrary 'horizontal' line as shown in (12). 1-6, Step-wise depression of legs III during semaphore movement. 7-12, Note changes in elevation of the opisthosoma during each bobbing sequence. Asymmetric movement of legs III was not part of this sequence.

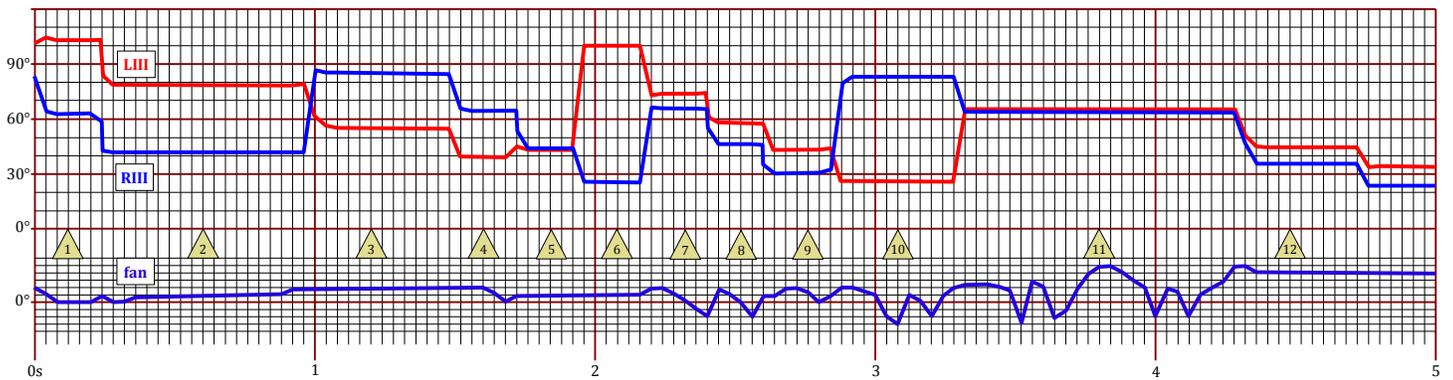
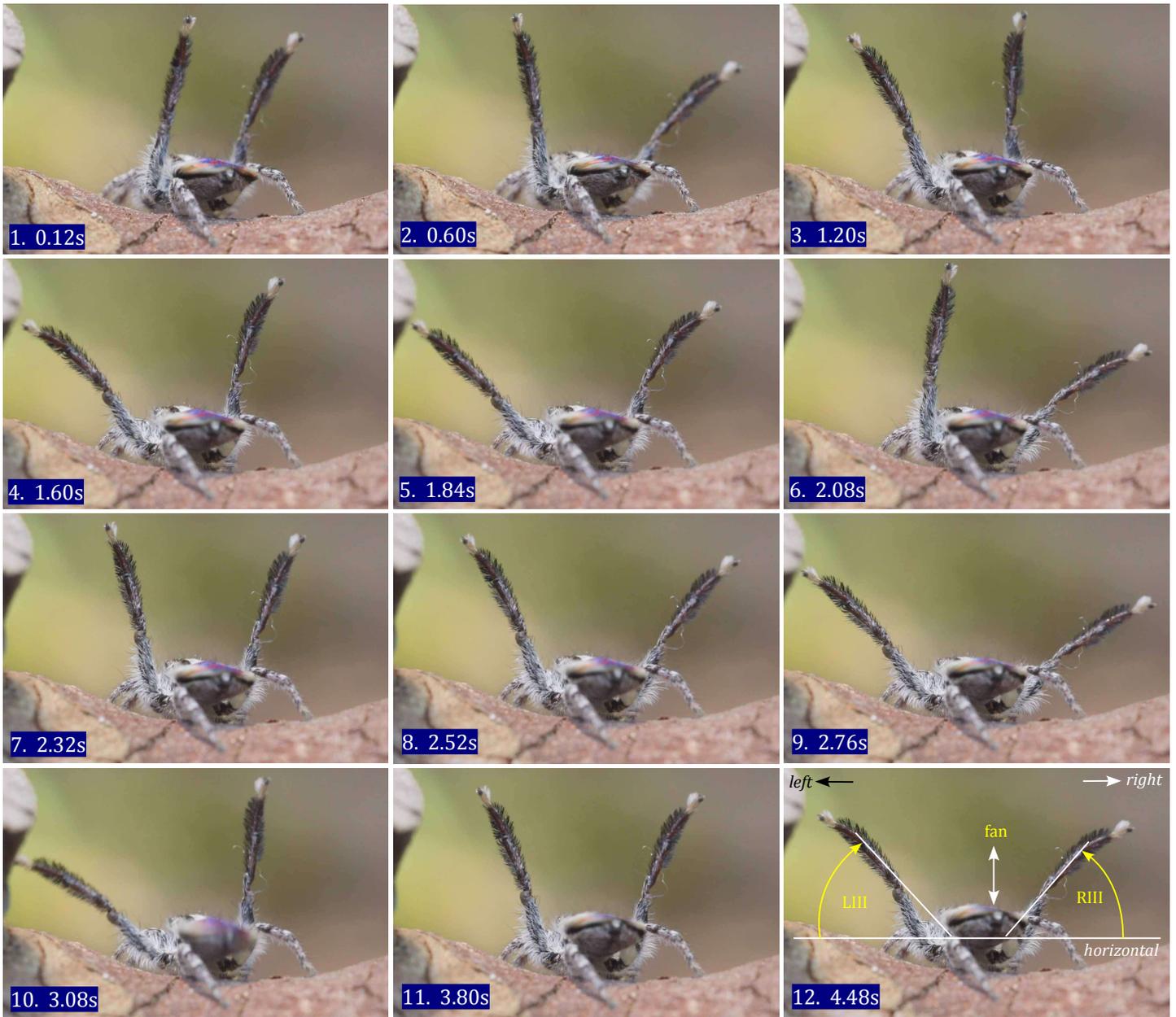


Figure 7. Posterior view of semaphore display (5s, 25fps). Inclination of tibiae III was measured from each frame as shown in (12). Elevation of the fan was estimated with comparison of adjacent frames to ensure that movement, if not absolute position, was accurately recorded.

