Supplementary Material

Marine Biology

Foraging ecology of juvenile loggerhead turtles: insights from C and N stable isotope ratios

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Appendix S1 – Curved carapace length notch-to-tip and notch-to-notch conversion

To determine if notch-to-tip (N-T) and notch-to-notch (N-N) curved carapace lengths (CCL) can be used interchangeably, 26 loggerhead turtles stranded dead or bycaught (dead and alive) in the North Levantine basin (North Cyrpus) were measured for both variables. N-T and N-N did differ significantly (Paired t test, t=-12.72, df=25, p<0.001, n=26) with N-T being larger (mean ± SD = 0.66 ± 0.61 m) than N-N (mean ± SD = 0.65 ± 0.60 m). There was a strong positive correlation between N-T and N-N (Pearson's correlation, ρ=0.99, p<0.001, n=26, Fig S1.1), hence, N-T could be converted to N-N for further analysis using the conversion equations derived here from linear regressions ($F_{1,24}$=6902, p<0.001, $R^2_{(Adj)}$=0.99, Fig S1.1).

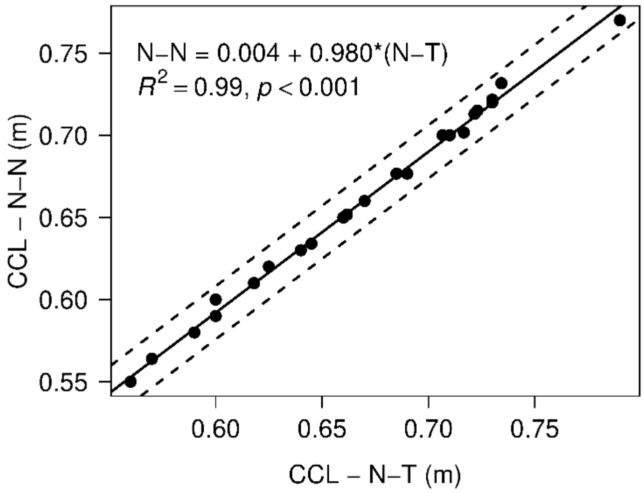

Fig. S1.1 Linear relationship between curved carapace lengths (CCL) notch-to-tip (N-T) and notch-to-notch (N-N) of loggerhead turtles sampled in the North Levantine basin (North Cyprus). Solid line depicts linear regression and dotted lines depict 95% confidence intervals. The conversion equation and regression statistics are shown

Appendix S2 – Isotopic differences with decomposition state and catch method

Individuals stranded in the North Levantine basin were either alive (n=18), fresh dead (n=18), moderately decomposed (n=10), severly decomposed (n=1), skeleton (n=1), or the decomposition state was unknown (n=19). Neither $\delta^{13}C$ nor $\delta^{15}N$ values differed with decomposition state (ANOVA, $\delta^{13}C$: $F_{(4,42)}=0.34$, p=0.85, $\delta^{15}N$: $F_{(4,42)}=1.48$, p=0.23, n=47, Fig S2.2) and therefore samples were considered one group for further analysis. Individuals found in the North Levantine basin were either bycaught (n=28) or stranded (n=27). Neither $\delta^{13}C$ nor $\delta^{15}N$ values differed with catch method (ANOVA, $\delta^{13}C$: $F_{(1,53)}=0.13$, p=0.72, $\delta^{15}N$: $F_{(1,53)}=2.32$, p=0.13, n=55, Fig S2.2) and therefore samples were considered one group for further analysis. Analysis for both decomposition state and strand method were found to be insensitive to the isotope analytical uncertainties (for details of this analysis see Appendix S5).

