

## Supplementary figures:

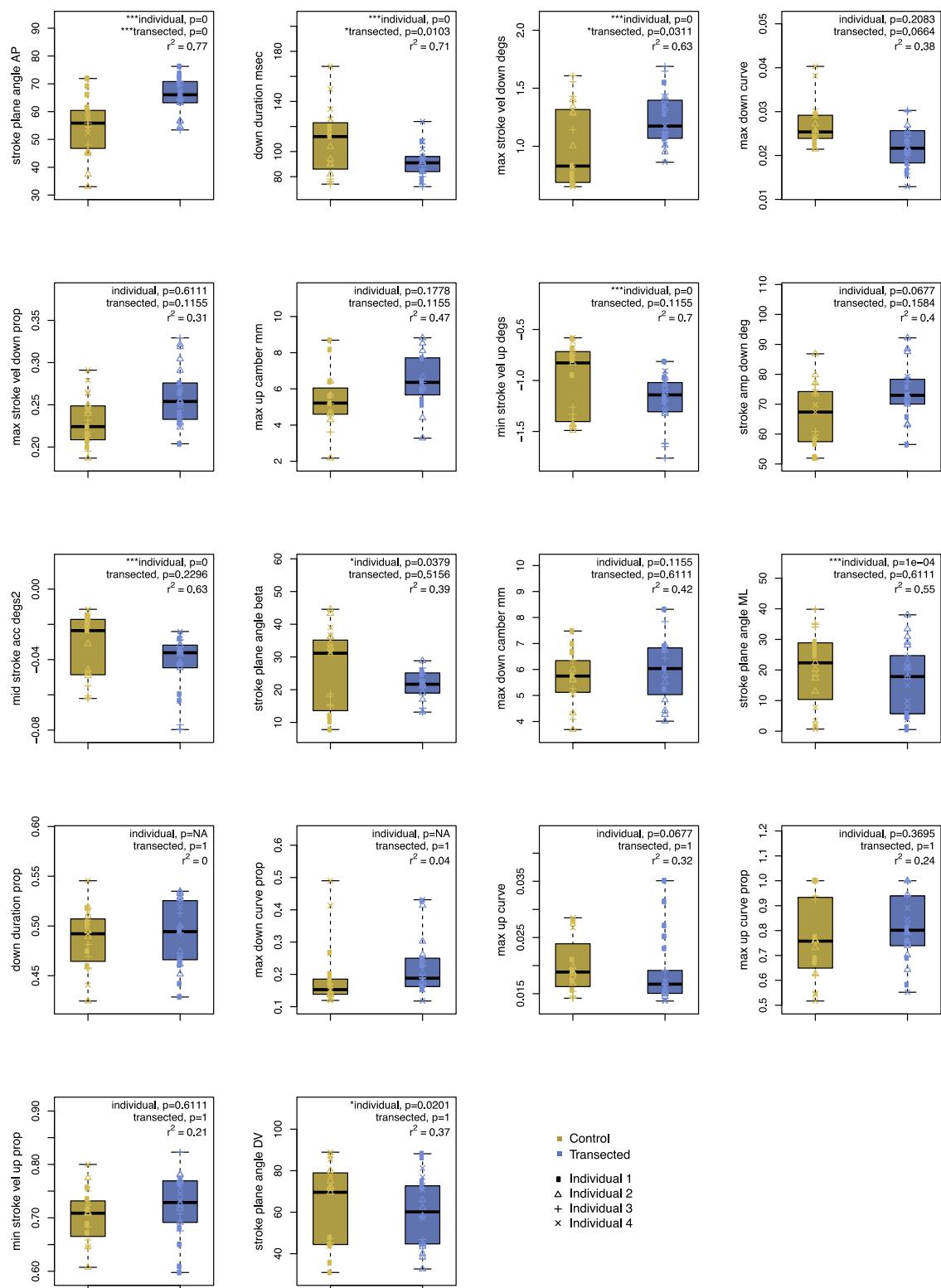
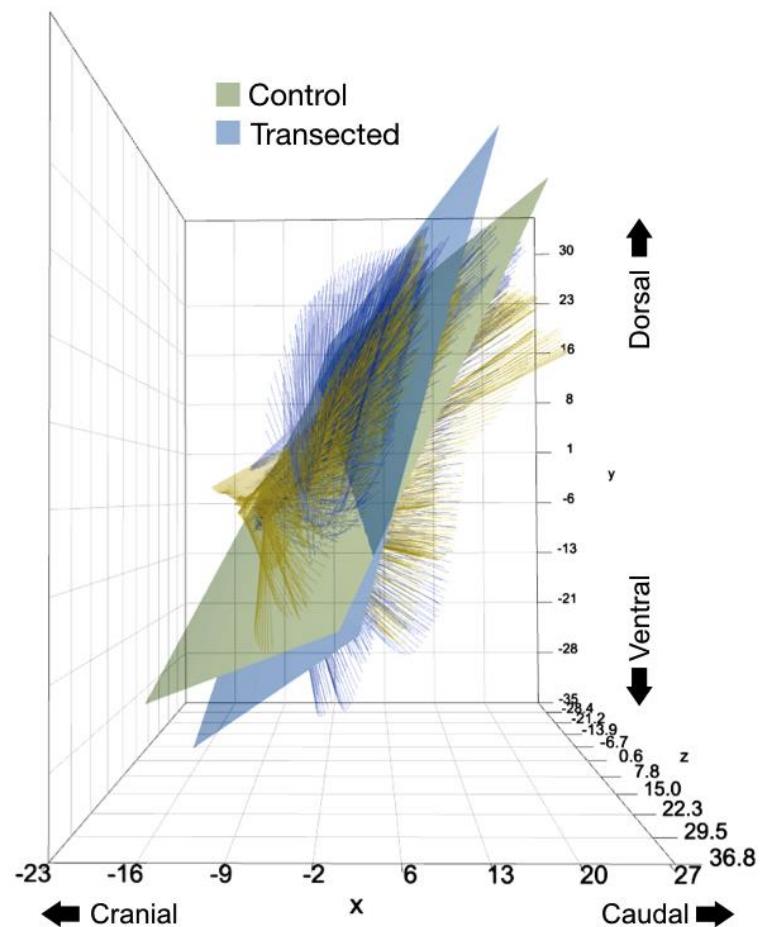