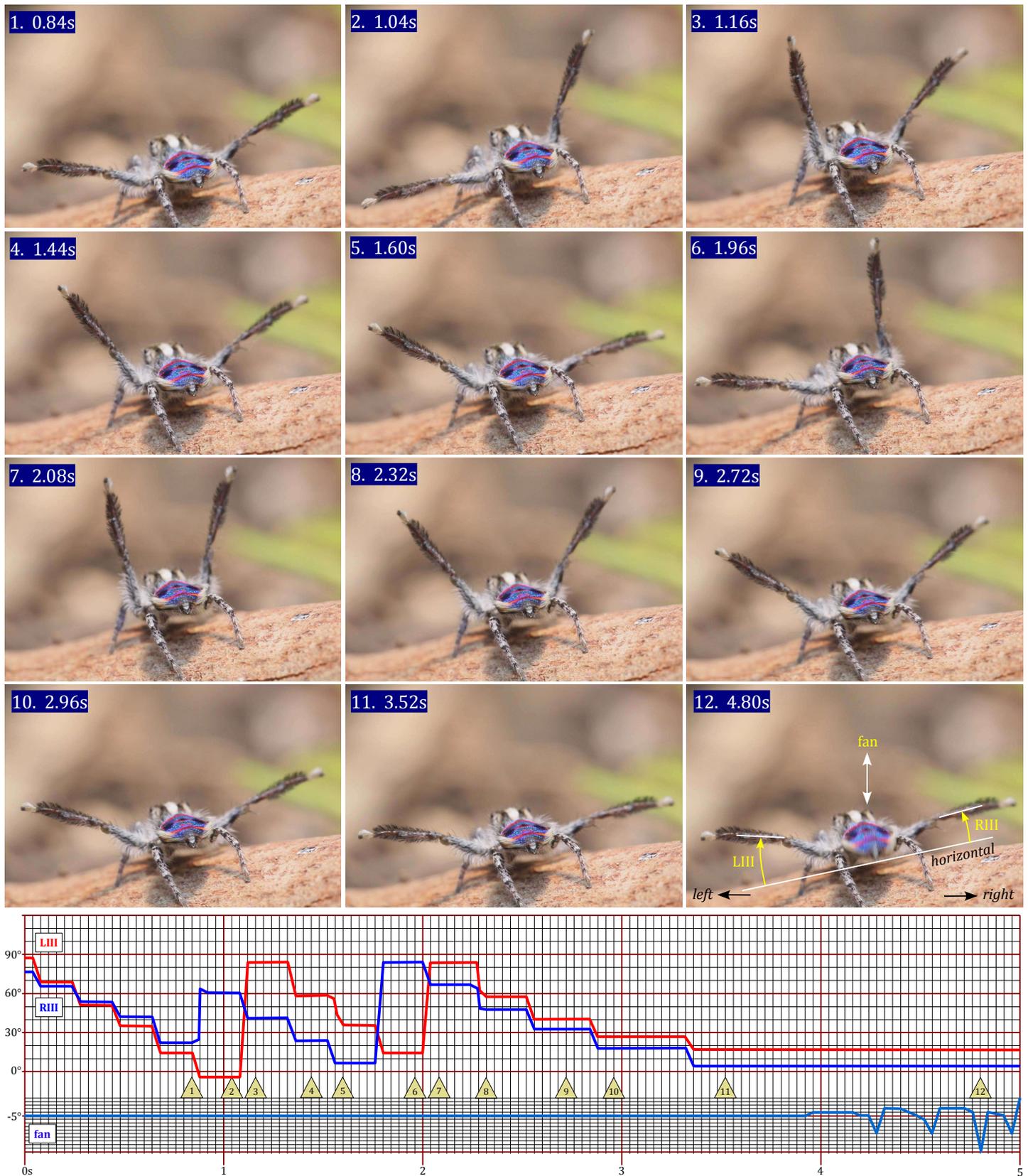


Figure 8. Posterior view of semaphore display (5s, 25fps). Leg elevation (tibia inclination) was measured for each frame relative to an arbitrary but approximate 'horizontal' line (12), and relative elevation of the fan was estimated with comparison of adjacent frames. Note the absence of bobbing during the first 4s (semaphore movement). Distinctly asymmetrical positions of legs III are shown in frames (2) and (6).

Fan dance. Fan dances by male *M. speciosus* (Figures 9-12) are characterized by rapid side-to-side waving of the expanded and elevated fan. Dances often involve simultaneous waving of the fan and the elevated legs III, but the fan may also be waved with legs III held in a fixed, V-shaped, pose (Figure 10). If the spider is side-stepping during this dance, the amplitude of movement of the trailing leg III is significantly greater than that of the leading leg III (Figure 11). A side-stepping fan dance may also alternate with typical semaphore movements (without any movement of the fan) during a pause before the male begins to step in the opposite direction (Figure 11). A fan dance may also be performed intermittently, with each brief (~ 0.12 s) dance followed by a 2-4s pause (Figure 12).

