ELECTRONIC APPENDIX

This is the Electronic Appendix to the article

Spider webs designed for rare but life-saving catches

by

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Electronic appendices are refereed with the text; however, no attempt is made
to impose a uniform editorial style on the electronic appendices.

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Appendix: Estimation of variables for the energetic model

Six variables were determined from experiments with young, adult, female *Z. x-notata* within 30 days of their final molt (standardized laboratory conditions with temperature=19±1°C, and relative humidity=60±5%, see Venner *et al.* 2003 for details on rearing conditions). The dry weight of intact prey and remains of prey or spiders were determined after drying in a steam room (60°C for 24h).

Just after their last molt, females weighed 33.2±1.1mg, (mean±s.e., *n*=57, Venner 2002). Starvation weight was estimated by placing spiders of known weight (43.63±1.96mg, *n*=28) in individual wooden frames (50×50×10cm) closed by two glass panes that enabled them to build their webs freely. Spiders were not fed until they died. The weight within the 24 hours following their death averaged 24.55±1.33mg. Spiders survived for 49±3.75 days.

Spider weight at time of egg laying ($SW_{Egg\text{-}laying}$) can be estimated in the field from the spider's weight just after egg-laying ($SW_{Post\text{-}egg\text{-}laying}$) and the dry weight of the egg mass (W_{Egg}) using the precise relationship established in laboratory (*n*=35, R^2=0.89, Venner 2002):

$$SW_{Egg-laying} = SW_{Post-egg-laying} + 3.26 \times W_{Egg} + 4.50$$

We surveyed a natural population of tagged adult females every day between August and November 2000 in the field. Spider weight and the dry weight of their cocoons were systematically recorded within one day of egg-laying. The spider's egg-laying weight was estimated as 79.4±4.4 mg (*n*=30).

Spider's body weight on a given day D (W_D) was calculated using the balance equation $W_D = W_{D-1} - Expenditure_{D-1} + Gain_{D-1}$. $Expenditure_{D-1}$ refers to daily basal metabolic expenditure plus expenditure associated with building activity (Venner *et al*. 2003).

$Gain_{D-1}$ refers to the fresh weight intake associated with x prey caught on Day D-1, and was estimated by:

$$Gain_{D-1} = \sum_{n=1}^{n=x} AR \times CWG \times DW_n$$

where x refers to total number of prey caught on day D-1, AR, CWG and DW_n correspond to the assimilation rate of one prey, the conversion coefficient from dry to fresh weight gain and the dry weight of the nth prey caught, respectively (see below and table 2).

The assimilation rate of prey is the ratio between the dry weight extracted from a prey and the dry weight of intact prey. A spider ingesting one house fly does not reach full satiety and is expected to consume its prey fully if hungry (Sebrier *et al*. 1994). Fifty-eight house flies that had just hatched were randomly selected and divided into two groups. Thirty flies were killed and dried, and 28 flies were offered to 28 spiders that had been starved for seven days. The mean dry weight of the non ingested house flies was 3.21±0.06mg (n=30) and the mean dry weight of the remains was 0.69±0.05mg (n=28). The Assimilation Rate (AR) was therefore 0.7844.

The dry to fresh weight conversion coefficient (CWG) was estimated by feeding two groups of adult females with two different amounts of food. CWG is calculated as the ratio of the difference between groups in fresh weight gain on difference in dry weight gain. Before testing, spiders had been starved for seven consecutive days. Each spider was then fed two house flies at a rate of one per eight days in group 1 (n_1=19, initial weight=29.2±1.4mg). Each spider in group 2 was fed eight flies at a rate of one every two days (N_2=19; initial weight=29.4±1.6). The flies (*Musca domestica*) weighed a mean of 11mg±1.1mg (n=190). Initial spider weight was similar in the two groups (t-test t_{37}=-0.089, p=0.93). The experiment lasted 16 days for both groups. Spiders from the two groups were not fed for the three days following the experiment to allow their digestive tracts to empty. They were then weighed, killed and their dry weight determined (Fresh Weight FW_1=28.03±1.58mg;

FW_2=53.14±2.05mg; Dry Weight DW_1=6.77±0.46mg; DW_2=16.87±0.68mg, where 1 and 2 refer to the two groups). The conversion coefficient from fresh to dry weight was estimated as 2.487.

The maximum daily weight gain was estimated by placing adult females that had been starved for seven days in the wooden frames. On day 0 the females weighed 34.3±1.6mg. We recorded the characteristics of their web on the next day (day 1). The weight of the spiders could be inferred from the relation $W_1 = W_0 - Expenditure_0 + Gain_0$ and amounted to 33.4±1.6mg (*n*=28). The gain was null in the absence of prey. We offered each spider up to five blowflies one after the other on day 1. A new blowfly was given as soon as the spiders rejected the remains (weight of a blowfly 25mg±2.5 mg, *n*=159). We considered that spiders had reached their maximum digestive capacity as soon as they refused the offered prey. The weight of spiders on day 2 was 57.0±2.6mg. This procedure enabled us to calculate the maximal daily gain (23.2±1.5mg).

LITERATURE CITED

Sebrier, M.A., Pasquet, A. & Leborgne, R. 1994 Resource management in the orb-weaving spider *zygella x-notata* II. Ability to manage a set of various prey. *Ethology* **96**, 343-352.