Figure S1. A summary of the ANOVA analysis for each kinematic variables between trials before and after the loss of sensory feedback.

All  $p$ -values have been corrected for multiple comparisons. The model, the model fits, and model AIC values for each comparison can all be found in Table S2.

**A**



**B**

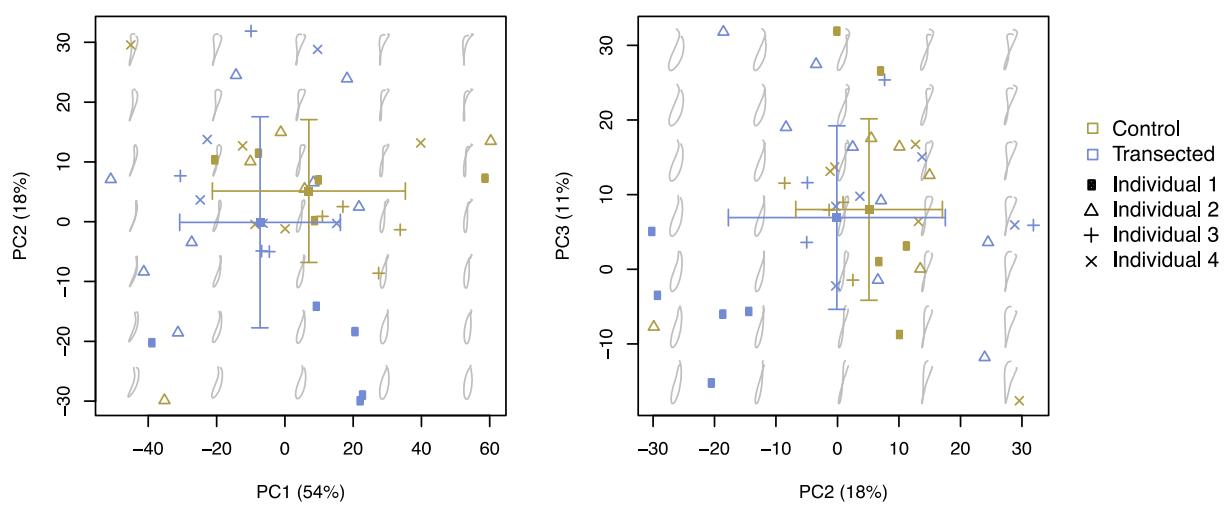


Figure S2. 3D stroke plane comparison before and after the loss of sensory feedback and A PC analysis of the shape of the fin stroke.