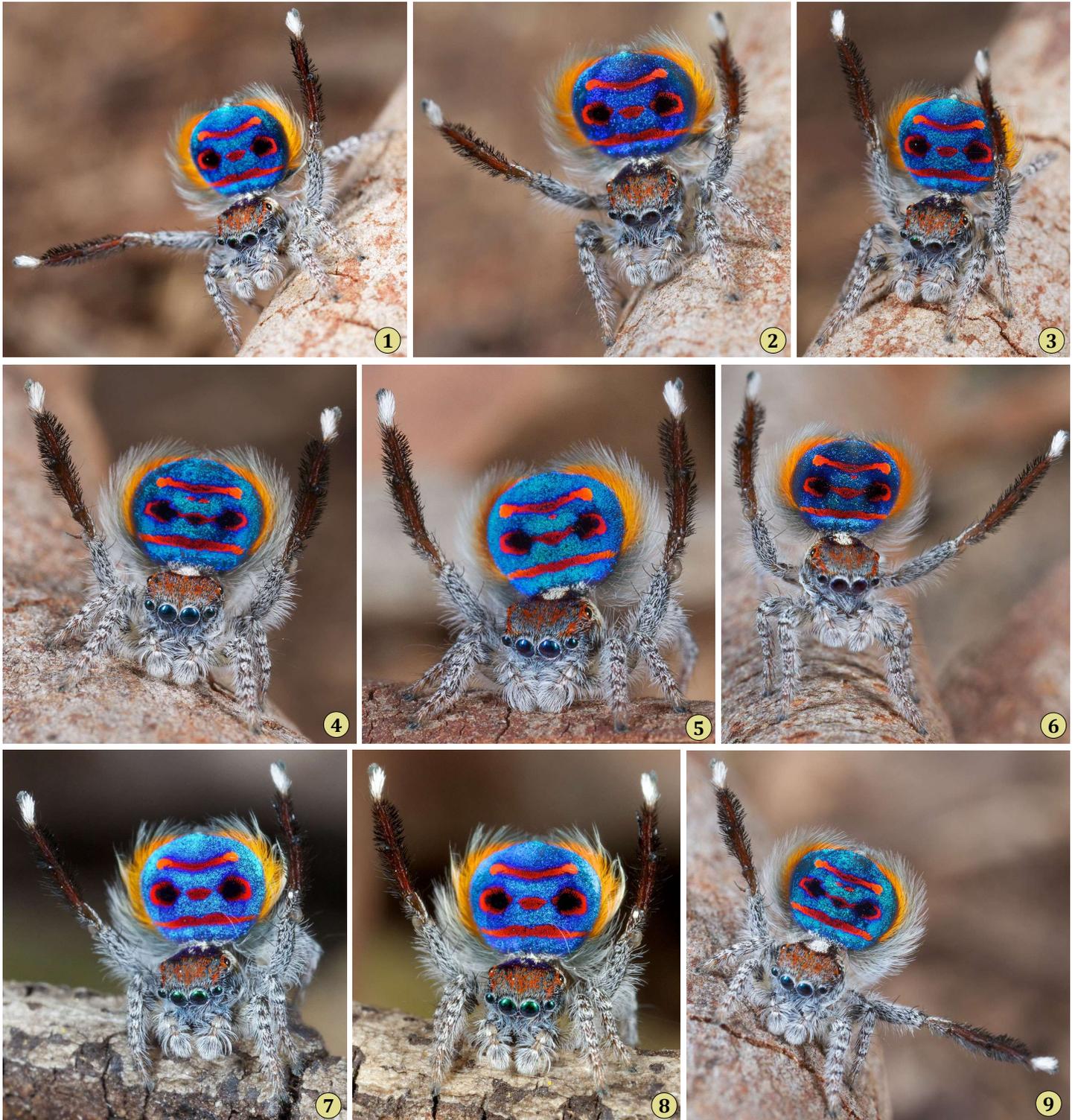


Figure 9. Typical poses assumed by male *M. speciosus* during a fan dance

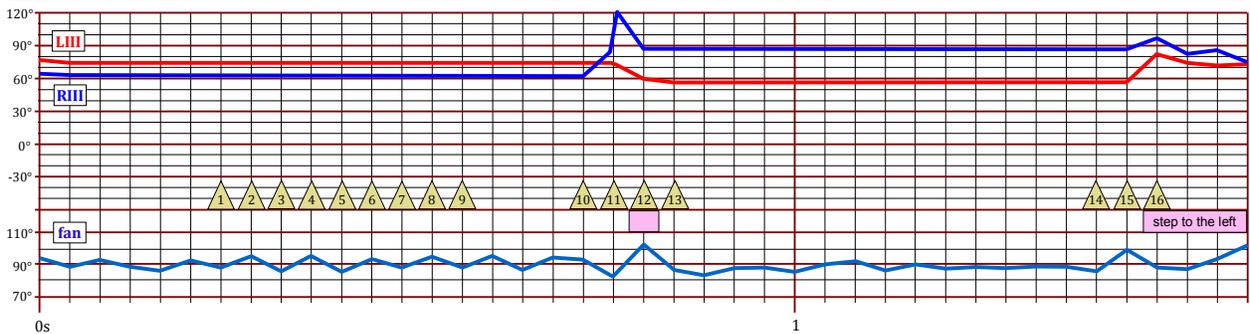
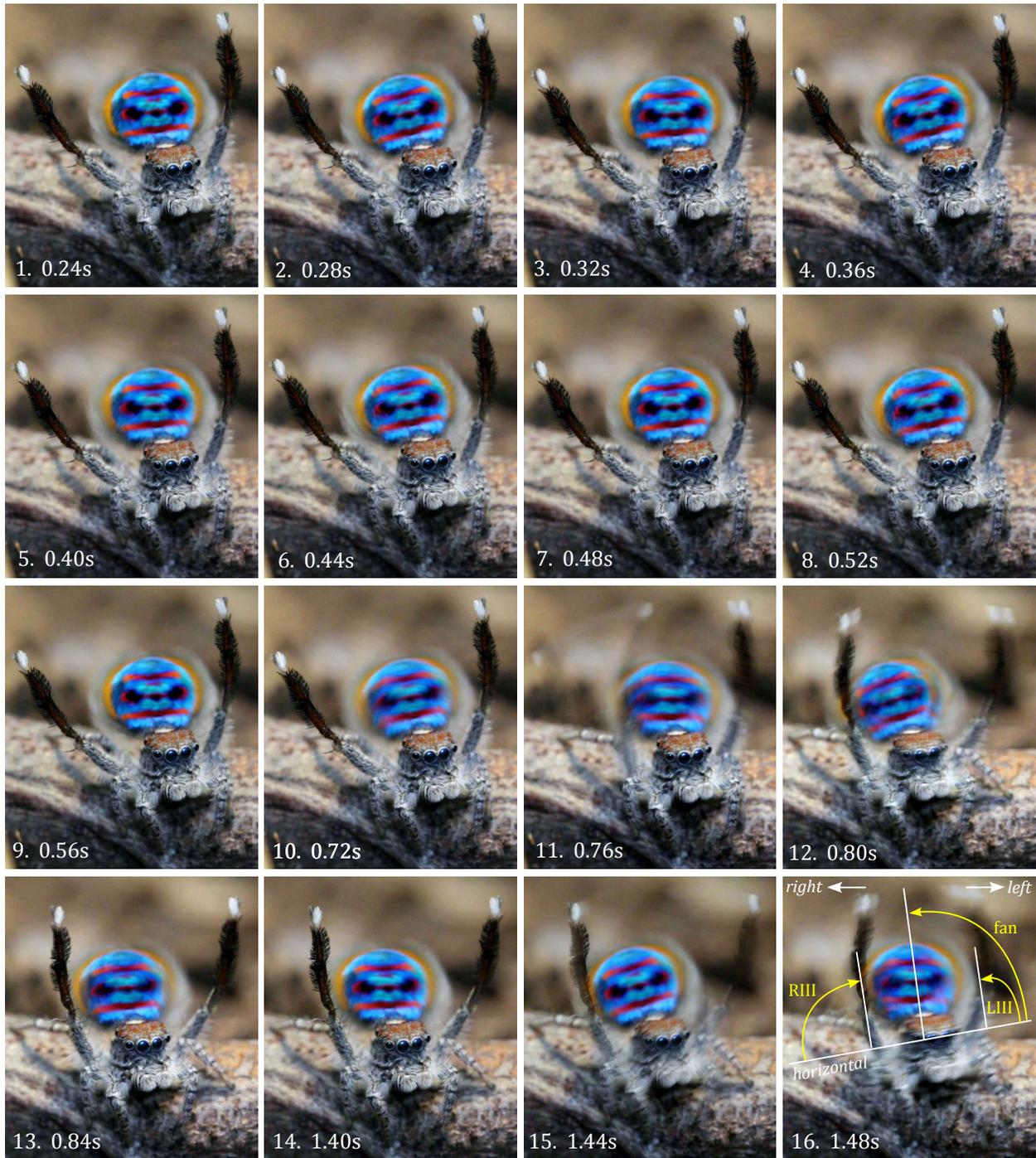


Figure 10. Fan dance in place, with rapid vibration of the fan and little waving of legs III (1.6s, 25fps). Elevation of legs III (inclination of tibiae), and lateral rotation of the fan was measured for each frame relative to an approximate 'horizontal' line as shown in (16). Some degree of rapid movement or vibration of the fan was continuous throughout this sequence.

