

Assessing reef island sensitivity based on LiDAR-derived morphometric indicators

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Table S1. Tidal data corresponding to 22 islands survey during October 2016. Contour elevation of each island (m, AHD) compared against Highest Astronomical Tide (HAT) across the island archipelago.

Island	Easting	Northing	Contour elevation (m)	HAT
Eva	234739.63	7573587.1	1.33	1.33
Y	233554.6	7570055.8	1.33	1.33
Observation	245821.8	7593864.85	1.35	1.35
Brown	247839.55	7577895.81	1.35	1.35
Ashburton	286255.54	7610836.86	1.39	1.39
Tortoise	278498.3	7612070.98	1.38	1.38
Direction	306383.38	7617551.59	1.51	1.51
NE Twin	315344.12	7620348.47	1.59	1.59
False	338431.2	7637520.69	1.77	1.77
Mary Anne	340391.9	7648062.2	1.79	1.79
Middle Mary Anne	351919.23	7644803.25	1.88	1.88
East	354535.04	7646890.44	1.91	1.91
Great Sandy	358706.77	7655452.75	1.94	1.94
Pup	360729.52	7659501.13	1.96	1.96
South Passage	368209.14	7661576.15	2.02	2.02
Passage	373882.09	7665676.34	2.06	2.06
Angle	378070.89	7668666.97	2.10	2.10
Middle	379420.4	7672048.24	2.11	2.11
Long	380633.02	7675704.32	2.12	2.12
Round	381798.15	7679915.56	2.13	2.13
Mardie	394427.08	7681512.06	2.23	2.23
Steamboat	402862.91	7697258.33	2.30	2.30

Sentinel-2 imagery

We can confirm that all satellite imagery used in Figures 1 is from Sentinel 2 [Set 2018] (Public Domain). Full terms available at https://scihub.copernicus.eu/twiki/pub/SciHubWebPortal/TermsConditions/Sentinel_Data_Terms_and_Conditions.pdf

Table S2. Table of morphometric data for the 22 Pilbara reef islands. Data includes island area (ha), Reef platform area (ha), island volume (m³), Average and maximum elevation (m), perimeter scarping and island major axis orientation.

Island	Island area (ha)	Reef platform area (ha)	Island volume (m ³)	Average island elevation (m)	Maximum elevation (m)	Perimeter slope > 30° orientation	Island major axis orientation (°)
Long	60.2	493.0	4723208	7.8	18.2	S	346
Y	30.7	101.3	1266198	4.1	8.6	NW,NE	331
Round	28.3	278.5	2388685	8.4	17.5	NW	74
Ashburton	27.0	78.6	1279850	4.7	11.4	-	8
Angle	21.2	212.9	1604321	7.5	16.0	NW	299
Great Sandy	18.0	495.3	1157551	6.4	15.9	-	34
Direction	17.8	152.5	790717	4.4	9.6	NW	285
Steamboat	14.5	18.1	960757	6.6	14.8	N,S,NE,NW	307
Eva	15.6	85.0	559427	4.9	8.9	N,NE,NW,S,SW	333
Observation	14.7	90.6	773537	5.2	10.1	E	305

Brown	13.0	41.8	535348	4.0	11.4	SW	310
Mardie	13.3	20.0	796399	5.9	11.7	-	303
Middle	10.6	132.1	738341	6.9	16.2	NE	289
South Passage	6.6	103.5	402464	6.0	13.7	NE	303
NE Twin	6.3	6.1	448096	7.0	13.4	NE,NW	287
East	4.8	109.8	249957	5.1	12.5	NW	357
Tortoise	3.5	8.4	182367	5.2	11.6	NW, SW	322
False	3.1	29.0	120718	3.8	6.2	-	13
Pup	2.2	151.0	109915	4.9	9.4	NW	3
Middle	1.1	56.4	35245	3.0	4.7	-	296
Mary Anne	0.9	51.9	19522	1.9	3.01	-	10
Mary Anne Passage	9.3	213.5	744661	7.9	18.2	S	351

Table S3. Table of morphometric data for the 22 Pilbara reef islands gathered from 2016 LiDAR used in the Principle components analyses. Factor scores derived from the PCA were normalised to generate an indexed value range between 1 and 0 (1 being high sensitivity characteristics and 0 low sensitivity characteristics).

