This is an electronic appendix to the paper by Ulanovsky *et al*. 2004 Dynamics of jamming avoidance in echolocating bats. *Proc. R. Soc. Lond.* B **271**, 1467–1475. (DOI 10.1098/rspb.2004.2750.)

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

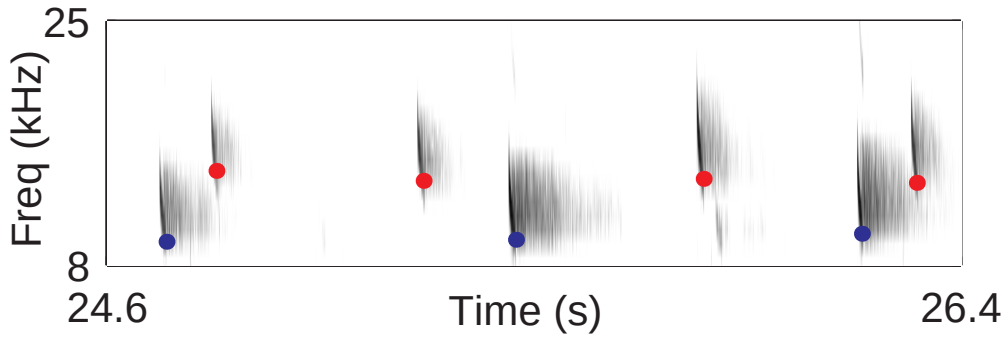
Electronic Appendix A: Methods

Recordings of *T. teniotis* suggested that in 2-bat scenarios, the two bats maintained quite a large frequency separation (figure 3a, separation of red and blue curves; figure numbers relate to the figures of the main text). Over the population, this frequency separation (horizontal lines in figure 4a) seemed larger than the typical frequency separation between individual bats in 1-bat scenarios (figure 4b). To check whether this is statistically significant, we employed a Monte-Carlo test. Firstly, we computed the following test statistic: $FS_{2\text{-bat}}$ = mean absolute frequency separation (FS) between the 20 pairs of bats in 2-bat scenarios (figure 4a), divided by the standard deviation of the frequency separations. Secondly, we repeated 5000 simulations, as follows: we simulated 40 frequencies from a normal distribution with the same mean and variance as were observed for the 1-bat scenarios (figure 4b), then randomly assigned the 40 frequencies to 20 "pairs of bats", and then calculated the test statistic $FS_{simulated}$ exactly as above. The distribution of the 5000 values of $FS_{simulated}$ gives the empirical distribution under the null hypothesis, H_0: the mean frequency separation between pairs of bats flying together is simply the mean frequency separation of randomly chosen pairs of bats flying alone. Thirdly, we computed the *p*-value of our test: *p*-value = proportion of $FS_{simulated}$ values (out of 5000 numbers) larger then $FS_{2\text{-bat}}$ (which is a single number). A small *p*-value of this test would support the alternative hypothesis, H_1: the mean frequency separation between pairs of bats flying together is larger than the mean frequency separation of randomly chosen pairs of bats flying alone. This would suggest that in 2-bat scenarios, *T. teniotis* use "static JAR", i.e. they shift their mean frequencies away from each other, statically maintaining this frequency difference throughout the recording time (tens of seconds).

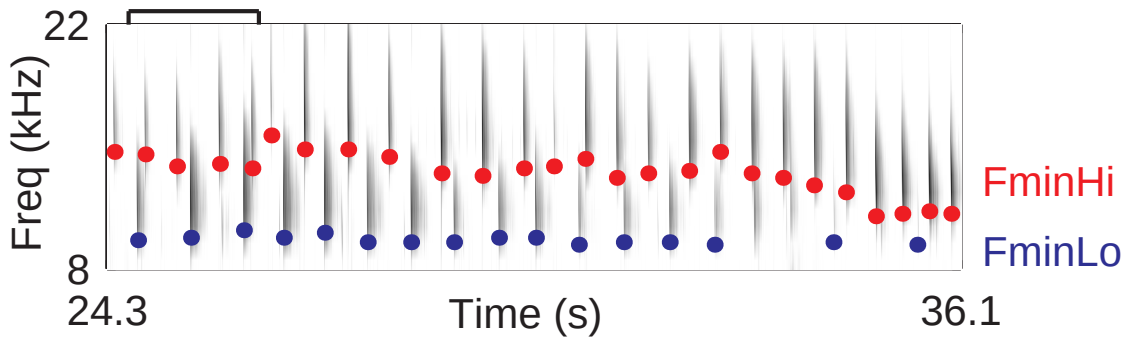
Figure 5: Example of *Tadarida teniotis* calls in 2-bat scenario; plotted as in figure 2 of the main text. *(a)* Spectrogram of a sequence of several pulses, with marks of our measurements of F_{min}, colored separately for the high-frequency bat (red) and low-frequency bat (blue). *(b)* Spectrogram of a longer time segment, showing the clear separation between F_{min} of the two bats during the recording. Rectangle at top denotes time of segment in *a*. *(c)* F_{min} vs duration, showing a clear separate cluster for each bat (red and blue). *(d)* Histograms of interpulse intervals for the two bats (red and blue) and for their mixture (black).