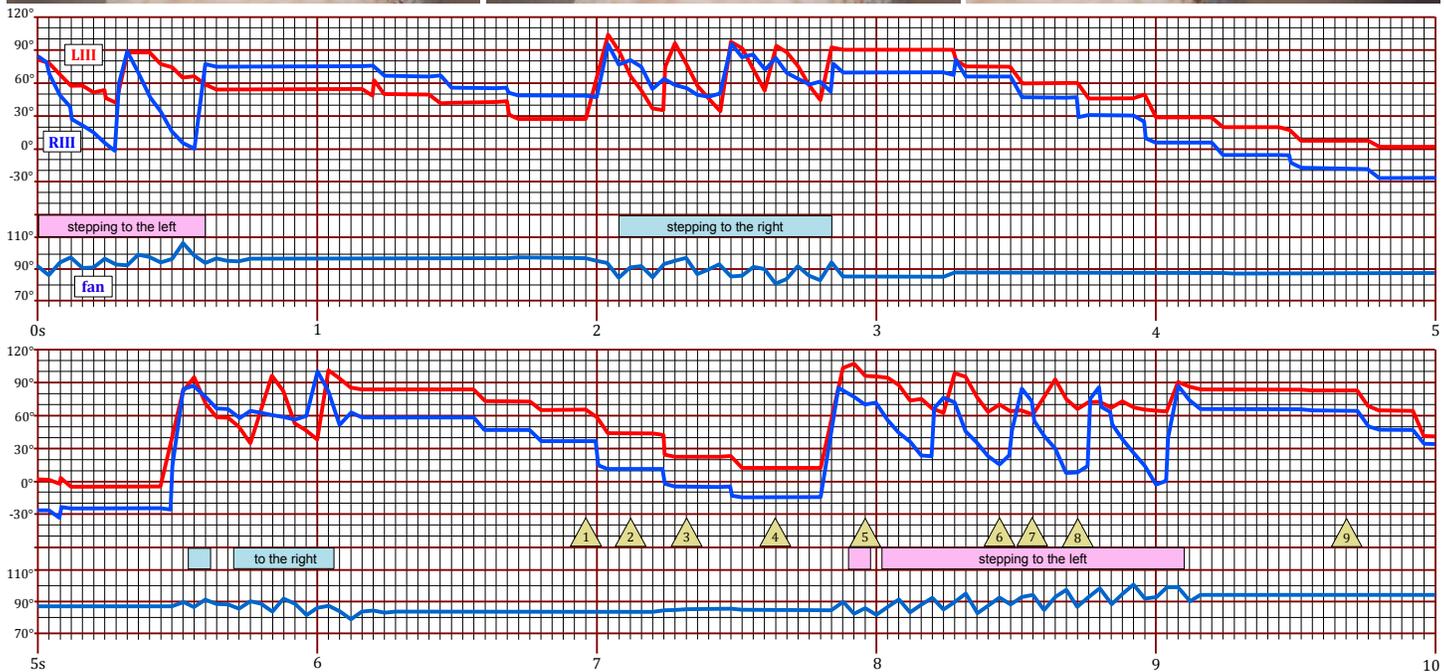
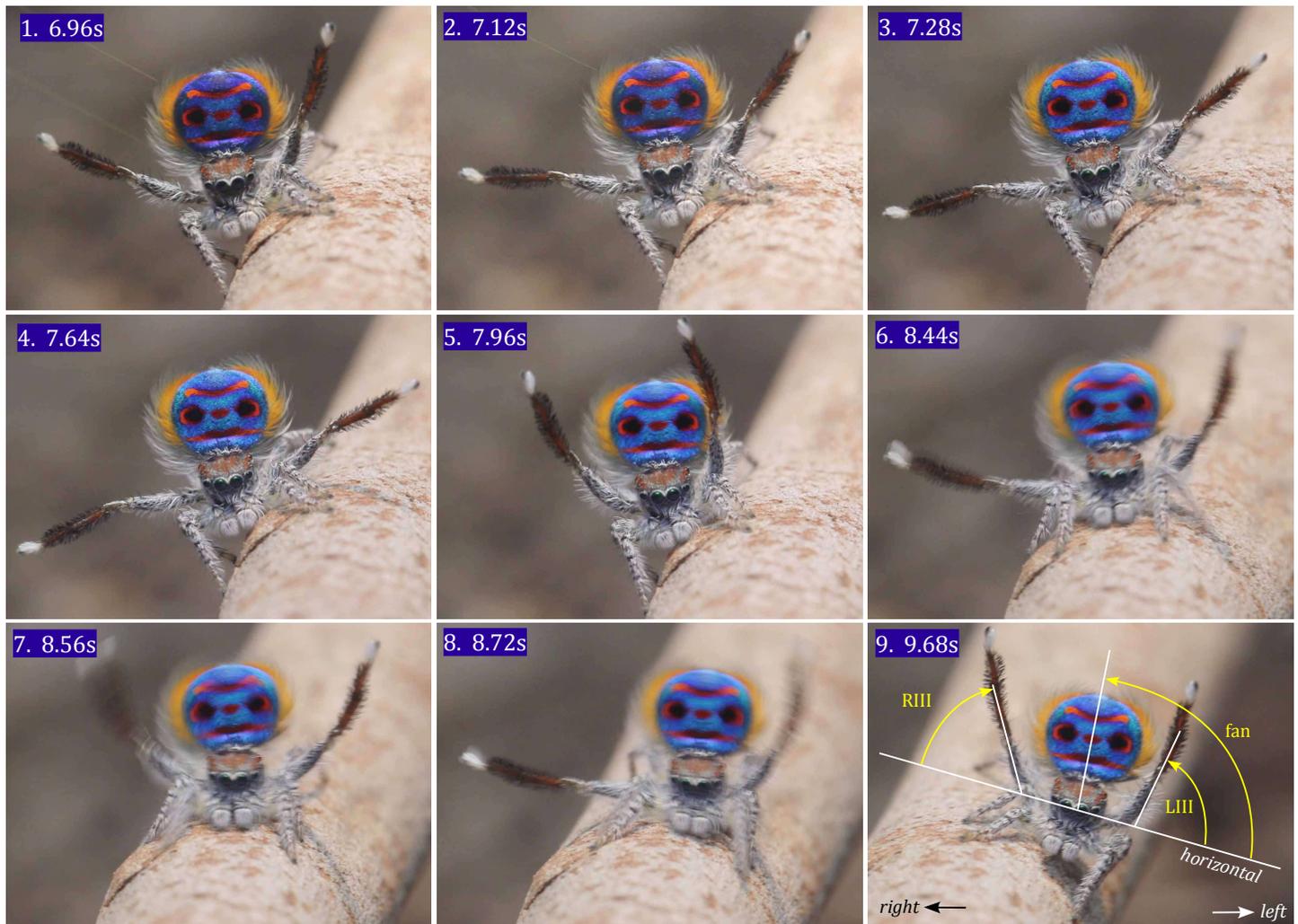


Figure 11 (continued on next page). Alternating fan dance and semaphore by side-stepping male *M. speciosus* (35s, 25fps). Here the fan and both legs III were waved rapidly as the spider was side-stepping (indicated by bars on the graph). Note the increased amplitude of movement of the trailing leg during side-stepping. At the end of each side-stepping sequence, this spider stopped and performed semaphore movement (step-wise lowering) of legs III. Elevation of legs III (inclination of tibiae) and lateral rotation of the fan was measured for each frame relative to an estimated horizontal line as shown in (9).

