Supplemental Information for

Constraining planktic foraminiferal depth habitats for improved polar and subpolar paleoreconstructions

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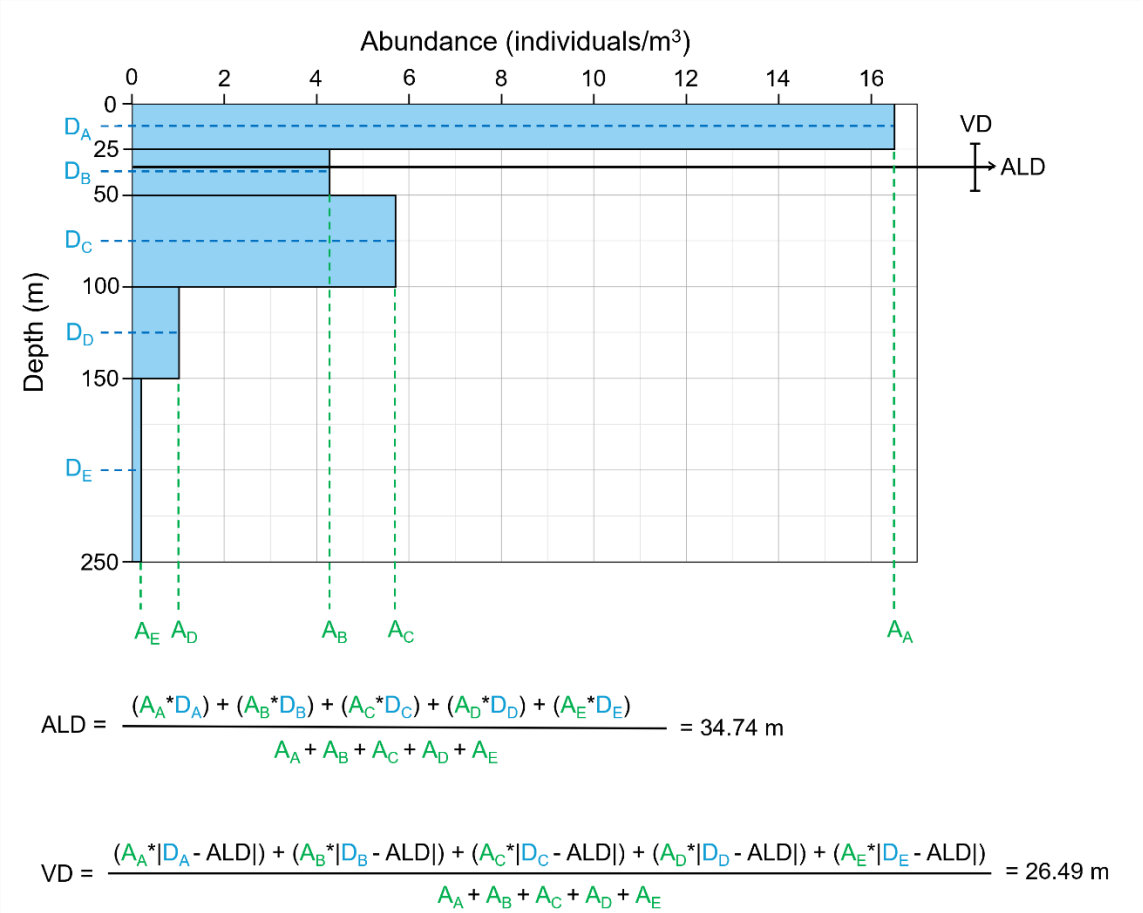

Figure S1. Example of how ALD and VD formulas were adapted from Rebotim et al. (2017) to a site from this study. Graph shows the depth habitat of *N. pachyderma* at station LP27 when sampled in May 2023. The abundance concentration at each depth interval is expressed as A_A, A_B, A_C, A_D, and A_E, while the averages of the sampling depths are D_A, D_B, D_C, D_D, and D_E.