Island	Island Area	Island Vol	Average elevation	Platform Area	Perimeter not scarped	Factor score	Normalised value (1 – 0)	
Mary-Anne	0.98	19522.61	1.98	51.95	416.15	-1.2868	0.00	1.00
Mid Mary-Anne	1.14	35245.82	3.08	56.46	514.73	-1.12668	0.16	0.96
Pup	2.22	109915.17	4.93	151	697.33	-0.678	0.61	0.86
FALSE	3.15	120718.77	3.82	29.07	690.18	-0.98916	0.30	0.93
Tortoise	3.5	182367.62	5.2	8.4	738.94	-0.83881	0.45	0.90
East	4.86	249957.63	5.13	109.81	951.36	-0.57784	0.71	0.84
NE Twin	6.36	448096.64	7.04	6.16	606.78	-0.555	0.73	0.84
Sth Passage	6.66	402464.68	6.04	103.54	1279.77	-0.3339	0.95	0.79
Passage	9.32	744661.94	7.98	213.59	1246.26	0.19266	1.48	0.67
Middle	10.64	738341.16	6.93	132.19	1455.49	0.01487	1.30	0.71
Brown	13	535348.75	4.01	41.85	2270.44	-0.25964	1.03	0.77
Mardie	13.32	796399.43	5.97	20.04	1798.67	-0.13015	1.16	0.74
Steamboat	14.5	960757.69	6.62	18.14	2058.75	0.06697	1.35	0.70
Observation	14.72	773537.52	5.25	90.60	1150.59	-0.34501	0.94	0.79
Eva	15.6	559427	4.90	85.01	1038.54	-0.34747	0.94	0.78
Direction	17.82	790717.24	4.43	152.51	1694.24	-0.01845	1.27	0.72
Great Sandy	18.03	1157551.17	6.41	495.3	4132.64	1.49735	2.78	0.62
Angle	21.2	1604321.42	7.55	212.91	1865.97	0.73695	2.02	0.45
Ashburton	27.02	1279850.38	4.73	78.62	1898.3	0.23301	1.52	0.66
Round	28.31	2388685.21	8.43	278.52	1983.07	1.30325	2.59	0.58
Y	30.71	1266198.32	4.12	101.33	1805.43	0.24576	1.53	0.66
Long	60.2	4723208.16	7.84	493	3626.56	3.1961	4.48	1.00

Table S4. Statistical results of PCA explaining total variance explained and components matrix (strength of individual parameters).

Total Variance Explained					
Component	Initial Eigenvalues			Extraction Sums of Squared ...	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	3.636	72.725	72.725	3.636	72.725
2	.653	13.062	85.787		
3	.467	9.348	95.135		
4	.220	4.403	99.538		
5	.023	.462	100.000		

Component Matrix^a

	Component 1
Island_Area	.900
Island_Volume	.941
Island_Elevation	.669
Platform_Area	.858
Perimeter_escarpment	.870

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Table S5. Table of morphometric data for the 22 Pilbara reef islands gathered from 2016 LiDAR used in the Principle components analyses. 2018 LiDAR data for 4 islands (Eva, Obs, Ashburton and Y) included to calculate change in ISCi between 2016 and 2018. Factor scores derived from the PCA were normalised to generate an indexed value range between 1 and 0 (1 being high sensitivity characteristics and 0 low sensitivity characteristics).

Island	Island Area	Island Vol	Average elevation	Platform Area	Perimeter not scarped	Factor score	Normalised value (1 – 0)	
Mary-Anne M	0.98	19522.61	1.98	51.95	416.15	-1.28641	0.00	1.00
MaryAnne Pup	1.14	35245.82	3.08	56.46	514.73	-1.12582	0.16	0.96
FALSE	2.22	109915.17	4.93	151	697.33	-0.67658	0.61	0.86
Tortoise	3.15	120718.77	3.82	29.07	690.18	-0.98815	0.30	0.93
East	3.5	182367.62	5.2	8.4	738.94	-0.8371	0.45	0.90
NE Twin	4.86	249957.63	5.13	109.81	951.36	-0.57666	0.71	0.84
Sth Passage	6.36	448096.64	7.04	6.16	606.78	-0.55236	0.73	0.84
Passage	6.66	402464.68	6.04	103.54	1279.77	-0.33267	0.95	0.79
Middle	9.32	744661.94	7.98	213.59	1246.26	0.19453	1.48	0.67
Brown	10.64	738341.16	6.93	132.19	1455.49	0.01606	1.30	0.71
Brown	13	535348.75	4.01	41.85	2270.44	-0.26073	1.03	0.77
Mardie	13.32	796399.43	5.97	20.04	1798.67	-0.12975	1.16	0.74
Steamboat	14.5	960757.69	6.62	18.14	2058.75	0.06736	1.35	0.70
Direction	17.82	790717.24	4.43	152.51	1694.24	-0.01921	1.27	0.72
Great Sandy	18.03	1157551.17	6.41	495.3	4132.64	1.49435	2.78	0.62
Angle	21.2	1604321.42	7.55	212.91	1865.97	0.73719	2.02	0.45
Round	28.31	2388685.21	8.43	278.52	1983.07	1.30317	2.59	0.58
Long	60.2	4723208.16	7.84	493	3626.56	3.19151	4.48	1.00
Obs 2018	15.08	823615.57	5.4	90.30	1094.36	-0.3235	0.96	0.22
Ash 2018	27.06	1286335.13	4.75	78.58	1892.87	0.23492	1.52	0.34
Eva 2018	15.18	724226.7	4.77	85.43	930.74	-0.40986	0.88	0.20
Y 2018	31.32	1322658.81	4.22	100.72	1806.35	0.27972	1.57	0.35

