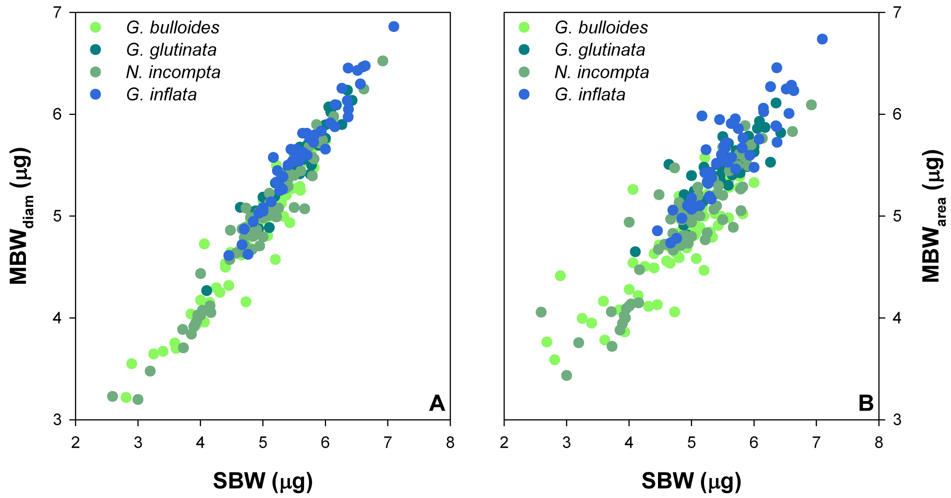
Sieve-based versus Measurement-based Weight

In supplementary figure 1 we show SBW versus MBW_{diam} (A) and MBW_{area} (B). A better correlation is found between SBW and MBW_{diam} than between SBW and MBW_{area}. Combined with the observation that SBW correlates with size (main text figure 1), this may indicate that diameter-normalised MBWs do not adequately isolate changes in test weight driven by test wall thickness and density from those driven by size. However, we also show that there is no correlation between size and MBW_{diam} (or MBW_{area}; supplementary figure 3), which suggests that the diameter-based normalisation procedure can be used to characterise test wall thickness and density. Hence, while MBWs established using either test area or diameter may be employed to estimate SNW, it may be prudent to use area during the normalisation procedure.



Supplementary Figure 1: Sieve-based weight (SBW) versus measurement-based weight (MBW) calculated using test diameter (A; $r^2 = 0.91$; $p<0.0001$) and test area (B; $r^2 = 0.67$; $p<0.0001$).

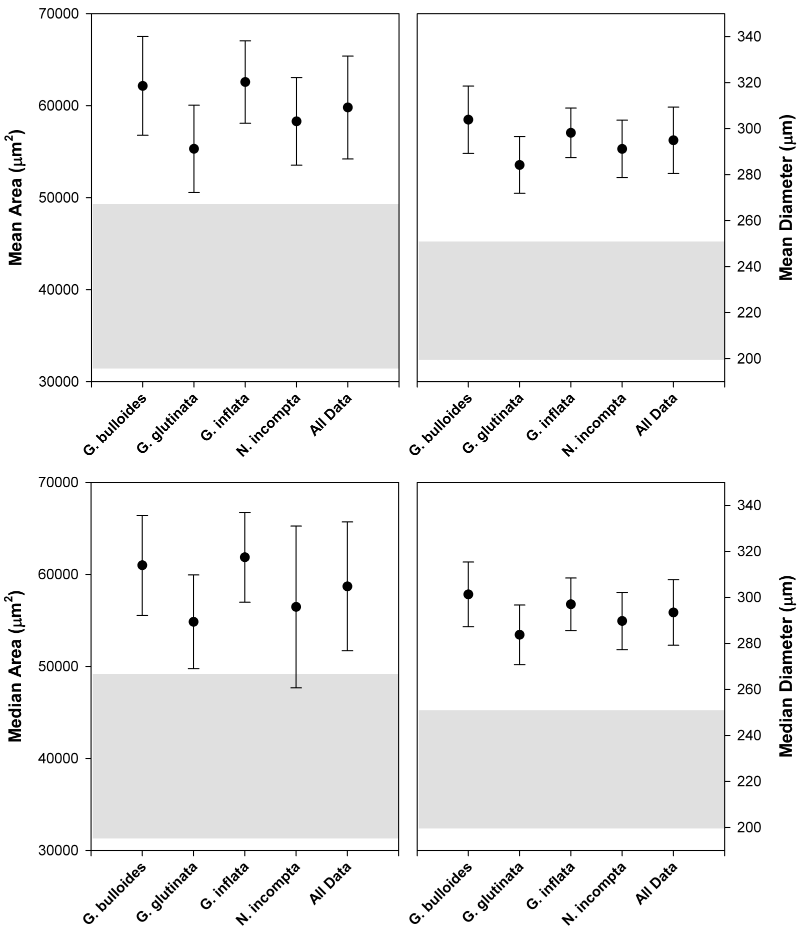
Sieving Efficacy:

In supplementary table 1 we provide basic statistics for area and diameter measurements for specimens collected during cruises M21-2 and M21-3. These data are provided to exemplify the ranges in test size that exist following sieving. Note that both the mean and median values frequently exceed the 225μm midpoint expected after sieving, and that the minimum and maximum values also reflect this bias towards larger tests. This bias exists because foraminifera are not spherical and hence imperfectly seperated into size bins by sieving.

Cruise	Station	MCN	Species	n	Area (μm^2)				Diameter (μm)			
					mean	max	min	median	mean	max	min	median
M21-2	148	627	*G. bulloides*	10	40343.34	47506.18	29586.42	42049.19	248.34	270.68	207.56	252.78
M21-2	148	627	*G. glutinata*	11	34953.92	42671.60	30462.14	33386.04	228.64	247.46	209.09	223.53
M21-2	148	627	*N. incompta*	26	37069.59	54584.33	26467.11	35521.07	233.72	311.58	196.17	230.58
M21-2	148	627	*G. inflata*	16	39778.01	48360.19	31989.23	40905.68	240.02	274.97	211.17	242.61
M21-2	164	640	*G. bulloides*	10	60080.40	76499.13	50907.74	58184.93	299.43	346.44	269.04	292.80
M21-2	164	640	*N. incompta*	21	56120.73	65722.67	40789.88	57081.23	286.92	315.19	241.46	291.17
M21-2	164	640	*G. inflata*	15	62453.30	74161.45	50364.94	62342.81	300.43	334.82	270.11	300.85
M21-2	176	649	*G. glutinata*	19	62896.28	77563.02	49966.89	65404.22	302.54	339.92	268.49	308.33
M21-2	176	649	*N. incompta*	19	57240.84	66670.76	48729.29	56531.19	289.67	305.45	264.53	289.72
M21-2	176	649	*G. glutinata*	21	55195.72	63667.25	45798.15	53867.83	286.29	312.36	262.19	282.04
M21-2	176	649	*N. incompta*	23	56066.74	69022.91	49474.74	55250.17	285.98	318.85	267.18	284.24
M21-2	176	649	*G. glutinata*	20	59168.85	77266.29	46210.68	58300.73	296.62	340.70	258.06	297.99
M21-2	176	649	*N. incompta*	24	56358.40	69804.55	45052.70	55688.04	289.23	317.75	259.13	289.80
M21-2	176	650	*G. glutinata*	17	58496.78	73611.41	47303.53	57160.84	294.08	328.65	272.81	292.87
M21-2	176	650	*N. incompta*	16	57944.29	70607.90	49054.98	56339.40	293.81	333.47	266.57	285.03
M21-2	176	650	*G. glutinata*	14	61337.33	73075.85	49105.64	60613.07	298.49	324.96	266.19	292.45
M21-2	176	650	*N. incompta*	13	65814.52	78670.34	50697.86	66887.88	308.26	337.87	267.93	311.88
M21-2	176	650	*G. glutinata*	21	56868.25	69182.13	47375.90	55532.43	287.48	317.08	265.53	286.00
M21-2	176	650	*N. incompta*	14	63732.39	78366.37	50350.47	63725.15	301.91	336.81	268.62	301.19
M21-2	176	650	*G. glutinata*	15	55094.33	67626.10	45950.14	53889.55	284.90	319.08	258.40	281.52
M21-2	176	650	*N. incompta*	17	57167.65	72113.27	50524.16	57862.87	288.97	328.86	268.78	287.67
