

Supplementary material for the manuscript entitled:

Beyond Seagrass Density: Holothuroid Occurrence across Fine-scale Habitat Mosaics in Reef

Flats of Tomini Bay, Indonesia

Supplementary figure lists

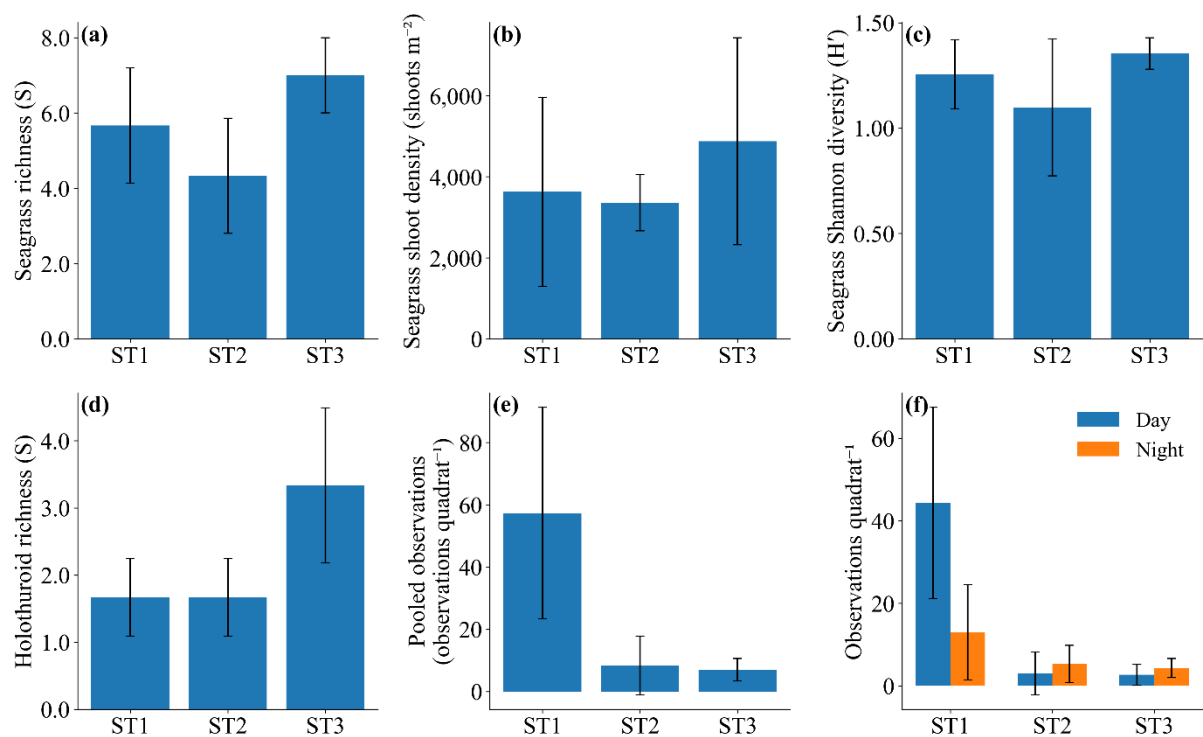


Figure S1. Detailed biological summaries. Station-level summaries of seagrass and holothuroid variables, including seagrass richness, seagrass shoot density, Shannon diversity, holothuroid richness, pooled holothuroid observations, and daytime and nighttime observations. Values are presented as mean $\pm$ SD across quadrats within each station and complement the main biological patterns shown in Figure 3.