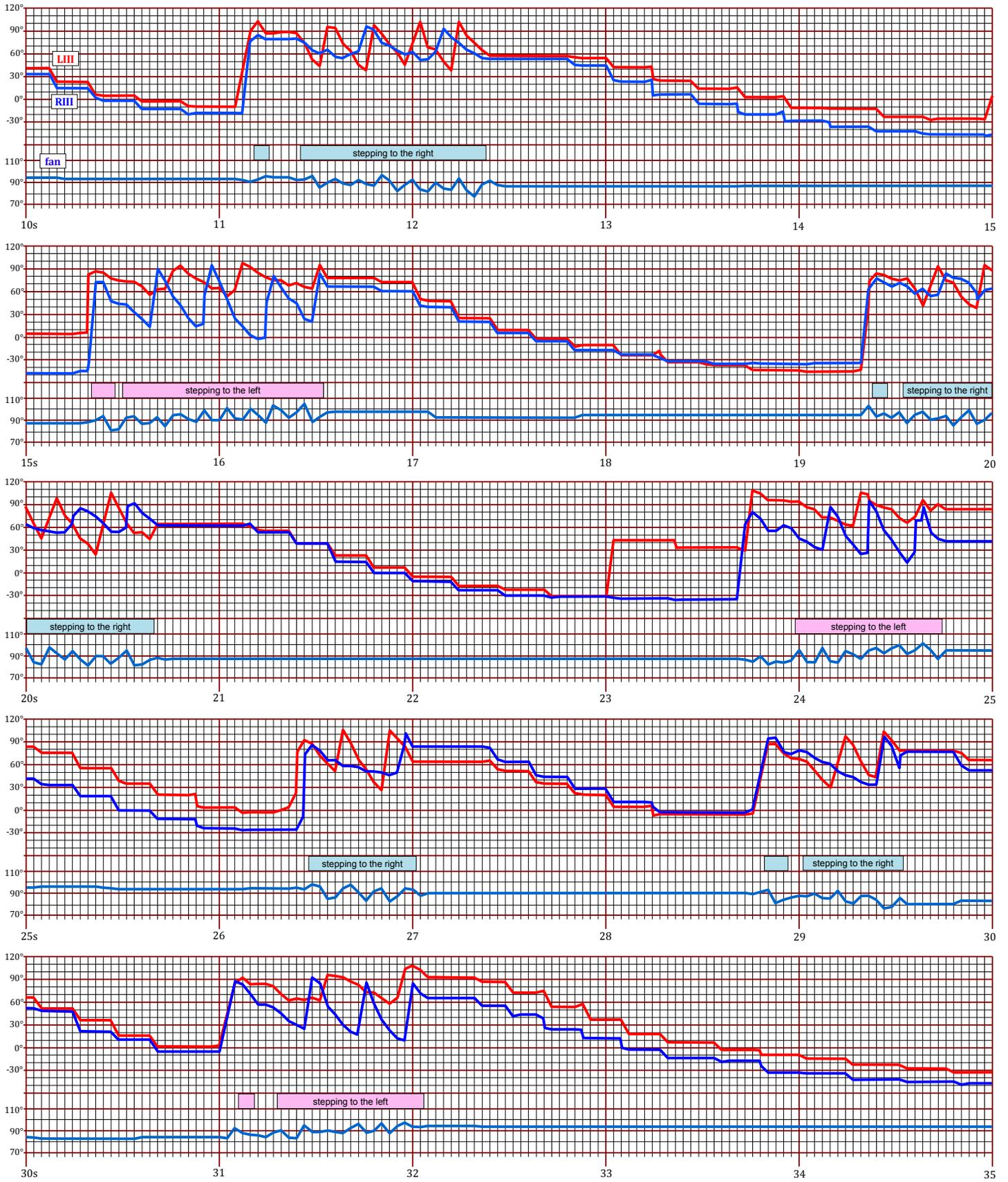


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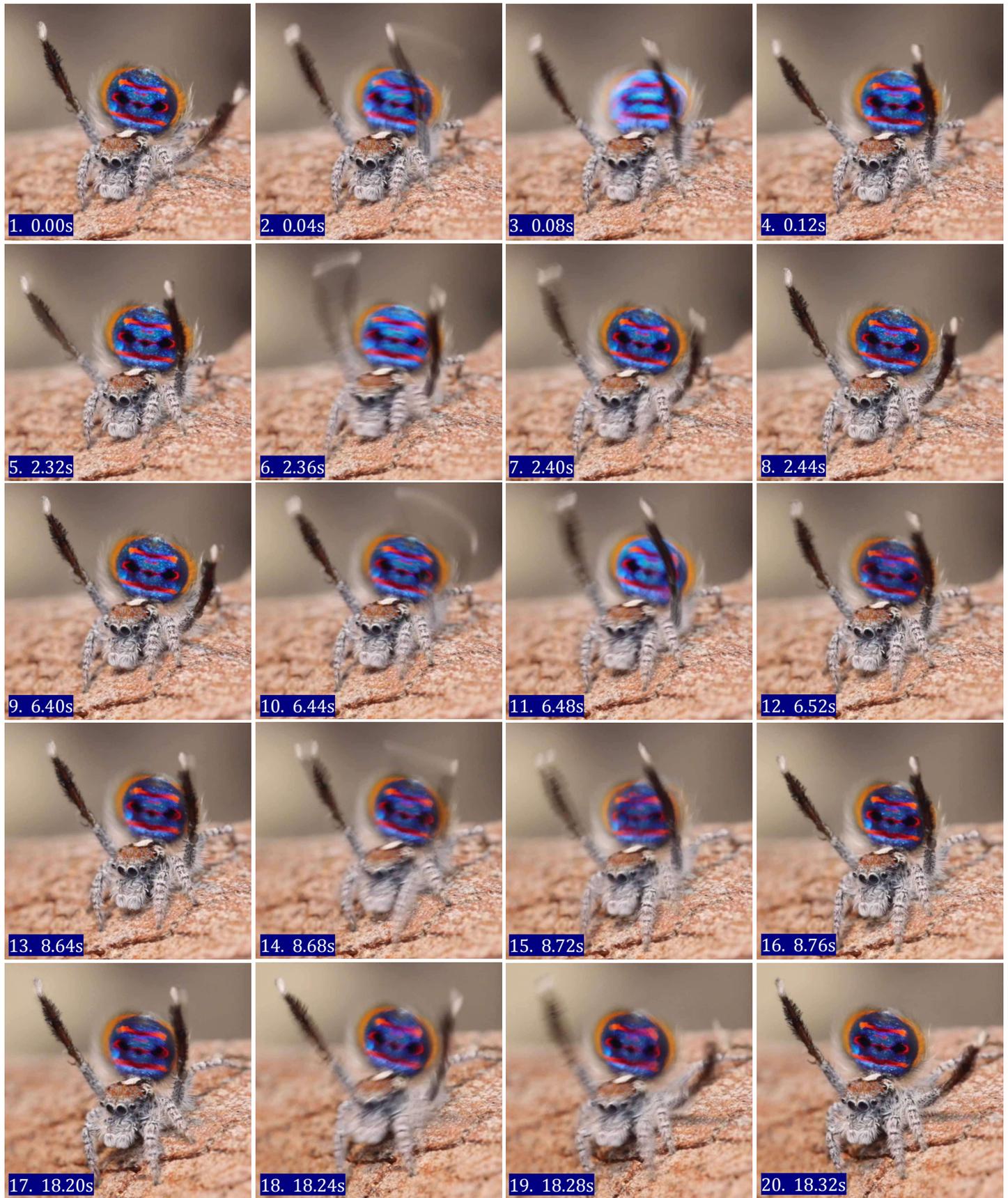


Figure 12. Intermittent fan dance (18.32s, 25fps). Each row (1-4, 5-8, 9-12, 13-16, 17-20) represents a brief (~0.12s) dance including simultaneous waving of legs III and the fan. These were separated by pauses of ~2-5s during which the spider held this pose but did not move.

Two leg wave. In this display (Figures 13-14), extended legs III were held upright and continuously waved, with some metatarsal flexion. This rapid display may also include bobbing and partial expansion of the fan.