M21-2	177	651	*G. glutinata*	14	56832.06	64868.65	40283.27	58087.23	288.03	305.73	244.39	289.49
M21-2	177	651	*N. incompta*	10	53658.67	67329.36	39885.21	53346.74	278.65	313.76	242.51	279.62
M21-2	177	651	*G. glutinata*	11	56066.68	71954.05	46927.18	53491.49	286.18	327.19	258.70	280.61
M21-2	177	651	*G. glutinata*	10	55694.55	63725.15	47701.58	57273.02	281.38	300.92	255.37	287.99
M21-2	158	638	*G. bulloides*	14	59153.54	78938.13	46203.45	56115.04	294.18	341.29	261.31	289.88
M21-2	158	638	*N. incompta*	15	54491.21	65715.43	44502.66	300.92	282.87	326.67	255.82	285.42
M21-2	158	638	*G. inflata*	12	62747.50	79842.80	46008.04	61908.57	301.20	346.99	254.69	300.49
M21-2	158	638	*G. bulloides*	26	51531.83	80899.46	33472.89	51776.23	279.51	375.87	227.03	281.29
M21-2	158	638	*N. incompta*	13	55264.09	68342.60	44292.78	53629.00	284.65	315.59	260.15	281.39
M21-2	158	638	*G. inflata*	13	58828.22	72221.83	42591.99	58521.47	289.66	331.66	246.10	288.91
M21-2	167	643	*N. incompta*	31	50992.96	68320.89	34022.93	51211.71	273.16	321.54	222.69	274.29
M21-2	167	643	*G. glutinata*	11	47900.94	66678.00	32409.00	48135.83	266.53	314.44	221.18	263.49
M21-2	167	643	*G. inflata*	10	58948.48	73264.02	52514.44	57070.38	289.92	324.43	273.65	286.84
M21-2	172	647	*G. inflata*	25	60879.99	77063.64	50184.01	59172.84	293.37	334.32	261.63	290.13
M21-3	204	671	*G. bulloides*	17	54562.62	67416.21	35159.20	54540.91	287.00	321.82	234.13	290.58
M21-3	204	671	*G. glutinata*	10	47213.06	58825.44	31844.48	47495.32	267.02	293.16	227.70	269.33
M21-3	204	671	*N. incompta*	41	56521.66	69688.75	38814.08	55583.09	288.84	325.29	237.72	287.63
M21-3	204	671	*G. inflata*	23	61976.53	81463.97	38394.31	62574.40	301.09	345.08	237.09	300.59
M21-3	211	674	*G. bulloides*	13	53843.90	77063.64	42541.33	52608.53	281.56	340.44	251.10	278.06
M21-3	211	674	*N. incompta*	31	57229.48	76614.93	44343.44	54280.36	290.79	340.29	253.45	285.68
M21-3	214	679	*N. incompta*	22	59114.28	73104.80	48034.50	59892.95	294.81	340.97	259.92	297.35
M21-3	216	682	*G. bulloides*	32	62710.11	77584.73	49018.79	62418.80	307.39	351.54	272.71	306.86
M21-3	216	682	*N. incompta*	27	59373.87	79379.61	48989.84	56357.49	295.94	346.10	266.63	286.24
M21-3	216	682	*G. inflata*	11	62677.04	73987.76	40391.83	62711.91	298.56	337.57	242.04	298.28
M21-3	217	684	*N. incompta*	26	57640.46	70767.12	45971.85	56733.84	291.32	325.33	259.56	287.82
M21-3	219	687	*G. bulloides*	23	58056.70	75326.67	38770.66	56683.18	296.86	353.64	239.65	292.38
M21-3	219	687	*N. incompta*	22	51117.63	65462.12	30628.60	53100.67	274.72	307.79	218.52	279.50
M21-3	223	691	*N. incompta*	14	54019.82	60381.48	47658.16	54924.49	281.24	296.94	261.96	283.24