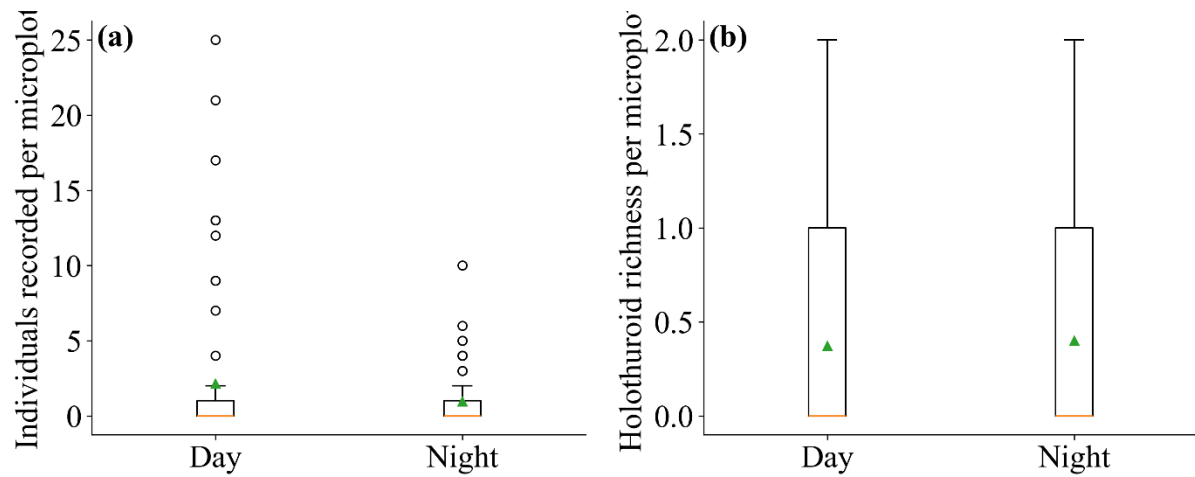


Figure S2. Additional diel plots for recorded biological plots. Daytime and nighttime variation in holothuroid observations per microplot and richness within biologically recorded plots. These plots provide a supplementary view of diel patterns after restricting the visualization to plots where biological observations were recorded.

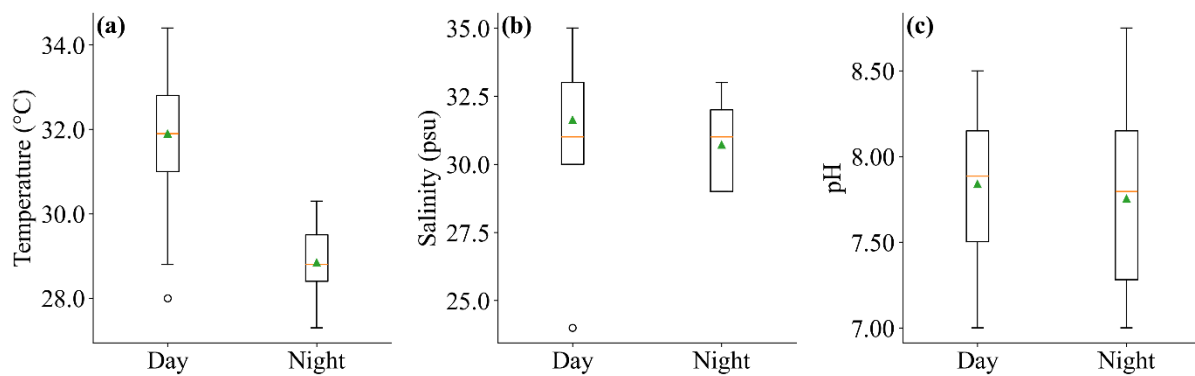


Figure S3. Expanded environmental diel plots. Daytime and nighttime distributions of water temperature, salinity, and pH. These supplementary plots provide the environmental context for diel holothuroid observations and support the interpretation of day–night variation as recorded observations and detectability rather than direct behavioural rhythm.

