The following supplements accompany the article

A comprehensive analysis of mechanical and morphological traits in temperate and tropical seagrass species

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Supplement 1. Variance partitioning analysis.

Breaking force (F_{brk}) is expressed as the product of width (w), thickness (t), and tensile strength (σ_{brk}) (eq.1):

(eq.1) $F_{brk} = w \cdot t \cdot \sigma_{brk}$

After logarithm transformation, eq.1 turns additive (eq.2):

(eq.2) $\log_{10}(F_{brk}) = \log_{10}(w) + \log_{10}(t) + \log_{10}(\sigma_{brk}) \rightarrow F_{brk}' = w' + t' + \sigma_{brk}'$

The variance (Var) of the breaking force can be then expressed as the sum of the covariances (Cov) between each term and the mechanical resistance (eq.3):

(eq.3) $Var(F_{brk}') = Cov(F_{brk}',w') + Cov(F_{brk}',t') + Cov(F_{brk}',\sigma_{brk}')$

The contribution (Cont) of each component to F_{brk}' is expressed as its covariance divided by the variance of F_{brk}' (eqs.4):

(eqs.4)

$Cont(w) = Cov(F_{brk}',w')/Var(F_{brk}')$

$Cont(t) = Cov(F_{brk}',t')/Var(F_{brk}')$

$Cont(\sigma_{brk}) = Cov(F_{brk}',\sigma_{brk}') /Var(F_{brk}')$

$Cont(w) + Cont(t) + Cont(\sigma_{brk}) = 1$

Therefore, the contribution of each component is translated as relative importance in mechanical resistance.

Supplement 2. Tables

Table S1. Sampling sites by bioregion, with geographical coordinates, species collected, date(s) of collection (mm/yy), and habitat details (depth in m). Species ID: *Amphibolis antarctica* (Aa), *A. griffithii* (Ag), *Cymodocea nodosa* (Cn), *C. rotundata* (Cr), C. *serrulata* (Cs), *Enhalus acoroides* (Ea), *Halodule pinifolia* (Hp), *H. uninervis* (Hu), *Halophila ovalis* (Ho), *H. ovalis* ssp. *bullosa* (Hb), *Posidonia australis* (Pa), *P. coriacea* (Pc), *P. oceanica* (Po), *P. sinuosa* (Ps), *Ruppia maritima* (Rm), *Syringodium isoetifolium* (Si), *Thalassia hemprichii* (Th), *Thalassodendron pachyrhizum* (Tp), *Zostera capricorni* (Zc), *Z. marina* (Zm), *Z. nigricaulis* (Zg), and *Z. noltei* (Zn). Number of samples per species is included between brackets next to each species code at each site.

