Table S1. Average stiffness (MPa), toughness (MPa) and band pair counts of vertebral centra from mature sharks sampled for the present study and Natanson et al., 2018.

Species	Anterior (A and C)			Posterior (D and E)		
	Stiffness	Toughness	BP count*	Stiffness	Toughness	BP count*
Dusky shark (*Carcharhinus obscurus*)	3.9± 0.62	2.13e-3±3.93e-4	14.5±0.22	7.57±1.6	3.95e-3±7e-4	13.8±0.17
Blue shark (*Prionace glauca*)	5.18±1.43	2.88e-3±7.97e-4	14.4±0.5	3.8±0.62	2.25e-3±3.38e-4	15±1.29
Shortfin mako (*Isurus oxyrinchus*)	2.57±1.53	1.32e-3±7.58e-4	27.7±0.91	8.38±1.98	3.91e-3±9.46e-4	18±0.77
Porbeagle shark *(Lamna nasus)*	1.43±0.54	8.18e-4±2.66e-4	18.5±0.88	2.39±0.77	1.69e-3±3.71e-4	14.5±0.67
Common thresher shark (*Alopias vulpinus*)	0.78±0.15	4.93e-4±8.78e-5	21.5±0.56	1.15±0.22	6.4e-4±1.2e-4	18.8±0.75
White shark (*Carcharodon carcharias*)	0.35±0.08	2.2e-4±4.04e-4	25.27±1.6	0.89±0.24	5.27e-4±1.27e-4	16.3±0.61

Columns with (*) are data from Natanson et al., 2018

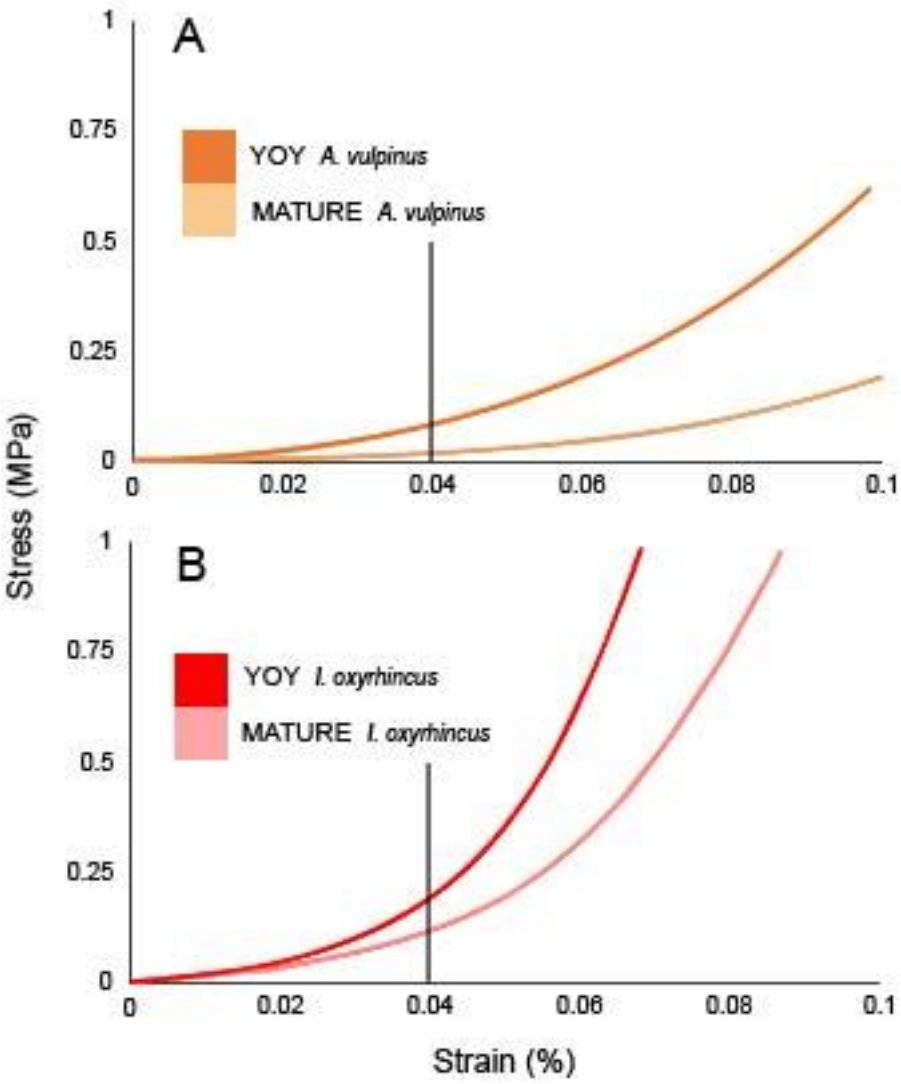

Figure S1. Stress-strain curves of YOY and mature shark centra that were compressed within the elastic (linear) region. 4% strain is the deformation in which stiffness and toughness were calculated. Curves detail data from compression tests from common thresher (A) and shortfin mako (B) and correspond with the x-radiographed YOY and mature shark centra from Figure 4. Dusky stress-strain curves are detailed in Figure 3.