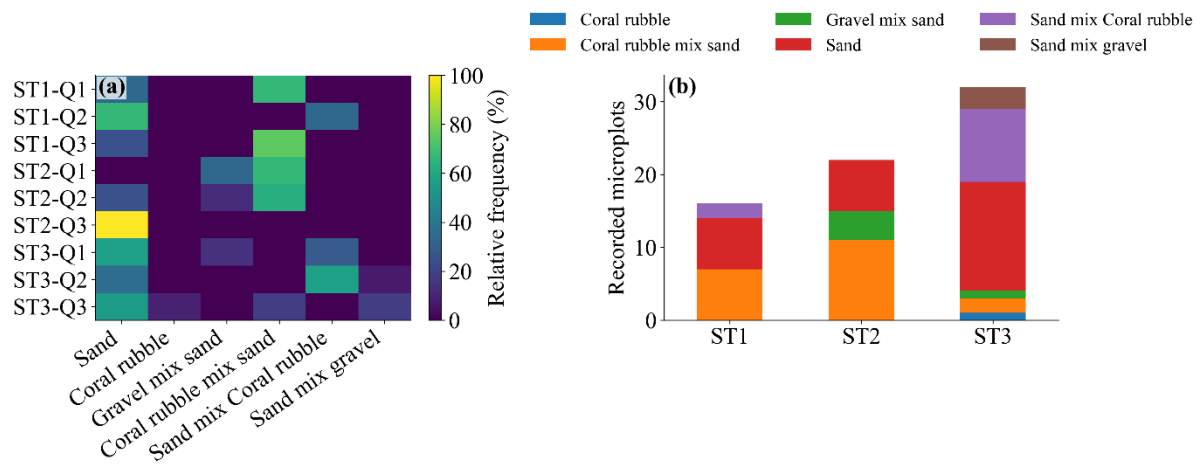


Figure S4. Detailed substrate composition. (a) Relative frequency of field-observed substrate classes among substrate-recorded biological microplots by quadrat and (b) counts of substrate-recorded microplots by station. Mixed-substrate categories were retained as field-observed classes. These data describe recorded microhabitat context and should not be interpreted as substrate availability or preference across the full 225-microplot sampling frame.

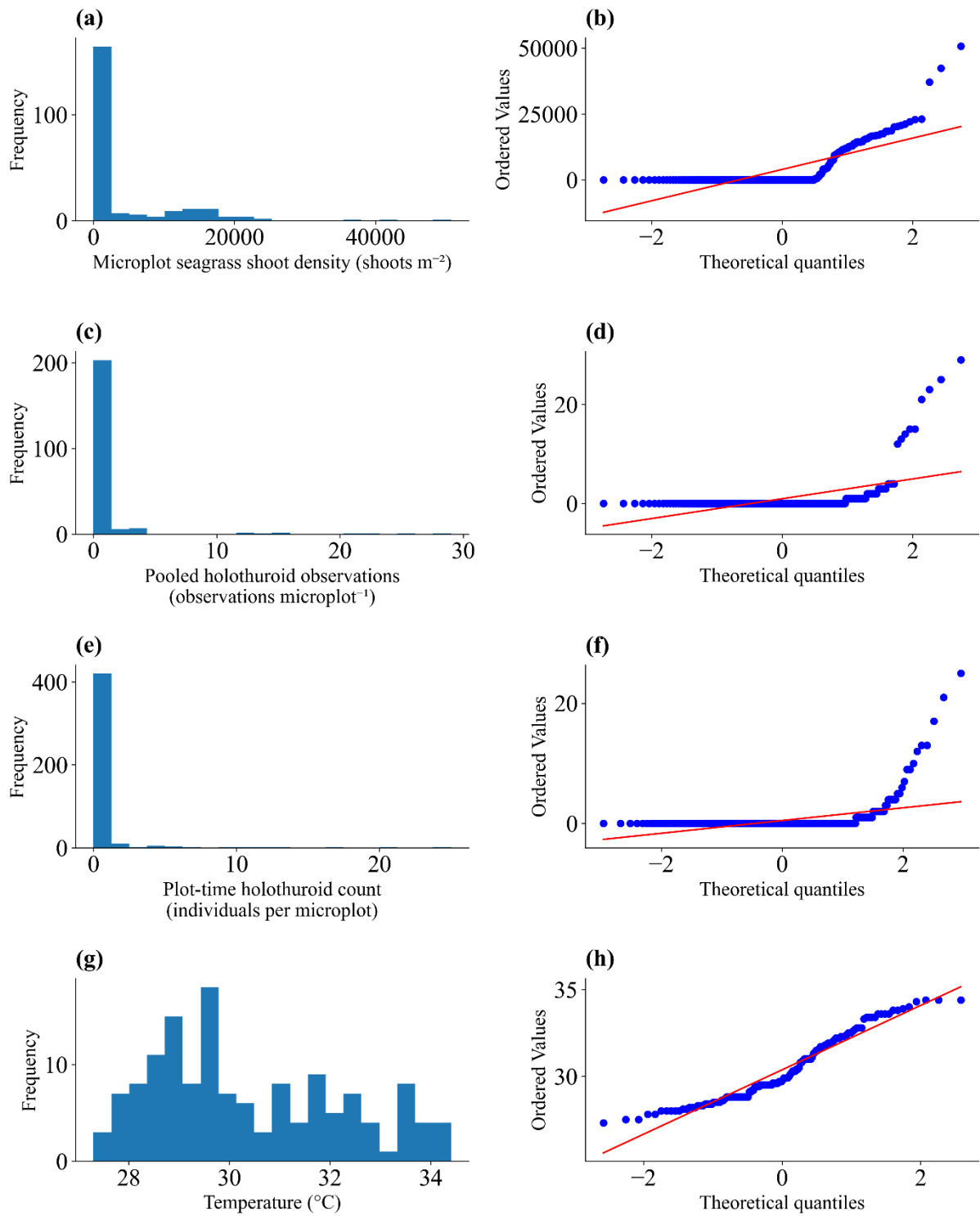


Figure S5. Normality diagnostic plots. Histograms and Q–Q plots for selected biological and environmental variables used in normality screening. These diagnostics show the zero-inflated

and non-normal structure of several biological variables, supporting the use of non-parametric and exploratory analytical approaches.