Sites	Geographical coordinates	Species ID	Date(s) of collection	Habitat details
TIP: Tropical Indo-Pacific region (8 species, 5 sites, 21 species-at-site sets)				
Lima Island, West Java, Indonesia.	05°34'42.96"S – 106°39'39.60"E	Ea (17), Th (17)	04/07, 11/07	Sandy, semi-exposed (< 1 m)
Kepuh / Muyaldi Islands, West Java, Indonesia.	05°57'52.00"S – 106°06'28.00"E	Cr (19), Cs (16), Ea (17), Hu (19), Si (20), Th (13)	04/07, 11/07	Muddy, sheltered (< 1 m), 2 stations
Pari Island, Jakarta Bay, Indonesia.	05°51'34.10"S – 106°37'17.20"E	Cr (10), Cs (11), Ea,(5), Hu (10), Si (9), Th (15)	03/10	Sandy/semi-exposed, muddy/sheltered (< 1 m), 2 stations
Bone Batang Island, South Sulawesi, Indonesia.	05°00'47.66"S – 119°19'35.12"E	Ea (5)	09/10	Sandy, exposed (< 1 m)
Laucala Bay, Suva, Fiji.	18°09'21.76"S – 178°26'48.97"E	Hb (5), Hp (5), Hu (5)	02/09	Muddy, sheltered (< 1 m)
MED: Mediterranean-Atlantic region (5 species, 5 sites, 12 species-at-site sets)				
Santibáñez, Cádiz, Spain.	36°28'06.91"N – 6°15'08.62"W	Cn (74), Zn (51), Zm (27)	10/07, 06/09, 11/09, 03/10, 06/10	Muddy, sheltered (< 1m), 3 stations
El Chato Beach, Cádiz, Spain.	36º28'44.51"N – 6º15'52.75"W	Cn (50)	10/07, 06/09, 11/09, 03/10, 06/10	Rocky pools, exposed (< 1m)
Bajo de la Cabezuela, Cádiz, Spain	36°31'42.52"N – 6°14'32.16"W	Cn (41), Zn (96)	10/07, 07/09, 11/09, 03/10, 06/10	Sandy-muddy, semi-exposed (< 1 m)
Caño de Cortadura, Cádiz, Spain.	36°31'34.75"N – 6°13'04.05"W	Cn (5), Rm (10), Zn (10)	06/09	Muddy, sheltered (<1 m)
Playa de los Arenales, Alicante, Spain.	38°15'43.33"N – 0°29'06.61"W	Po (13)	04/07, 06/09	Sandy, ocean exposed (~17 m)
TSO: Temperate Southern Oceans region (10 species, 9 sites, 22 species-at-site sets)				
Pittwater, NSW, Australia.	33°35'07.56"S – 151°19'27.45"E	Ho (10), Pa (15), Zc (10)	10/08	Muddy, sheltered (< 1 m), 2 stations
Silver Beach, Botany Bay, NSW, Australia	34°00'24.38"S – 151°11'20.98"E	Ho (9)	10/08	Sandy, semi-exposed (< 1 m)
Quibray Bay, Botany Bay, NSW, Australia	34°01'27.69"S – 151°10'45.12"E	Pa (19)	10/08	Muddy, sheltered (< 1 m), 2 stations
Garden Island, WA, Australia.	32°14'36.46"S – 115°40'41.93"E	Aa (10), Tp (5)	11/08	Rocky, ocean exposed (~6 m)
Cockburn Sound (outer), WA, Australia.	32°15'53.54"S – 115°41'52.65"E	Zg (5), Ho (5), Ps (5), Si (5)	11/08	Sandy, exposed (~10 m)
Cockburn Sound (inner), WA, Australia.	32°15'21.01"S – 115°42'29.04"E	Pa (10), Ps (7)	11/08	Sandy, sheltered (~2.5 m), 2 stations
Cottesloe, WA, Australia.	32°00'10.62"S – 115°45'01.12"E	Aa (10), Ag (10), Ho (5)	11/08	Sandy, ocean exposed (< 2 m)
Lal Bank, WA, Australia	31°48'33.00"S – 115°43'00.40"E	Pc (5)	11/08	Sandy, ocean exposed (~3 m)
Swan River, WA, Australia.	31°58'54.28"S – 115°49'17.79"E	Ho (5)	11/08	Sandy, sheltered (~0.5 m)

Table S2. Compilation of leaf lifespan of seagrasses from literature. (-) not available.