(A) The average 3D stroke plane is shown before and after the loss of sensory feedback. The loss of sensory feedback leads to a significant difference in the stroke plane relative to the A-P axis. After the loss of sensory feedback, the stroke plane is oriented more vertically. The lightly colored lines represent the path of the leading edge fin ray during the superimposed fin strokes. (B) A PC analysis was conducted on the three-dimensional shape of the trajectory of the leading edge fin ray throughout the fin stroke. PC1, 2, and 3 explain 55, 17, and 9 %, respectively (81% in total), of the variation in fin stroke shape. In this analysis, the trajectory of the fin was corrected for differences in stroke plane angle between trials and individuals. After correction, there are no significant differences in the shape of the fin stroke ( $p>0.05$ ).

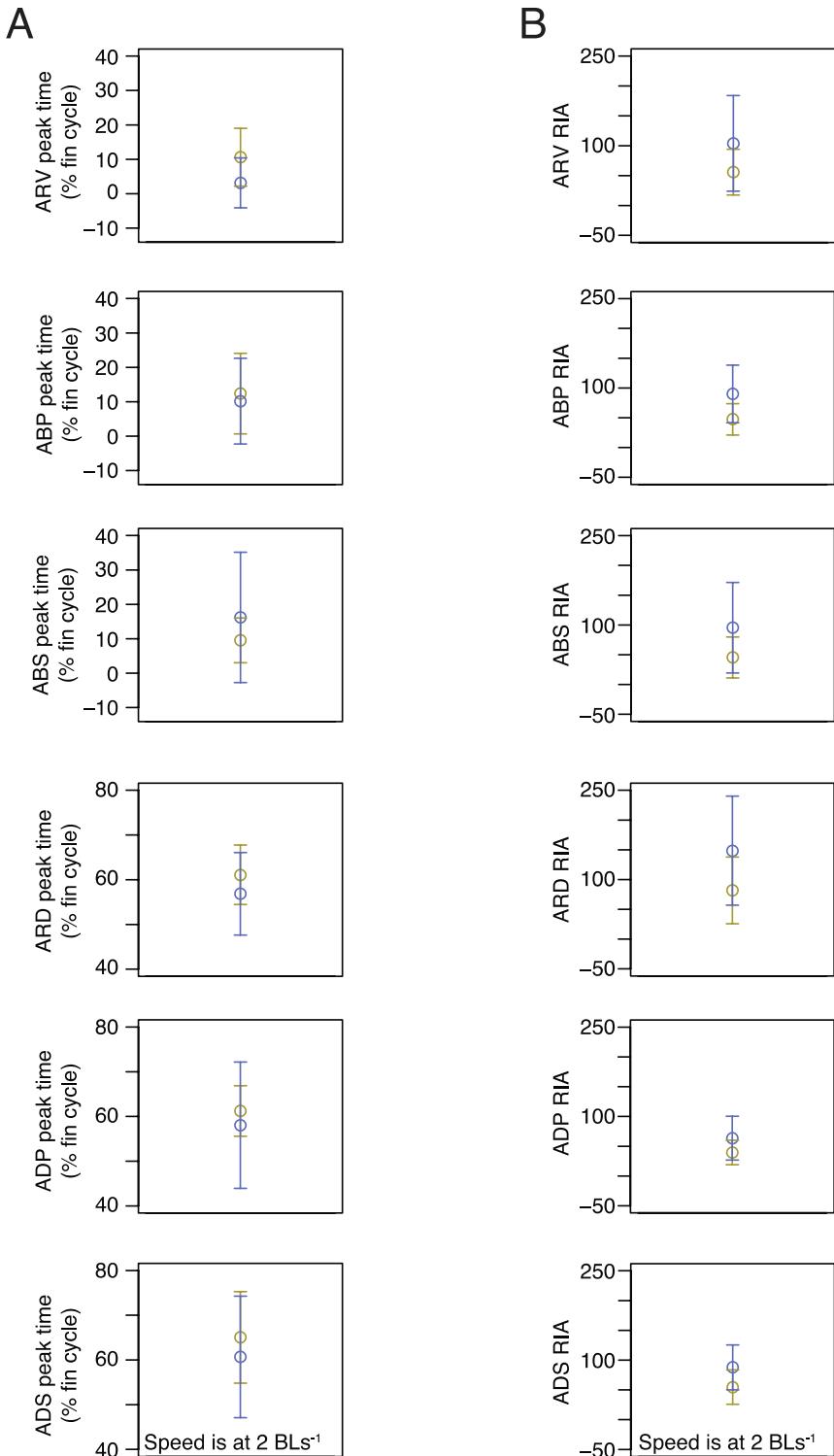


Figure S3. The relationship between both the time of peak amplitude (A) and the RIA (B) of activity and speed for each muscle.