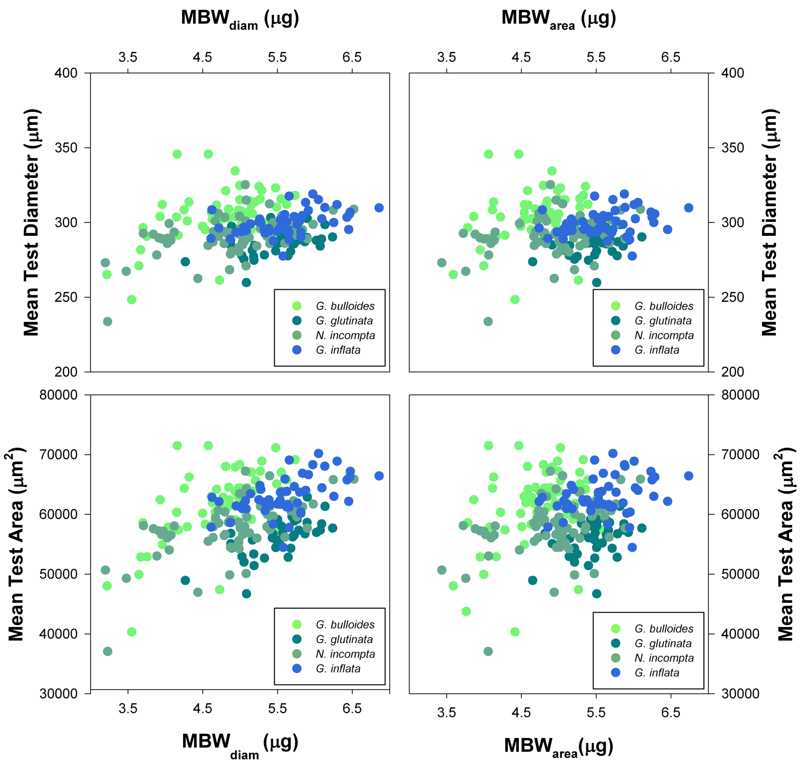
Supplementary Table 1: The mean, minimum, maximum and median values of area and diameter for aliquots of tests collected during cruise M21 legs 2 and 3 from the 200-250μm sieve fraction.

In supplementary figure 2 we show the mean and median measured test area and diameter for the tests analysed as part of this study. The grey shaded areas correspond to the size range that would be expected given the sieve mesh size (200-250μm) assuming the tests are spherical. However, because the tests are not spherical, the sieved tests are larger than expected. Also shown in supplementary figure 2 are the standard deviations associated with the mean measured values.



Supplementary Figure 2: The mean and median values of test size by species. Error bars equal the corresponding standard deviation ($\pm 1\sigma$) for the size measurements. The grey shaded areas correspond to the expected maximum size range given the sieve fraction size window of 50μm, assuming the tests are spherical. The sieved tests are larger than would be expected given the sieve mesh size because they are non-spherical.

In supplementary figure 3 we show that both MBW_{diam} and MBW_{area} do not correlate with test area (r^2=0.18 and r^2=0.007, respectively) and diameter (r^2=0.07; r^2=0.003, respectively). These observations suggests that the measurement-based technique isolates changes in test weight driven by test wall thickness and density from those driven by size. These observations suggest that MBWs can be used to reliably characterise variations in test wall thickness and density.



Supplementary Figure 3: Foraminiferal test size versus MBW_{area} and MBW_{diam} for each of the species considered as part of this study. The lack of correlations between size and MBW suggests that size does not influence measurement-based weights, and that such weights can be used to reliably characterise variations in test wall thickness and density.