Species	**Location**	**Leaf lifespan (days)**			**Source**
		Mean	**Min.**	**Max.**	
Amphibolis antarctica	Rottnest Island, Western Australia	85.9	-	-	Marbà &Walker, 1999
Amphibolis griffithii	Success Bank, Western Australia	42.5[m]	5	80	Lavery & Vanderklift, 2002
Amphibolis griffithii	Warnbro Sound, Western Australia	90.9	-	-	Marbà & Walker, 1999
Cymodocea nodosa	Several locations	45.0	-	-	Duarte, 1991
Cymodocea nodosa	El Médano, Canary Islands	62.5[m]	45	80	Reyes *et al.*, 1998
Cymodocea rotundata	Agatti lagoon, India	31.6	29	34	Lal *et al.*, 2010
Cymodocea rotundata	Bolinao reef lagoon, The Philippines	38.3	-	-	Varmaat *et al.*; 1995
Cymodocea serrulata	Bolinao reef lagoon, The Philippines	42.0	-	-	Varmaat *et al.*, 1995
Enhalus acoroides	Several locations	104.5[f]	75[f]	158[f]	Hemminga *et al.*, 1999
Enhalus acoroides	Bolinao reef lagoon, The Philippines	139.0	-	-	Varmaat *et al.*, 1995
Halodule uninervis	Bolinao reef lagoon, The Philippines	26.2	-	-	Varmaat *et al.*, 1995
Halophila ovalis	Several locations	12.4	-	-	Duarte, 1991
Halophila ovalis	Bolinao reef lagoon, The Philippines	4.4	-	-	Varmaat *et al.*, 1995
Posidonia australis	Botany Bay, New South Wales, Australia	106.7[c]	-	-	West & Larkum 1979
Posidonia australis	Warnbro Sound, Western Australia	140.9	-	-	Marbà & Walker, 1999
Posidonia coriacea	Success Bank, Western Australia	81.5[m]	35	128	Lavery & Vanderklift, 2002
Posidonia oceanica	Several locations	302.8	-	-	Duarte, 1991
Posidonia oceanica	Mediterranean Spanish coast	257.7[f]	183[f]	395[f]	Marbà *et al.*, 1996
Posidonia oceanica	Lacco Ameno, Italy	295.9[f]			Zupo *et al.*, 1997
Posidonia sinuosa	Warnbro Sound, Western Australia	233.4	211.7	254.1	Marbà & Walker, 1999
Posidonia sinuosa	Marmion lagoon, Western Australia	126.0[m]	84	168	Jernakoff & Nielsen, 1997
Syringodium isoetifolium	Several locations	52.0	-	-	Duarte, 1991
Syringodium isoetifolium	Bolinao reef lagoon, The Philippines	68.7	-	-	Varmaat *et al.*, 1995
Thalassia hemprichii	Bolinao reef lagoon, The Philippines	34.5	-	-	Varmaat *et al.*, 1995
Thalassia hemprichii	Papua New Guinea	40.6	-	-	Heijs, 1985
Thalassodendron pachyrhizum	Cowaramup Bay, Western Australia	86.3	-	-	Marbà & Walker, 1999
Zostera capricorni	Several locations	56.0	-	-	Duarte, 1991
Zostera marina	Roscoff, France	97.0	67	140	Jacobs, 1979
Zostera marina	Oresund, Denmark	60.0[a]	-	-	Pedersen & Borum, 1993
Zostera marina	Several locations	51.4	-	-	Duarte, 1991
Zostera marina	Venice lagoon, Italy	47.9	-	-	Sfriso & Ghetti, 1998
Zostera noltei	Cádiz Bay, Spain	18.6	7	40	Brun *et al.* unpubl.

[f] Values read from figures.

[c] Calculated from leaf turnover (leaves crop per year).

[a] Approximative.

[m] Mean of the maximum – minimum range.

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Table S3. Mechanical traits (mean ± sd) of seagrasses by species and plant parts. n: number of observations. See Table S1 for species ID.