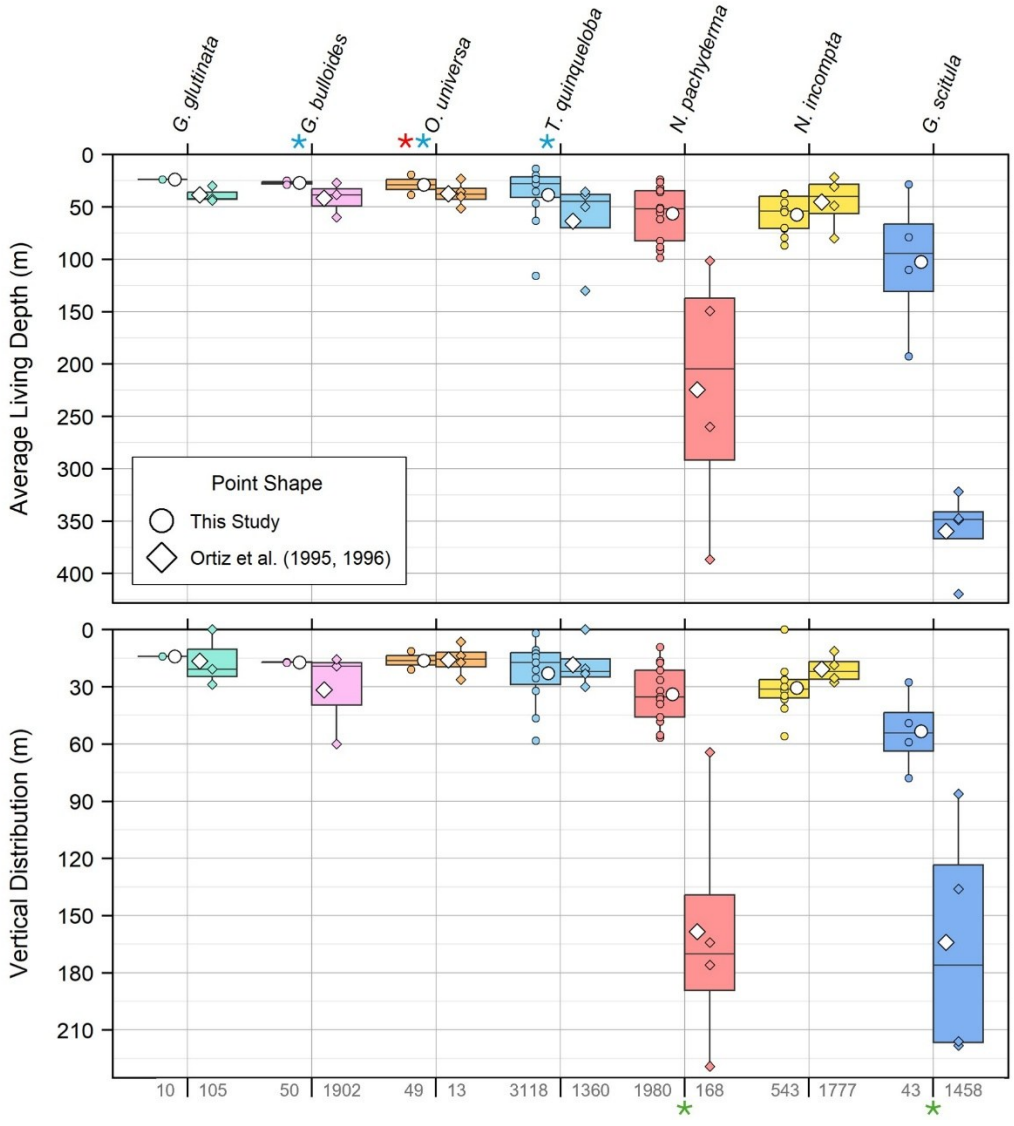

Figure S2. (a) ALD and **(b)** VD values for all seven species found in both this study and that of Ortiz et al. (1995, 1996). Small points represent individual data points, while large points represent unweighted means. Points are shaped by study, with circles denoting this study and diamonds representing Ortiz et al. (1995, 1996). For each individual species, boxplots from this study are on the left while boxplots based upon data from Ortiz et al. (1995, 1996) are on the right. A blue asterisk signifies a spinose species, which a red asterisk signifies a species with algal symbionts. Green asterisks denote species where the depth habitat reconstructed in this study differed significantly from the depth habitat constrained by Ortiz et al., (1995, 1996). Raw counts of individuals that informed all ALD and VD calculations for a particular taxa are located below the boxplot, with the numbers on the left correlating to this study and those on the right correlating to the study of Ortiz et al. (1995, 1996).

