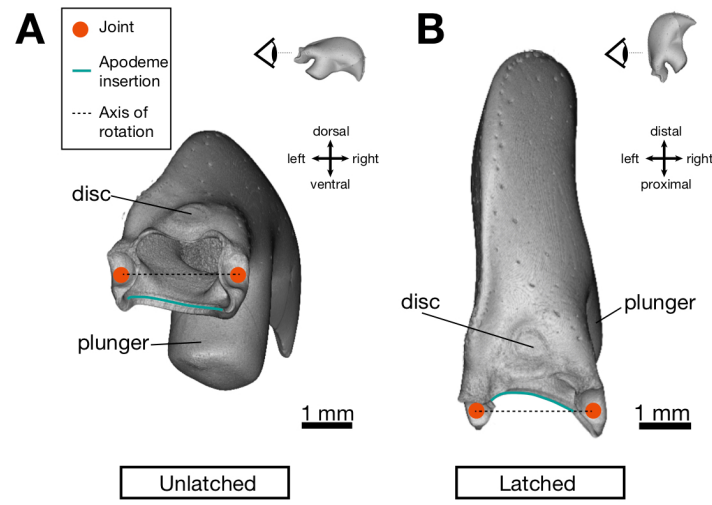
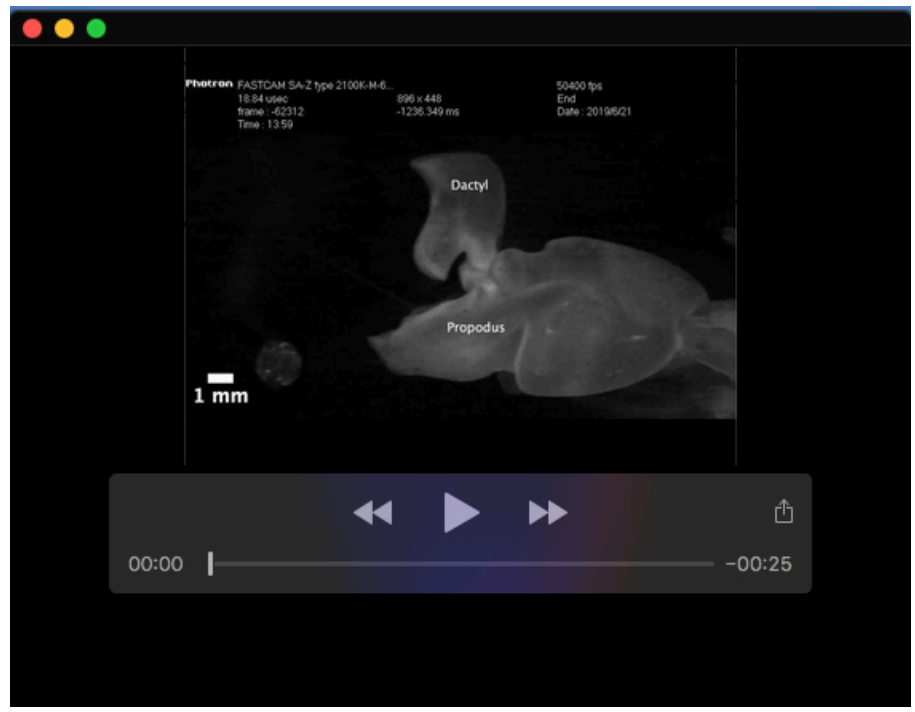


Fig. S1. Subtle features of dactyl morphology in *Alpheus heterochaelis* promote latching. **A.** When the dactyl is closed against the propodus, the joint (pivot) is above the apodeme insertion (turquoise line) to which the closer and trigger muscles attach. Posterior (proximal) view of the dactyl joint. **B**. To latch, the dactyl is opened and rotates into this position. The notched morphology of the dactyl causes the apodeme insertion (turquoise line) to pass above the axis of rotation (dashed line) formed by the dactyl joint. In this orientation, activation of the closer muscle will not generate a net closing torque on the dactyl. Visualization guides have been included in the upper right where terminology is with respect to a dactyl being observed by a viewer positioned as in A, and the adhesive disc and plunger have also been labeled to assist with orientation. Images are reconstructions from micro-CT scans of dactyl molts; apodemes were digitally removed for clarity.

Table S1. Morphological information for specimens included in this study.