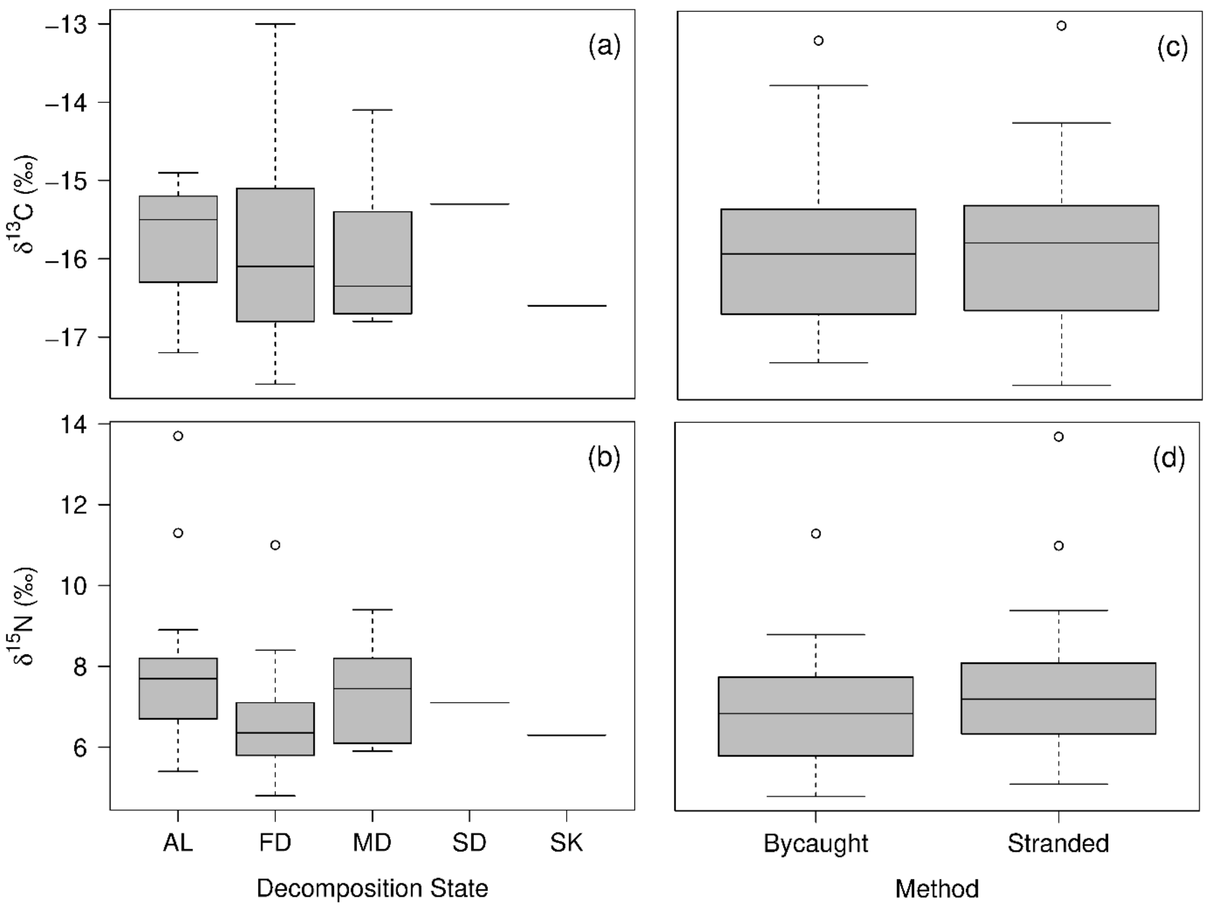

Fig. S2.2 (a) $\delta^{13}C$ and (b) $\delta^{15}N$ values of stranded loggerhead turtles of varying decomposition states found in the North Levantine basin. AL: alive, FD: fresh dead, MD: moderately decomposed, SD: severely decomposed, SK: skeleton. (c) $\delta^{13}C$ and (d) $\delta^{15}N$ values of stranded loggerhead turtles either stranded or bycaught in the North Levantine basin