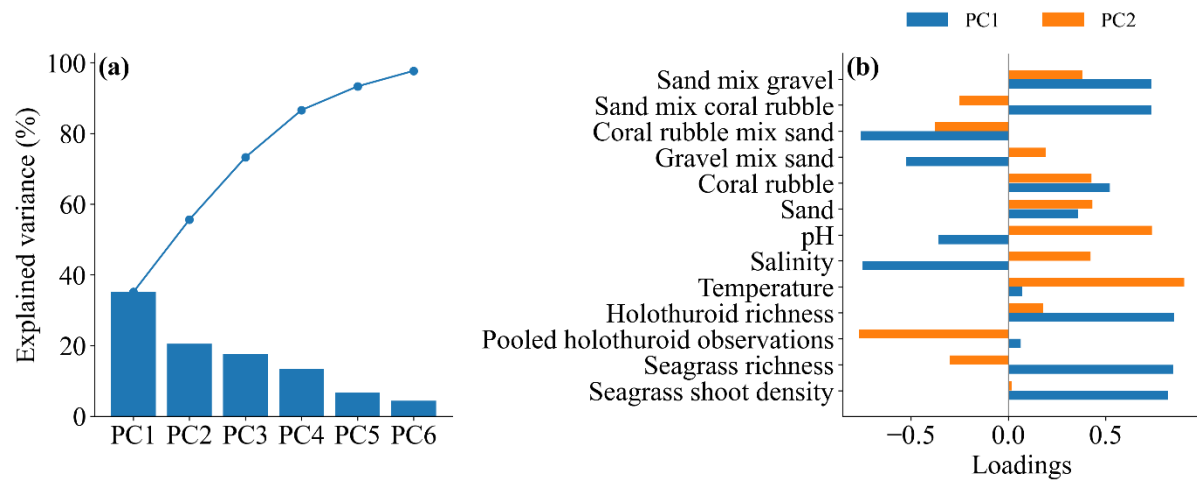


Figure S6. PCA details. Supplementary PCA outputs showing explained variance and PC1–PC2 loadings for quadrat-level biological, environmental, and substrate variables. These plots support the interpretation of PCA as an exploratory ordination of habitat-mosaic gradients rather than evidence of causal habitat control. In panel B, Pooled holothuroid observations represent summed daytime and nighttime records and may include repeated observations of the same individuals.

Supplementary table lists

Table S1. Post hoc paired Wilcoxon signed-rank sensitivity analyses for daytime and nighttime holothuroid observations, holothuroid richness, and measured environmental variables. Total pairs indicate all matched daytime–nighttime observations, whereas nonzero pairs represent pairs contributing to the signed-rank statistic after zero differences were excluded. These analyses were conducted as sensitivity checks only and were not treated as primary inferential evidence because the diel data were strongly zero-inflated and observations were nested within the sampling design.

Variable	Total pairs	Nonzero pairs	Zero differences	Day mean	Day SD	Day median	Night mean	Night SD	Night median	W	P	Interpretation
Holothuroid observations	225	35	190	0.67	2.98	0	0.30	1.11	0	193	0.04	Sensitivity analysis only; not used as a primary inferential result.
Holothuroid richness	225	26	199	0.12	0.33	0	0.12	0.37	0	163	0.73	Sensitivity analysis only; not used as a primary inferential result.
Temperature	70	69	1	31.89	1.43	31.9	28.84	0.66	28.8	10.5	<0.001	Sensitivity analysis only; not used as a primary inferential result.
Salinity	70	62	8	31.63	2.00	31	30.71	1.49	31	533	0.002	Sensitivity analysis only; not used as a primary inferential result.
pH	70	70	0	7.84	0.39	7.89	7.75	0.50	7.79	1055.5	0.27	Sensitivity analysis only; not used as a primary inferential result.

Note: W = Wilcoxon signed-rank statistic; P-values are unadjusted and are reported for sensitivity assessment only; For holothuroid observations, 190 of 225 paired differences were zero, leaving 35 nonzero pairs contributing to the test.