Species	Plant part	n	Breaking force (N)	Tensile strength (N mm^{-2})	Extensibility (%)	Stiffness (N mm^{-2})
Aa	Leaf	20	9.97 ± 1.87	6.75 ± 2.44	13.47 ± 6.51	64.77 ± 21.36
Aa	Stem	10	35.57 ± 11.74	16.37 ± 5.66	31.35 ± 14.27	160.56 ± 169.83
Ag	Leaf	10	10.93 ± 2.41	6.8 ± 2.74	10.70 ± 4.08	78.35 ± 23.01
Ag	Stem	5	22.76 ± 5.25	18.67 ± 6.05	32.00 ± 3.45	281.65 ± 88.45
Cn	Leaf	170	5.41 ± 2.70	4.85 ± 1.68	7.43 ± 2.54	79.66 ± 23.79
Cn	Sheath	125	5.13 ± 1.30	2.27 ± 1.68	14.66 ± 6.37	24.54 ± 10.99
Cr	Leaf	29	2.77 ± 1.30	2.46 ± 1.05	4.79 ± 1.91	62.13 ± 18.41
Cr	Sheath	8	4.92 ± 1.26	2.51 ± 0.34	9.57 ± 1.38	41.54 ± 5.28
Cs	Leaf	27	5.50 ± 1.97	3.55 ± 1.14	4.27 ± 2.07	102.86 ± 17.52
Cs	Sheath	8	8.96 ± 1.08	2.09 ± 0.16	6.88 ± 1.25	42.65 ± 2.11
Ea	Leaf	45	25.24 ± 9.72	2.60 ± 1.11	5.27 ± 2.89	59.91 ± 17.85
Ea	Sheath	8	27.42 ± 2.48	3.13 ± 1.34	28.34 ± 6.69	16.20 ± 7.03
Hb	Leaf	5	1.43 ± 0.26	3.85 ± 1.01	17.45 ± 4.69	30.05 ± 7.4
Hb	Petiole	5	0.40 ± 0.08	1.67 ± 0.58	58.22 ± 24.36	4.34 ± 2.38
Ho	Leaf	34	5.89 ± 2.15	4.78 ± 1.17	10.33 ± 3.80	72.55 ± 17.73
Ho	Petiole	34	1.94 ± 0.54	2.41 ± 0.60	50.13 ± 26.96	11.87 ± 7.91
Hp	Leaf	5	0.74 ± 0.10	6.21 ± 0.89	7.13 ± 0.58	94.13 ± 4.95
Hu	Leaf	33	2.47 ± 1.74	3.77 ± 1.30	4.13 ± 1.80	117.62 ± 22.46
Hu	Sheath	6	5.44 ± 1.14	3.11 ± 0.44	6.27 ± 1.03	72.50 ± 14.08
Pa	Leaf	44	36.82 ± 10.37	6.11 ± 2.43	8.26 ± 2.77	110.44 ± 43.63
Pa	Sheath	43	27.68 ± 15.67	2.57 ± 1.44	11.63 ± 6.92	55.83 ± 37.06
Pc	Leaf	5	29.49 ± 6.19	4.45 ± 0.59	12.43 ± 4.33	44.12 ± 32.19
Po	Leaf	13	20.37 ± 10.66	5.78 ± 1.31	3.21 ± 0.88	269.68 ± 60.51
Po	Sheath	5	47.00 ± 3.48	3.45 ± 0.48	40.11 ± 12.01	33.85 ± 11.43
Ps	Leaf	14	32.52 ± 6.77	17.07 ± 4.17	6.56 ± 1.77	373.41 ± 90.19
Rm	Leaf	10	0.95 ± 0.29	6.72 ± 1.86	17.18 ± 3.53	67.39 ± 18.18
Si	Leaf	35	1.46 ± 0.55	0.87 ± 0.99	9.19 ± 4.49	16.01 ± 19.76
Th	Leaf	55	6.04 ± 4.64	1.31 ± 0.72	5.48 ± 3.12	32.03 ± 16.02
Th	Sheath	10	7.14 ± 2.86	1.16 ± 0.31	13.17 ± 3.57	13.60 ± 4.07
Tp	Leaf	5	17.84 ± 6.51	7.45 ± 2.58	13.15 ± 3.66	65.9 ± 9.6
Tp	Stem	5	29.22 ± 2.62	7.05 ± 0.9	10.89 ± 1.94	128.22 ± 24.26
Zc	Leaf	10	2.38 ± 0.68	4.46 ± 0.56	3.43 ± 0.47	146.47 ± 20.95
Zc	Sheath	6	2.81 ± 0.65	3.08 ± 0.60	6.89 ± 0.86	58.01 ± 20.95
Zg	Leaf	5	3.21 ± 0.26	9.46 ± 1.61	5.07 ± 1.17	161.9 ± 117.93
Zg	Stem	5	7.77 ± 1.49	10.97 ± 3.66	4.38 ± 1.53	245.71 ± 61.25
Zm	Leaf	27	7.36 ± 3.46	5.09 ± 1.31	5.27 ± 1.36	123.74 ± 26.81
Zm	Sheath	20	7.77 ± 1.73	3.68 ± 0.36	15.61 ± 4.49	36.86 ± 8.68
Zn	Leaf	157	1.35 ± 0.51	5.25 ± 2.26	5.32 ± 2.16	127.95 ± 54.11
Zn	Sheath	98	1.13 ± 0.41	2.98 ± 1.14	15.67 ± 8.63	38.31 ± 13.97

Table S4. Non-mechanical traits (mean ± sd) of seagrass leaves by species. See Table S1 for species ID. (-) not measured.