Tadarida teniotis

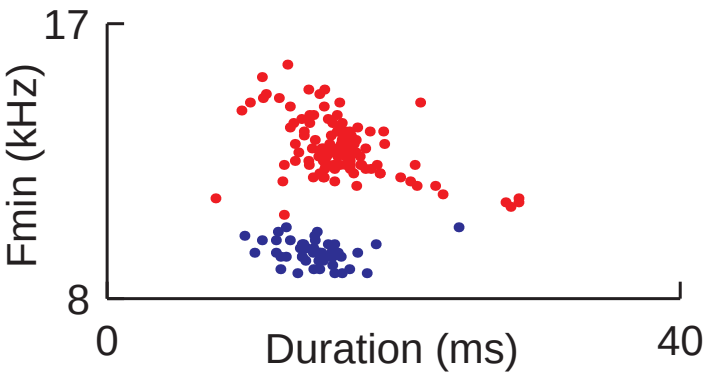
(a)



(b)



(c)



(d)

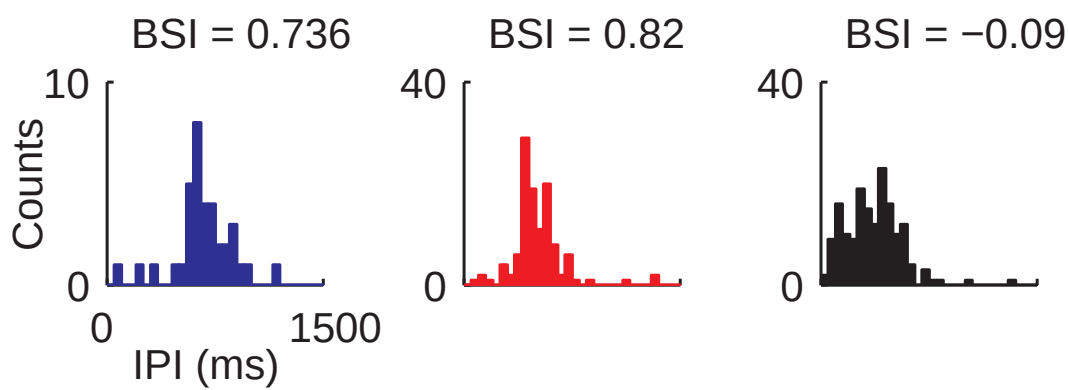


Figure 6: Example of jamming avoidance response (JAR) in *Tadarida teniotis* recorded in a 2-bat scenario; plotted as in figure 3 of the main text. *(a)* F_{min} of the calls of both bats over the entire recording, with dots showing raw data and solid lines showing smoothed data. *(b)* Amplitude of calls over the entire recording, for the lower-frequency bat (AmpLo). Arrows: times when the F_{min} of the higher-frequency bat (FminHi) behaved similarly to the amplitude of the lower-frequency bat (AmpLo). *(c)* Amplitude of calls for the higher-frequency bat (AmpHi). *(d)* Overlay of the smoothed F_{min} of one bat over the smoothed amplitude of the other bat (amplitudes were normalized to fit F_{min} ranges), with the correlation coefficients of the two curves.

