Supplementary information

Table S1. Results from the AMS ^{14}C analyses used to construct the age model in Bacon (Blaauw and Christen, 2011). Italicised samples were identified as outliers and excluded from the age model. Calibrated years BP (Cal yr BP) represents the 'best' estimation of calibrated age calculated in the age model where present is 1950 CE. Samples with prefix '-Wk' were dated at Waikato University, those with the prefix 'OZ' were dated at the Australian Nuclear Science and Technology Organisation (ANSTO) AMS facility (Fink et al. 2004).

Laboratory ID	Sample type	^{14}C age	^{14}C age with offset applied	1σ error	Depth (cm)	Cal yr BP
surface		-55	-55	1	0	-55
OZZ021	*A. helmsi* shell	1030	214	32	5.5	-10
OZS803	*A. helmsi* shell	*1720*	*904*	*27*	*9.5*	*33*
OZZ022	*A. helmsi* shell	985	169	32	10.5	45
OZZ023	*A. helmsi* shell	985	169	32	16.5	117.5
OZS804	*A. helmsi* shell	985	169	27	20.5	167.5
Wk-24750	*A. helmsi* shell	*1584*	*768*	*32*	*30.5*	*302.5*
OZZ024	*A. helmsi* shell	*1575*	*759*	*36*	*30.5*	*302.5*
OZS805	*A. helmsi* shell	1320	504	27	45.5	506
OZZ025	*A. helmsi* shell	1505	689	32	55.5	612.5
OZS806	*A. helmsi* shell	1665	849	22	65.5	726
Wk-24751	*A. helmsi* shell	1987	1171	32	82.5	1056.5
OZZ026	*A. helmsi* shell	2235	1419	35	89.5	1262
OZS807	*A. helmsi* shell	2420	1604	27	95.5	1384
OZZ027	*A. helmsi* shell	2365	1549	32	106.5	1494
OZS808	*A. helmsi* shell	2630	1814	27	115.5	1617.5
OZZ028	*A. helmsi* shell	2565	1749	36	122.5	1679
Wk-24752	*A. helmsi* shell	2638	1822	32	129.5	1755

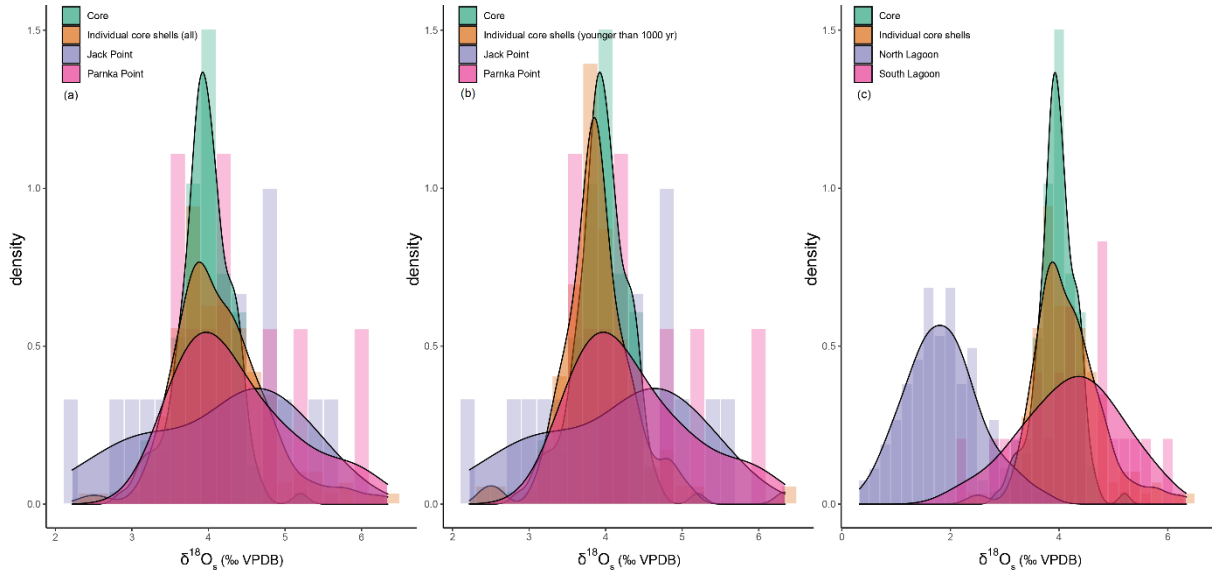

Figure S1: Density plots with histograms of *A. helmsi* $\delta^{18}O_s$ comparing values from core C18 aggregate and individual shell values with (a) modern locations in the South Lagoon and (b) the North and South Lagoon. Modern $\delta^{18}O_s$ values for the North Lagoon are sourced from Chamberlayne et al. (2021). $\delta^{18}O_s$ values for the modern South Lagoon sites Jack Point and Parnka Point are calculated from temperature and $\delta^{18}O_w$ values from Chamberlayne et al. (2021) using the oxygen isotope fractionation equation developed in that study.