Species	n	Leaf thickness (mm)	Leaf width (mm)	Leaf cross-section area (mm^2)	Leaf length (cm)	Leaf frontal area (cm^2)	Leaf mass area ($g\ m^{-2}$)	Leaf fibre content (% DW)
Aa	20	0.20 ± 0.08	8.43 ± 0.60	1.66 ± 0.60	4.5 ± 0.6	2.60 ± 0.46	84.6 ± 37.6	43.5 ± 2.6 (6)
Ag	10	0.26 ± 0.07	6.86 ± 0.44	1.80 ± 0.59	6.0 ± 0.9	3.05 ± 0.61	105.5 ± 47.9	47.8 ± 0.8 (3)
Cn	170	0.31 ± 0.10	3.66 ± 1.04	1.19 ± 0.61	29.3 ± 19.0	10.11 ± 8.88	50.4 ± 16.9	50.8 ± 7.7 (63)
Cr	29	0.24 ± 0.03	4.79 ± 0.87	1.13 ± 0.20	16.3 ± 4.9	6.20 ± 2.26	36.1 ± 9.9	44.1 ± 4.4 (11)
Cs	27	0.19 ± 0.03	8.28 ± 0.87	1.66 ± 0.31	12.7 ± 3.5	8.76 ± 3.33	33.2 ± 3.1	51.6 ± 4.4 (13)
Ea	45	0.64 ± 0.13	15.77 ± 2.31	10.20 ± 3.17	50.5 ± 18.1	71.33 ± 37.8	74.9 ± 11.7	52.1 ± 12.2 (9)
Hb	5	0.05 ± 0.01	7.36 ± 0.71	0.39 ± 0.11	-	-	-	-
Ho	34	0.09 ± 0.02	14.07 ± 1.80	1.23 ± 0.31	3.3 ± 0.4	4.01 ± 0.83	26.6 ± 9.3	44.7 ± 4.8 (15)
Hp	5	0.15 ± 0.04	0.83 ± 0.15	0.12 ± 0.02	-	-	-	-
Hu	33	0.17 ± 0.05	3.48 ± 0.66	0.62 ± 0.62	12.1 ± 2.9	4.17 ± 1.28	38.5 ± 8.2	44.3 ± 5.2 (10)
Pa	44	0.59 ± 0.1	10.78 ± 1.47	6.37 ± 1.44	54.6 ± 17.9	52.76 ± 20.57	72.9 ± 7.4	51.1 ± 4.0 (15)
Pc	5	1.04 ± 0.15	6.39 ± 0.74	6.72 ± 1.67	76.0 ± 9.9	48.88 ± 10.39	124.7 ± 17.3	58.4 ± 0.8 (3)
Po	13	0.34 ± 0.14	9.98 ± 0.80	3.41 ± 1.33	60.3 ± 6.6	54.84 ± 4.13	68.9 ± 3.7	57.6 ± 4.3 (3)
Ps	12	0.27 ± 0.04	7.21 ± 0.83	1.96 ± 0.46	50.2 ± 18.4	35.33 ± 12.14	54.7 ± 8.4	59.5 ± 1.4 (6)
Rm	10	0.17 ± 0.03	0.82 ± 0.09	0.14 ± 0.02	8.5 ± 1.6	0.58 ± 0.15	39.1 ± 2.4	37.3 ± 1.9 (3)
Si	35	1.68 ± 0.34	1.68 ± 0.34	2.32 ± 0.85	12.1 ± 5.1	1.91 ± 0.87	54.3 ± 25.8	30.7 ± 6.8 (9)
Th	55	0.40 ± 0.10	11.10 ± 2.31	4.59 ± 1.96	15.7 ± 5.5	14.22 ± 8.14	45.5 ± 4.4	46.8 ± 7.2 (18)
Tp	5	0.17 ± 0.02	14.18 ± 0.89	2.40 ± 0.36	29.3 ± 7.9	35.58 ± 11.15	45.5 ± 5.3	49.4 ± 1.1 (3)
Zc	10	0.19 ± 0.02	2.72 ± 0.56	0.53 ± 0.14	13.8 ± 3.4	2.66 ± 0.91	38.2 ± 1.7	44.0 ± 1.3 (3)
Zg	5	0.16 ± 0.01	2.21 ± 0.30	0.35 ± 0.06	14.9 ± 1.9	2.53 ± 0.44	42.4 ± 20.7	55.2 ± 1.4 (3)
Zm	28	0.30 ± 0.06	4.58 ± 0.71	1.42 ± 0.51	27.3 ± 6.8	10.56 ± 4.70	43.3 ± 10.3	43.9 ± 1.6 (12)
Zn	157	0.21 ± 0.05	1.25 ± 0.27	0.28 ± 0.11	18.8 ± 8.3	1.70 ± 1.00	34.4 ± 7.5	41.7 ± 3.8 (27)