Appendix S3 – Temporal variation in isotope ratios

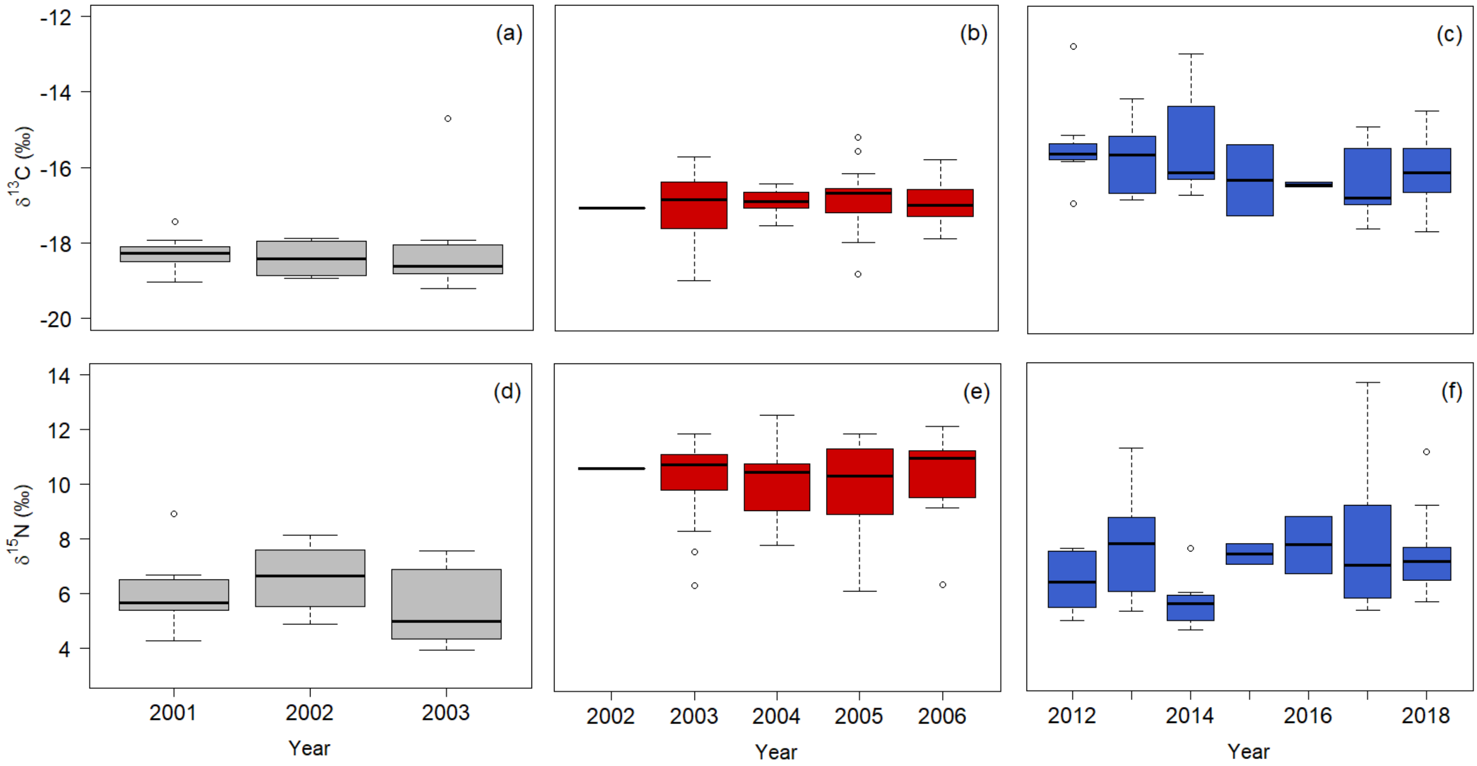

Fig. S3.3 Temporal change of $\delta^{13}C$ (top row) and $\delta^{15}N$ values (bottom row) of juvenile loggerhead turtles sampled in the Central Mediterranean (a,d), NE Adriatic (b,e), and North Levantine basin (c,f)