(A) In general, the time of peak amplitude is very consistent for each muscle before and after the loss of sensory feedback. (B) The RIA of any given muscle is always significantly greater in transection trials in comparison to control trials.

## Supplementary tables:

Table S1. Summary of ANOVA models for comparisons between kinematic variables before and after the loss of sensory feedback at  $2\text{BLs}^{-1}$ .

Variable (v)	Formula	Factors	AIC	$r^2$
Down duration (ms)	v~indiv+transected	indiv+transected	328.0734999	0.714481771
Down duration (% Fin cycle)	v~transected	transected	-162.448099	0.00296107
D. M. κ (mm <sup>-1</sup> )	v~indiv+transected	indiv+transected	-318.254060	0.38150507
D. M. κ P. (%fc.)	v~transected	transected	-72.8485307	0.035362559
D. M. Vel. (d/ms)	v~indiv+transected	indiv+transected	-10.1912563	0.629368861
D. M. Vel. P. (%fc.)	v~indiv+transected	indiv+transected	-162.222706	0.307001716
U. M. κ (mm <sup>-1</sup> )	v~indiv+transected	indiv+transected	-315.30321	0.319800628
U. M. κ P. (%fc.)	v~indiv+transected	indiv+transected	-39.3252306	0.240623414
M.S. Acc. (d/ms <sup>2</sup> )	v~indiv+transected	indiv+transected	-241.075629	0.628477697
U. M. Vel. (d/ms)	v~indiv+transected	indiv+transected	-16.4422813	0.703139478
U. M. Vel. P. (%fc.)	v~indiv+transected	indiv+transected	-120.888786	0.207497597
Stroke Amp. (d)	v~indiv+transected	indiv+transected	297.592746	0.400808819
SP. Ang. AP	v~indiv+transected	indiv+transected	256.0612612	0.770655277
SP. Ang. DV	v~indiv+transected	indiv+transected	345.7718326	0.369824963
SP. Ang. ML	v~indiv+transected	indiv+transected	297.7715606	0.549823493
2D SP. Ang. Beta	v~indiv+transected	indiv+transected	288.8346832	0.389795245
M. D. Camber (mm)	v~indiv+transected	indiv+transected	93.52226576	0.417958144
M. U. Camber (mm)	v~indiv+transected	indiv+transected	106.8996634	0.474093989

Comparisons are made of data recorded at a swimming speed of  $2\text{ BLs}^{-1}$ .

Amp = amplitude, D. = down stroke, Vel. = velocity, P. = proportion of fin cycle, U. = up stroke,

M. = maximum, SP. = stroke plane, Ang. = angle, AP = Anterior-Posterior plane, DV = Dorsal-Ventral plane, ML = Medial-Lateral plane, d=degrees, s = seconds, %fc. = % fin cycle,  $\kappa$  = fin ray curvature in units  $\text{mm}^{-1}$ , v = variable.

Table S2. Summary of muscle activity.