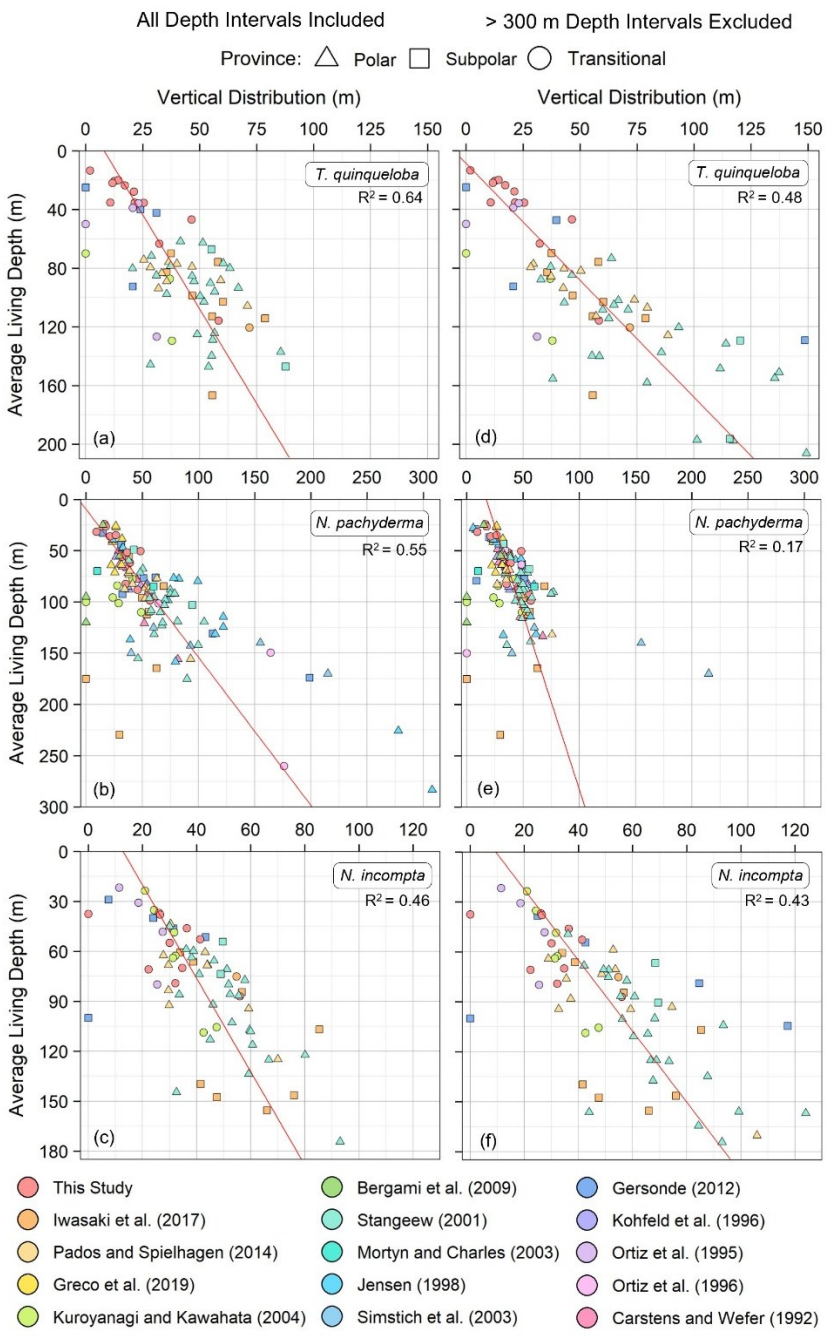

Figure S3. Data taken from 12 studies that assessed the ALD and VD of **(a, d)** *T. quinqueloba,* (**b, e**) *N. pachyderma*, and/or (**c, f**) *N. incompta,* calculated per the methods of Rebotim et al. (2018). The left column represents ALD and VD values calculated using all depth intervals sampled in each study, whereas the right column denotes ALD and VD determined without data from depth intervals >300 m factored into the calculation. Points are shaped by province and colored by study. Linear regression lines for each panel are shown in red, all of which had p-values less than 2.0×10^{-7}.

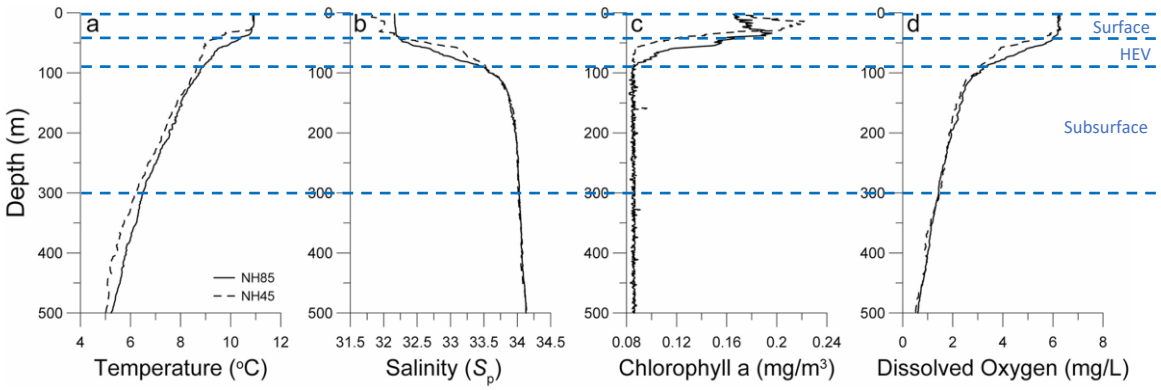

Figure S4. Station profiles of a) temperature, b) salinity, c) chlorophyll α, and d) dissolved oxygen from two sites located along the Newport Hydrographic Line in May 2022 (modified from Hupp and Fehrenbacher, 2023). Blue dashed lines indicate general boundary of the zones categorized by environmental conditions: 1) the surface zone where temperature, primary productivity, and DO are high while salinity is low; 2) the zone of High Environmental Variability (abbreviated as "HEV" hereafter) where the thermocline begins, the halocline occurs, and primary productivity and DO rapidly drop; and 3) the subsurface zone where temperature and DO are low, there is little to no primary production, and salinity is high.

