

Supplementary information

Hagfish slime and mucin flow properties and their implications for defense

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Supplementary Note:

- (a) Calculation of shear rate during knot sliding
- (b) List of suction feeding fish preying on hagfish

Supplementary Video 1:

A hagfish is trapped in its own slime. To avoid self-asphyxiation, the hagfish forms a sliding knot to shear off the slime.

Supplementary Video 2:

Complex flow behaviour of natural hagfish slime and sample loading

Supplementary Video 3:

Hagfish mucin viscoelasticity and the effect of shear

Supplementary Video 4:

Extensional elastic properties of mucins in hagfish slime

Supplementary Video 5:

Liquid filament thinning event of natural hagfish mucin in a CaBER (Capillary Breakup Extensional Rheometer), recorded at 5000 fps with a play rate of 24 fps.

Supplementary Note 4:

(a) Calculation of shear rate during knot sliding

Assuming a hagfish body length $l = 0.2$ m, a knotting time of $t = 1$ s, and a gap range between the sliding surfaces of $h = 0.001 - 0.01$ m

This equals a sliding velocity of $v = l/t = 0.2$ m/s

According to $\gamma = v/h$ this corresponds to an average shear rate of $\gamma \approx 20 - 200$ s⁻¹ during knot sliding.

(b) Selection of suction feeders preying on hagfish

Predator / Predator family	Preys on hagfish	Uses suction feeding
<i>Polyprion americanus</i> (Atlantic wreckfish)	Zintzen et al., (2011)	Brick Peres et al., (2003)
<i>Congridae</i> (Conger eels)	Zintzen et al., (2011)	De Schepper et al., (2007)
<i>Squalidae</i> (Spiny dogfishes)	Zintzen et al., (2011)	Wilga et al., (1998)
<i>Otaria flavescens</i> (Southern sea lion)	Jørgensen et al., (1998)	Berta et al., (2005)
<i>Gadus callarias</i> (Codfish)	Jørgensen et al., (1998)	Muller et al., (1984)
<i>Phoca vitulina</i> (Harbour seal)	Jørgensen et al., (1998)	Marshall et al., (2014)

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