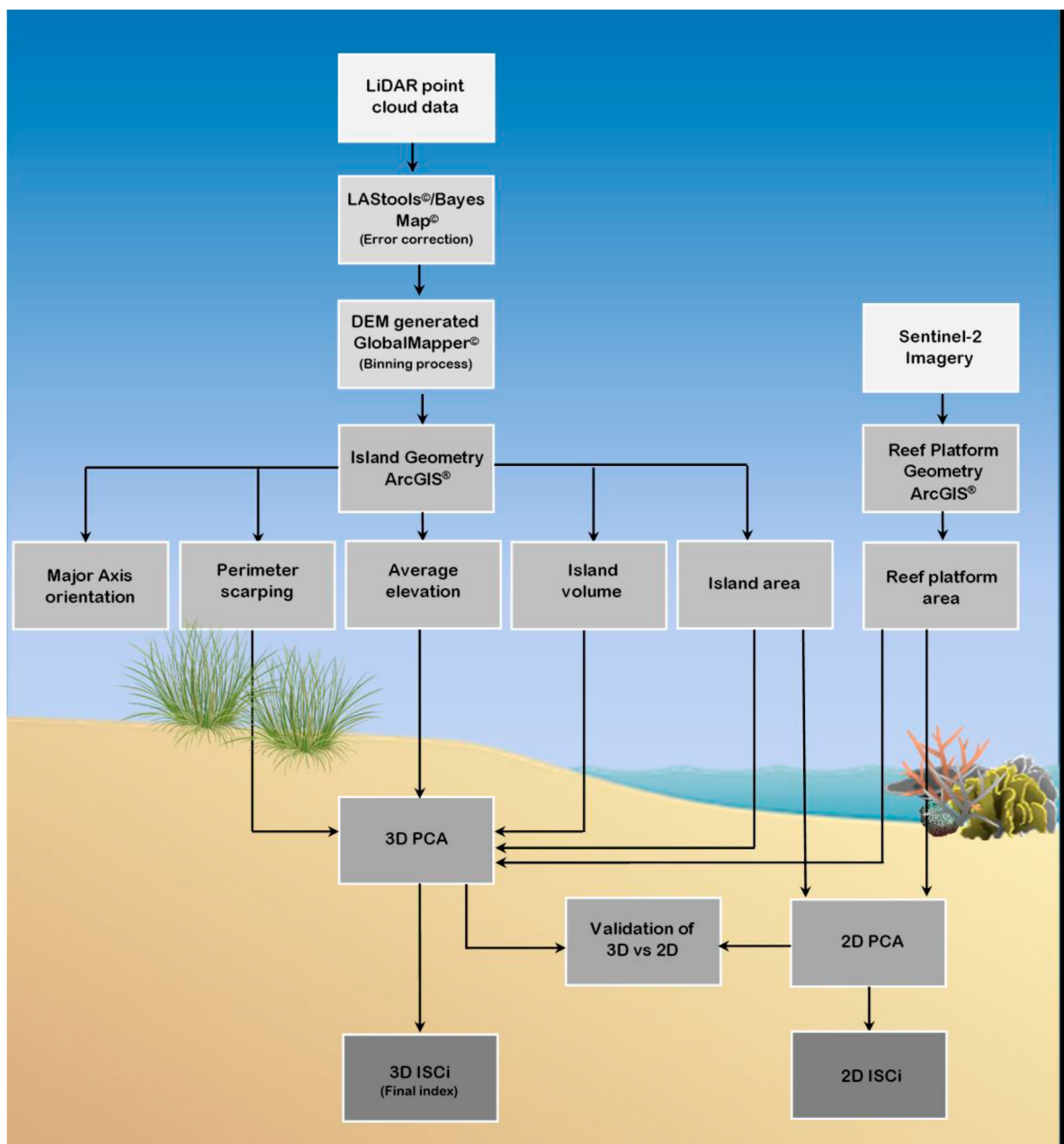


Figure S1. Methodology flow chart (including processing and analysis of DEM and Sentinel-2 imagery).