Tadarida teniotis

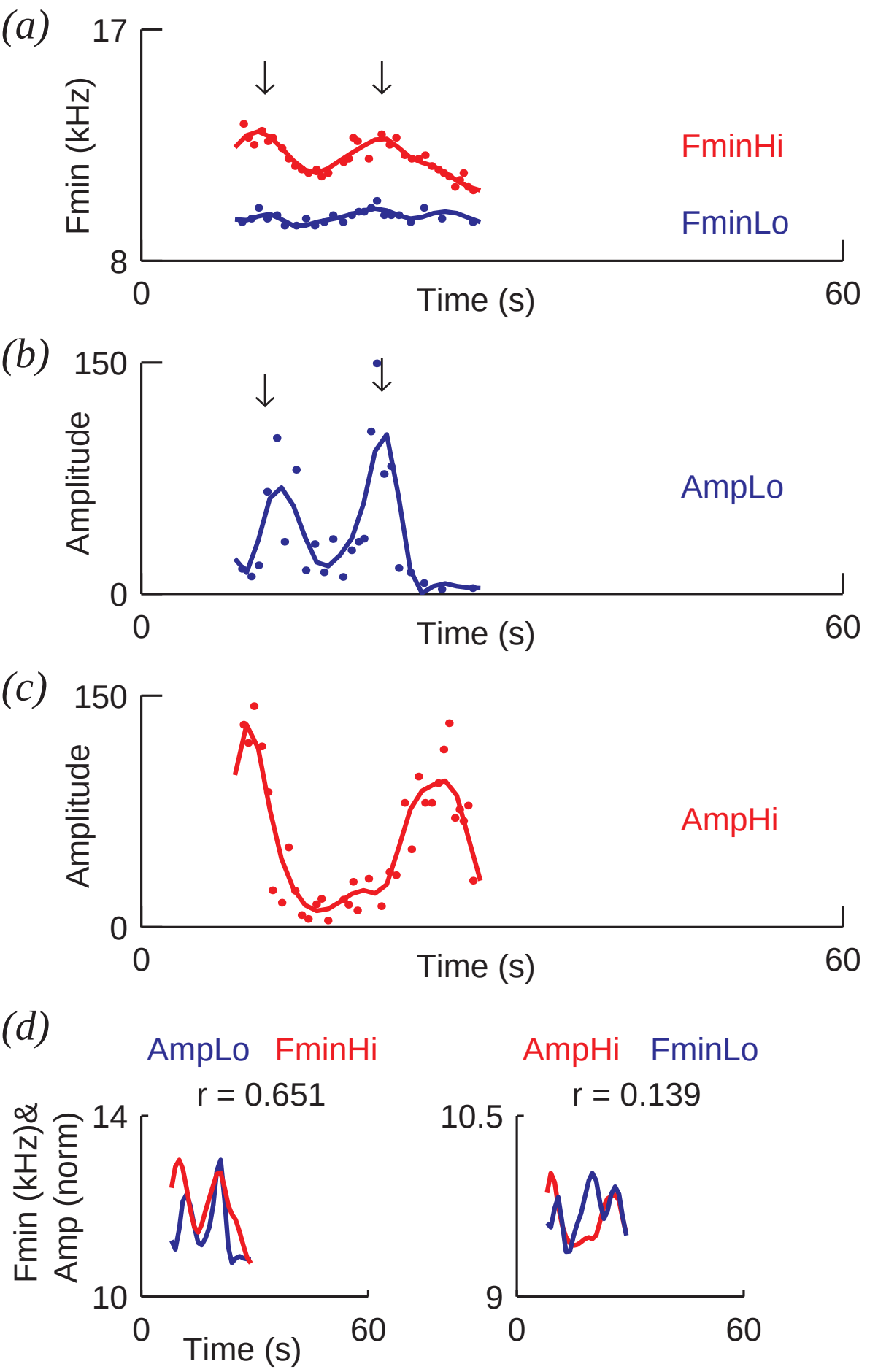
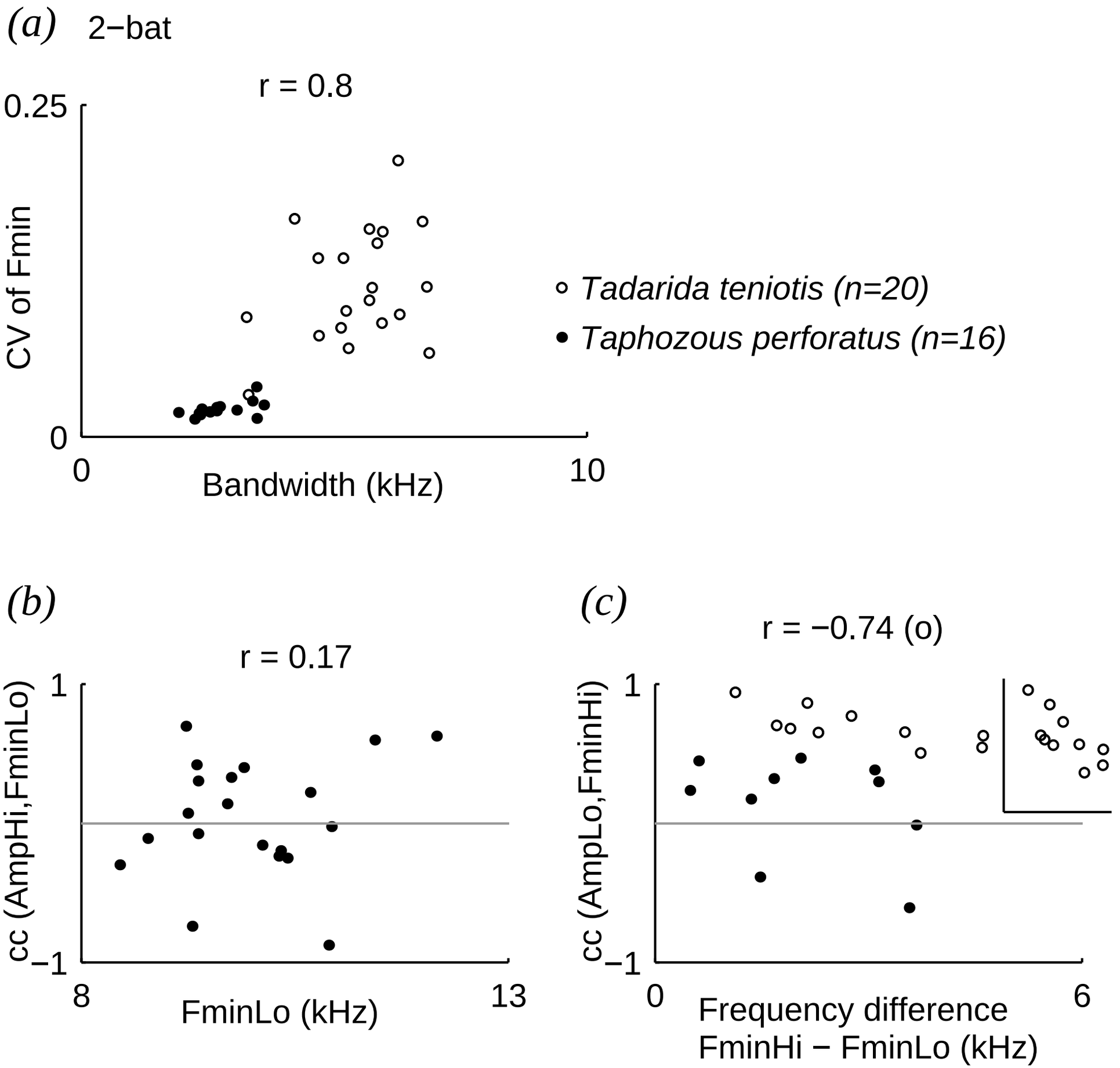


Figure 7: Examining hypotheses on the nature of JAR in echolocating bats. *(a)* CV of F_{min} in 2-bat files (for mixtures of the two bats = "Mixed") vs the average bandwidth, for all 2-bat files of the two species. The positive correlation suggests stronger static JAR in bats employing calls with larger bandwidth. *(b)* Correlation coefficients ("cc") between the 2 bats vs the F_{min} of the lower-frequency bat. *(c)* Correlation coefficients between the 2 bats (a different comparison than in *b*) vs the frequency difference between lower- and higher-frequency bats. Open circles: files with cc > 0.5; these are also shown in the Inset (in which the x-axis shows a 0–5 kHz range and the y-axis a 0.3–1.0 range).


(a)
2−bat
r = 0.8
0.25
0
CV of Fmin
0
10
Bandwidth (kHz)
Tadarida teniotis (n=20)
Taphozous perforatus (n=16)
(b)
r = 0.17
1
−1
cc (AmpHi,FminLo)
8
13
FminLo (kHz)
(c)
r = −0.74 (o)
1
−1
cc (AmpLo,FminHi)
0
6
Frequency difference
FminHi − FminLo (kHz)