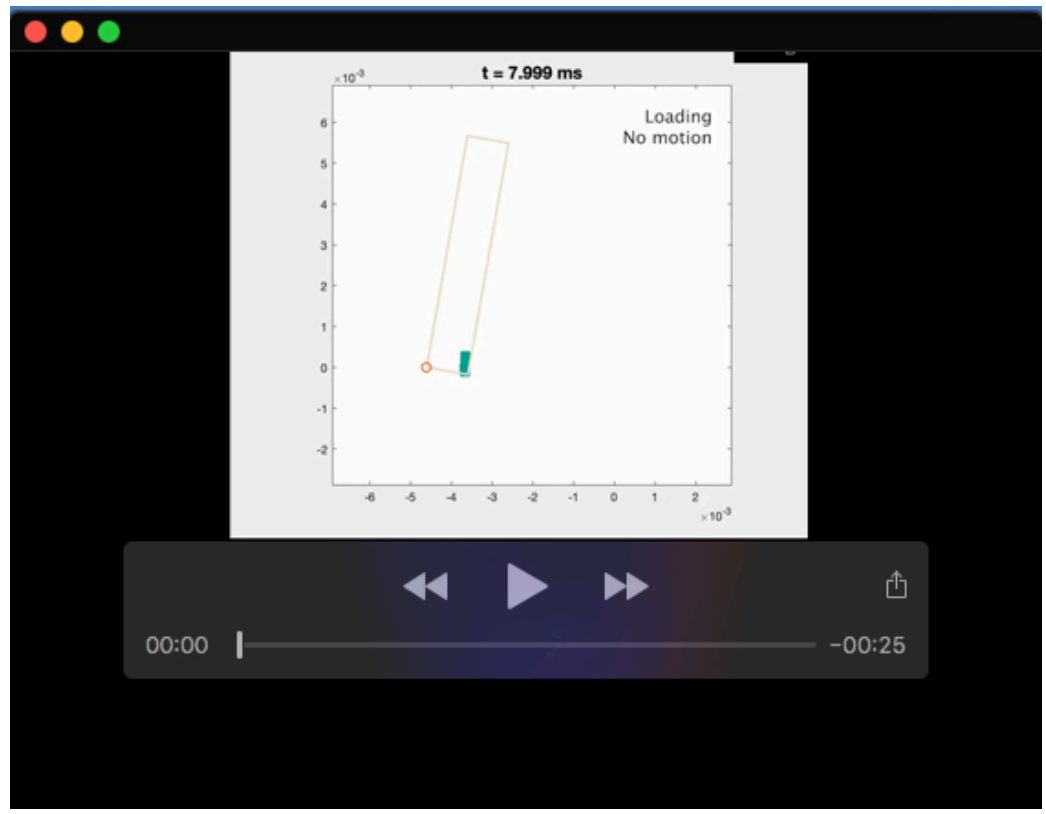
Specimen ID	**A5**	**A11**	**A13**	**A15**	**D001**	**D002**	**D003**	**JD4**	**JD2**	**pair1female**
Total Mass (g)	0.9227	1.2858	0.2975	0.3488	0.6283	0.6674	0.6413	1.0460	0.92	0.6407
Claw Mass (g)	0.1274	0.2915	0.0391	0.0535	0.1359	0.1132	0.0813	0.1933	0.1411	0.1549
Total Length (mm)	32.75	34.70	23.85	24.32	28.50	31.41	30.64	34.17	33.12	25.53
Propodus length (mm)	12.89	16.62	9.24	9.86	13.10	12.74	11.32	15.43	14.04	13.05
Dactyl length (mm)	5.78	6.69	3.79	3.96	5.56	5.10	4.76	6.40	5.54	5.25
Sex	Didn't record	Male	Male	Male	Male	Female	Female	Male	Male	Female

Note that 'JD2' and 'pair1female' are the identifications for specimens filmed only for analysis of propodus deformation. Total mass included the mass of the entire shrimp (including claw). Claw mass included both the dactyl and propodus. All masses are wet masses. Lengths were either measured directly on the specimen or using calibrated photos. JD2 mass is reported to two decimal points due to a recording oversight.



Movie 1. Example video demonstrating exoskeleton deformation during the loading phase before a strike. To emphasize propodus shape change, the video is played back approximately 4.25x slower than in real life. This loading phase is typical in duration (442.5 ms). Original filming rate: 50,400 fps; effective rate after subsampling: 128 fps; playback speed: 30 fps.

Movie 2. Example of a loading video followed by the corresponding strike video sequence. In each video, the shrimp can be seen in lateral view (top) and ventral view (using a mirror; below). The ventral view was used to determine dactyl motion, while the lateral image was used to check that the claw was oriented properly and not touching the tank bottom. This loading sequence took 391 ms and the strike took 0.81 ms. Note that the loading and strike sequences were originally filmed at 50,400 fps and then saved at different framerates to accommodate their different timescales. Loading sequence effective rate after subsampling: 504 fps; playback speed: 30 fps. Strike sequence: 50,400 fps no subsampling; playback speed: 30 fps.



Movie 3. Example loading and striking from the reduced-order model. During the simulation, the spring is loaded with energy, seen through the elongation of the animated spring, When the energy loading is complete, the unlatching process begins by rotating the spring opposite to the simulated dactyl motion (rectangular block). It should be noted that the time step changes from 1 ms to 1 μs after torque reversal.