Table S1. A summary of prior depth habitat studies from which data was extracted to compare to the results of this study, with a particular focus on *T. quinqueloba, N. pachyderma,* and *N. incompta*. "Study" lists the publication that the data originated from; "Province" indicates the foraminiferal province that the study sampled in; "Location" provides the general location where the sampling took place; "Sample Year(s)" indicate the years during which data was collected; "Max Depth (m)" reports the maximum depth to which samples were taken; "Size Fraction (µm)" lists the sizes of individuals that were included in the study; "Average ALD and VD (m)" lists ALD ± VD values for *T. quinqueloba*, *N. pachyderma*, and *N. incompta*; "# of Applicable Sites" lists the number of sites used to inform each ALD and VD calculation per species are listed. Asterisks denote the studies where publicly available data (in individuals/m3) was used to calculate ALD and VD following Rebotim et al. (2017). All other rows indicate studies that had either already applied the methods of Rebotim et al. (2017) (e.g., Greco et al., 2019) or did not have publicly available data, but ALD and VD values had been calculated or reported by Kretschmer et al. (2018).

						Average ALD and VD (m)			# of Applicable Sites		
Study	**Province**	**Location**	**Sample Year(s)**	**Max Depth (m)**	**Size Fraction (µm)**	*T. quin*	*N. pachy*	*N. inc*	*T. quin*	*N. pachy*	*N. inc*
Carstens and Wefer (1992)	Polar	Arctic	1987	500	> 63		73 ± 11			13	
Simstich et al. (2003)	Polar	Arctic	1992, 1994	300	125-250		146 ± 118			4	
Kohfeld et al. (1996)*	Polar	Arctic	1992-1993	275	N/A		80 ± 43			6	
Jensen (1998)	Polar	Arctic	1994-1996	1000	63-500		119 ± 105			15	
Greco et al. (2019)	Polar	North Atlantic/Arctic	2008	300	> 100		49 ± 28			8	
Pados and Spielhagen (2014)*	Polar	North Atlantic/Arctic	2011	500	100-250	95 ± 53	89 ± 51	88 ± 53	10	10	10
Stangeew (2001)*	Polar	North Atlantic/Arctic	1997, 1999	500	125-250	133 ± 82	104 ± 68	109 ± 68	25	25	25
Bergami at al. (2009)	Polar	Southern	1998-2001	220	> 100		74 ± 11			4	
Mortyn and Charles (2003)	Subpolar	Southern	1996	440	> 150		78 ± 35			2	
Gersonde (2012)*	Subpolar	North Pacific	2009	1000	> 160	74 ± 52	90 ± 72	79 ± 45	4	7	6
Iwasaki et al. (2017)*	Subpolar	Subarctic Pacific	2015	300	> 100	105 ± 56	124 ± 45	109 ± 56	9	9	9
Ortiz et al. (1995)*	Transitional	Eastern Pacific	1990	200	> 125	63 ± 19		45 ± 21	4		4
Ortiz et al. (1996)*	Transitional	Eastern Pacific	1990	800	> 125		224 ± 158			4	
This Study	Transitional	Eastern Pacific	2022-23, 2025	300	N/A	38 ± 23	56 ± 39	57 ± 31	11	13	10
Kuroyanagi and Kawahata (2004)*	Transitional	Western Pacific	2002	200	125-1000	96 ± 25	94 ± 28	64 ± 33	3	6	7

Table S2. Results from SIMPER analysis on community composition of sites grouped by year. Mean change in relative abundance reflects the change from older sample year to newer, with negative values representing a decrease in abundance and positive values representing an increase.

Comparison			Species	Bray-Curtis Dissimilarity	% Contribution to Dissimilarity	Highest Abundance	Mean (a) Change
2022	vs	2023	*T. quinqueloba*	0.358	33.41%	2022	-0.171
2022	vs	2023	*N. pachyderma*		32.94%	2023	0.179
2022	vs	2025	*T. quinqueloba*	0.654	40.05%	2022	-0.524
2022	vs	2025	*N. pachyderma*		48.66%	2025	0.637
2023	vs	2025	*T. quinqueloba*	0.498	35.44%	2023	-0.353
2023	vs	2025	*N. pachyderma*		45.95%	2025	0.457