		Control trials across three speeds							
Muscle	Speed	ONSET %F	OFFSET %F	DUR %F	PEAK %F	RIA	Mag. (mv)	Onset CV	Dur. CV
ARV	2	-7.52 ± 8.86	28.05 ± 12.02	35.58 ± 14.45	10.60 ± 8.41	55.35 ± 38.70	1.54 ± 1.20	41.40 ± 25.50	19.34 ± 5.55
ABP	2	-3.15 ± 6.78	29.43 ± 12.11	32.58 ± 12.28	12.35 ± 11.70	47.37 ± 26.28	0.94 ± 0.45	48.48 ± 28.53	28.93 ± 20.16
ABS	2	-0.05 ± 4.35	32.82 ± 10.96	32.87 ± 11.74	9.51 ± 6.50	45.47 ± 34.42	1.10 ± 0.92	104.83 ± 140.44	22.56 ± 23.19
ARD	2	43.23 ± 8.26	79.99 ± 10.99	36.76 ± 12.33	61.09 ± 6.65	81.87 ± 56.01	1.33 ± 0.75	15.21 ± 12.44	14.85 ± 9.64
ADP	2	45.19 ± 7.56	76.57 ± 5.89	31.38 ± 9.42	61.24 ± 5.65	39.44 ± 20.52	0.87 ± 0.41	12.00 ± 9.43	18.23 ± 16.72
ADS	2	49.51 ± 13.03	80.31 ± 8.59	30.79 ± 8.66	65.06 ± 10.22	54.76 ± 28.80	1.01 ± 0.46	21.46 ± 18.47	17.69 ± 10.48
Transection trials and p-values									
ARV	T - 2	-15.08 ± 9.35	46.99 ± 13.66	62.07 ± 16.65	3.15 ± 7.27	103.91 ± 80.09	1.60 ± 1.19	28.01 ± 9.71	20.10 ± 9.41
	p	0.002	2.0x10-07	5.8x10-09	0.0003	0.004	0.826	0.257	0.352
ABP	T - 2	-9.83 ± 6.37	48.79 ± 13.85	58.62 ± 14.81	10.19 ± 12.45	89.96 ± 48.29	0.82 ± 0.49	42.93 ± 29.38	25.24 ± 17.01
	p	0.0001	1.54x10-7	2.0x10-10	0.478	6.17x10-5	0.31	0.747	0.490
ABS	T - 2	-7.28 ± 8.20	55.95 ± 14.27	63.24 ± 15.03	16.19 ± 18.95	95.35 ± 76.03	1.14 ± 0.85	135.19 ± 238.079	22.07 ± 16.12
	p	5.63x10-5	9.8x10-10	1.0x10-12	0.07	0.0016	0.867	0.793	0.835
ARD	T - 2	38.71 ± 7.66	94.09 ± 13.35	55.38 ± 13.93	56.85 ± 9.22	148.56 ± 91.49	1.35 ± 0.738	19.65 ± 6.45	23.54 ± 7.32
	p	0.027	2.3x10-5	4.7x10-7	0.041	0.00098	0.896	0.456	0.108
ADP	T - 2	39.23 ± 9.68	91.21 ± 14.57	51.97 ± 16.57	58.05 ± 14.11	63.63 ± 36.83	0.864 ± 0.468	22.77 ± 9.61	28.61 ± 16.45
	p	0.0085	2.98x10-6	1.10x10-7	0.251	0.002	0.972	0.078	0.028
ADS	T - 2	38.32 ± 11.11	89.62 ± 13.47	51.30 ± 14.77	60.68 ± 13.58	87.69 ± 37.72	1.02 ± 0.385	20.91 ± 16.17	25.62 ± 8.89
	p	0.0004	0.0019	8.4x10-9	0.154	0.0003	0.959	0.957	0.142

% F = % Fin cycle.

All values are presented as the average ± standard deviation.

Table S3. Summary statistics for the amount of activity overlap between antagonistic muscles.

		Control					
		Arrector		Profundus		Superficialis	
Speed		In cycle-flip	Transition	In cycle-flip	Transition	In cycle-flip	Transition
2		-14.00 ± 14.25	-14.03 ± 15.66	-14.26 ± 14.33	-21.00 ± 6.75	-13.51 ± 17.25	21.13 ± 8.64
Transection							
		Arrector		Profundus		Superficialis	
Speed		In cycle-flip	Transition	In cycle-flip	Transition	In cycle-flip	Transition
2		8.24 ± 15.18	7.69 ± 13.77	9.61 ± 18.26	-0.45 ± 15.75	17.38 ± 15.31	-4.49 ± 13.33
<i>p</i>		1.034x10 <sup>-07</sup>	1.626 x10 <sup>-07</sup>	2.823 x10 <sup>-07</sup>	9.499 x10 <sup>-09</sup>	2.027 x10 <sup>-10</sup>	2.090 x10 <sup>-07</sup>

Values represent the percentage of the fin cycle a given muscle pair is active at the same time.

In cycle refers to overlap occurring within the fin beat cycle that would occur around the time of peak abduction.

Transition refers to overlap that would occur around the time of peak adduction and protraction between consecutive fin strokes.

*p*-values are from t-test between overlap data from control and transection trials.

Average ± standard deviation