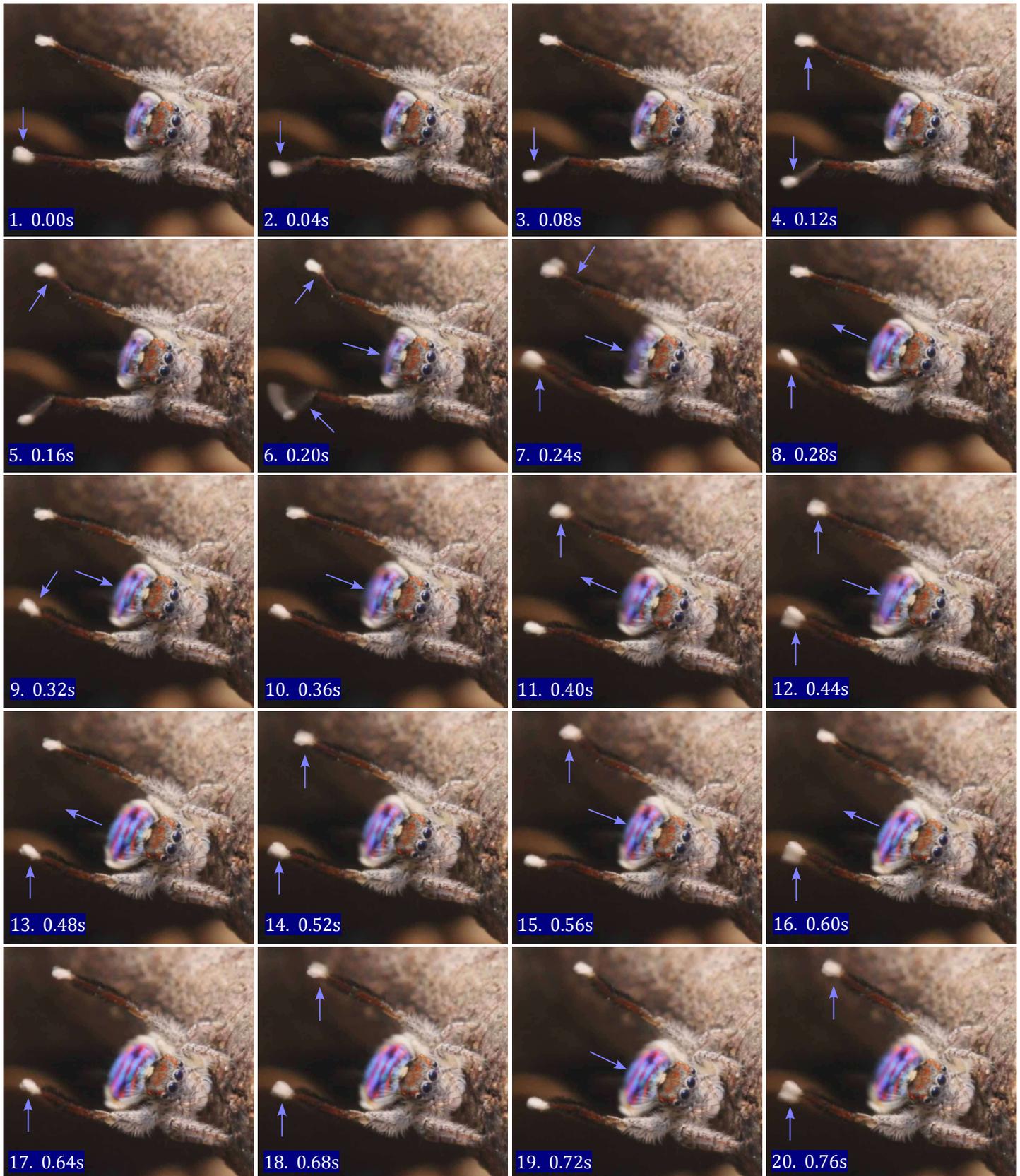


Figure 13. Sequential frames (0.76s, 25fps) showing rapid two leg wave in place. 2-7, Metatarsal flexion. Movement of the legs and fan (bobbing) relative to the previous frame, often of slight amplitude, is incated with arrows.

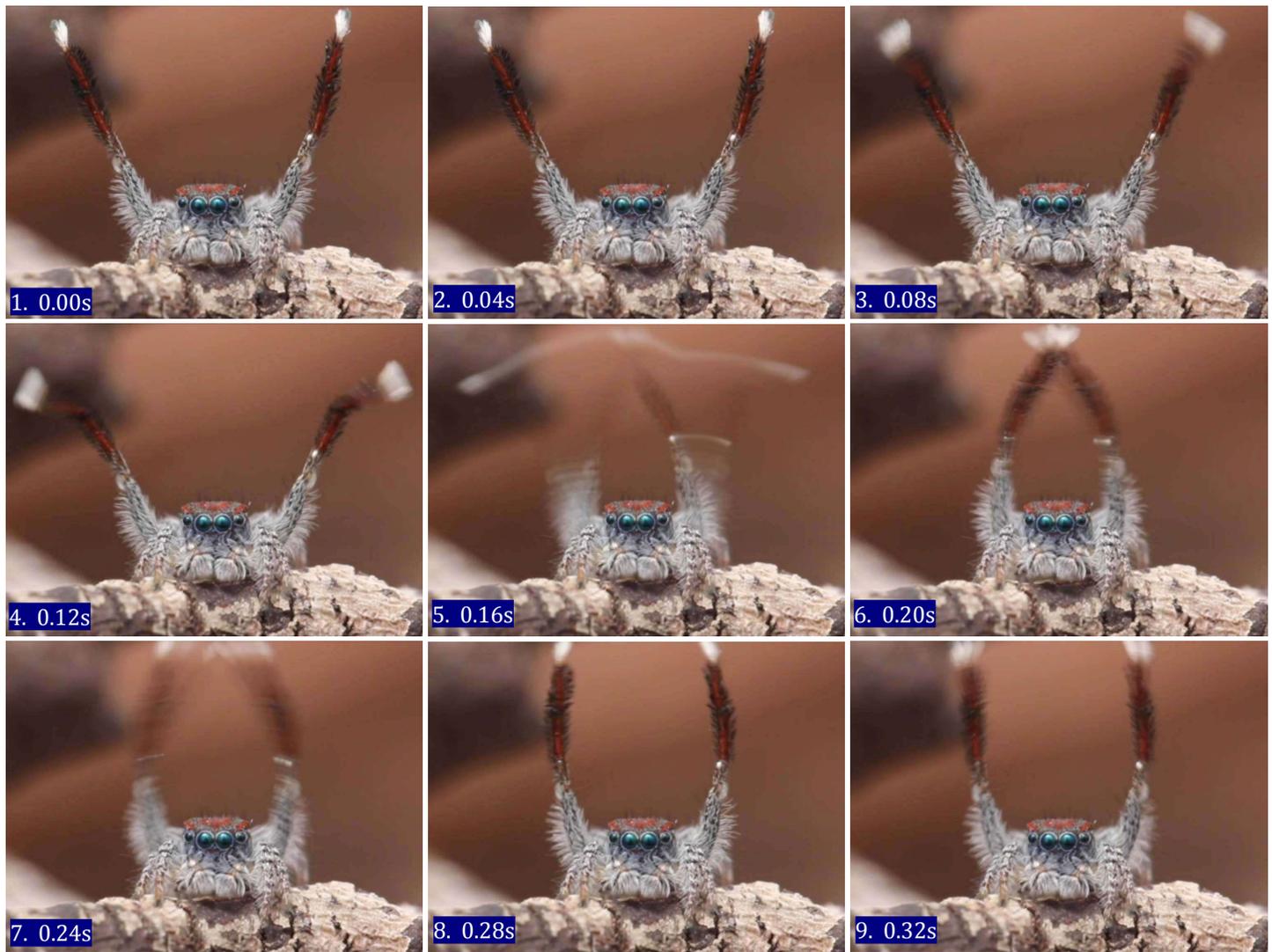


Figure 14. Sequential frames (0.32s, 25fps) showing continuous and rapid two leg waving, including metatarsal flexion (4)

Acknowledgments

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