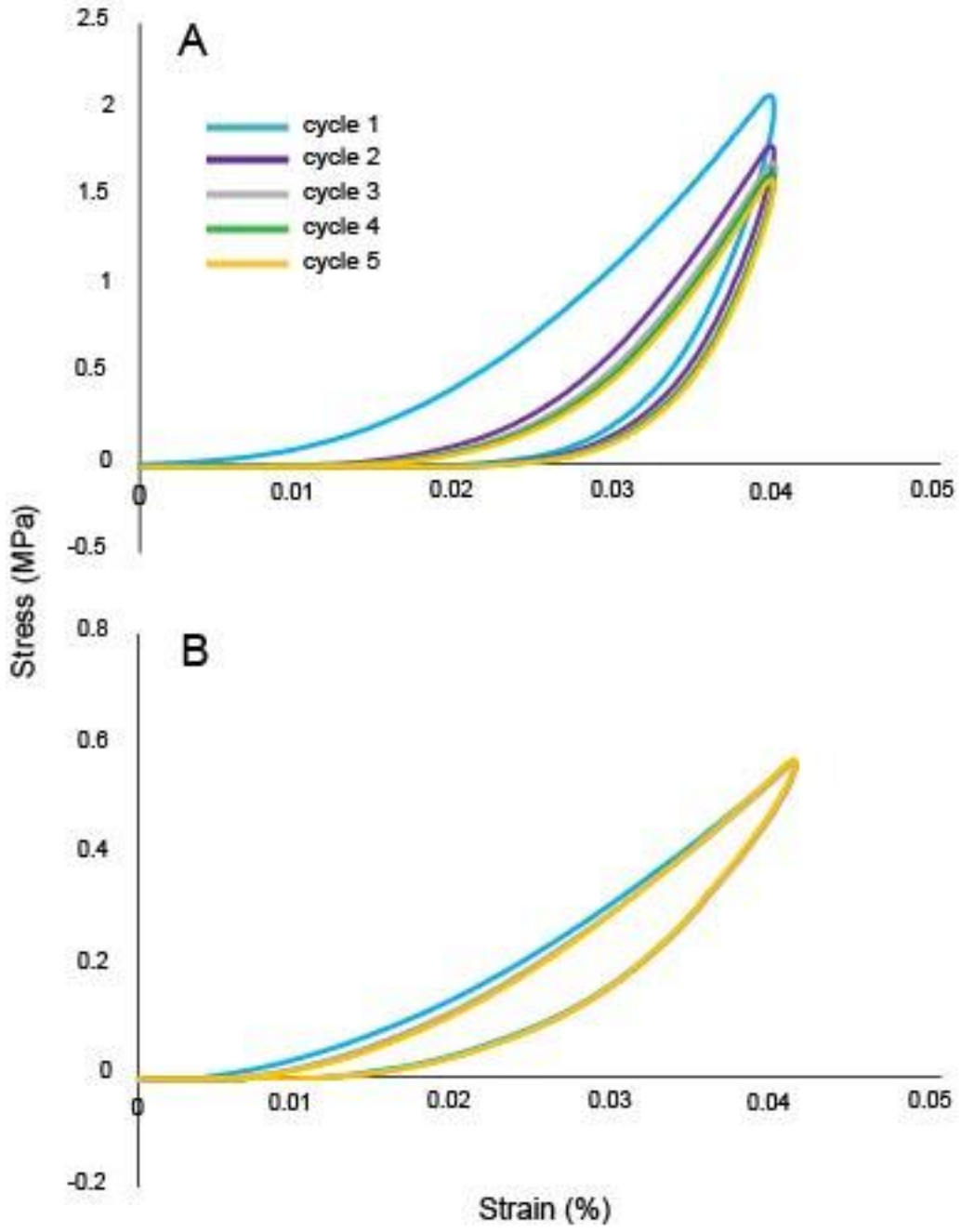

Figure S2. Cyclical tests (5) of centra from two mature sharks at a displacement rate of 0.03mm/s. (A) The centrum from a mature dusky had the following stiffness measures (MPa); cycle 1 = 50.66, cycle 2 = 44.14, cycle 3 = 40.2, cycle 4 = 40.36, cycle 5 = 39.57. (B) Common thresher had similar stiffness values among the five compression cycles; cycle 1 = 13.8, cycle 2 = 13.76, cycle 3 = 13.77, cycle 4 = 13.87, cycle 5 = 13.94.