Appendix S4 – Seasonal variation in isotope ratios

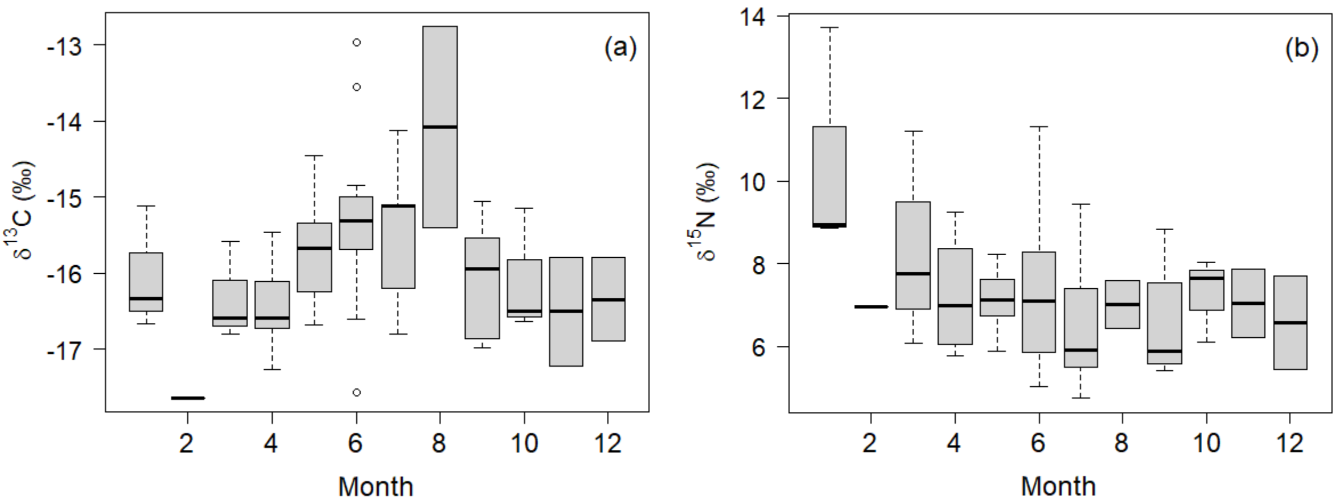

Fig. S4.4 Seasonal change of $\delta^{13}C$ and $\delta^{15}N$ values of juvenile loggerhead turtles sampled in the North Levantine basin.

Appendix S5 - Sensitivity of the analysis to the isotope analytical uncertainties

To determine the robustness of our isotope analysis each statistical analysis underwent uncertainty analysis. Analytical precision for $\delta^{13}C$ and $\delta^{15}N$ values was 0.18‰ and 0.20‰, respectively, determined as the standard deviation from the reference materials $USGS_{40}$, $USGS_{41}$, and BLS (see Table S5.1 for values). Analytical accuracy was calculated as the sample variance across all samples (see Table S5.1 for values). The combined analytical uncertainty was estimated as a sum of squares of the analytical precision and accuracy assuming that they are uncorrelated (see Table S5.1 for values). Therefore, to identify that the results are insensitive to the isotope combined analytical uncertainties, each analysis was repeated 100 times whilst perturbing the isotope data using additive noise. Noise was calculated as random values following a truncated Gaussian distribution centred on zero with a standard deviation equal to the combined analytical uncertainty. For each analysis the percentage of repeats with a p-value that meets the desired p-value was calculated (see Table S5.1 for values).

Table S5.1 Uncertainty analysis results. % of repeats: percentage of repeats with the desired p-values which are shown in parenthesis. CMed: Central Mediterranean, EIon: East Ionian, NEA: NE Adriatic, NL: North Levantine basin.

Statistical analysis	Isotope ratio	Analytical accuracy (‰)	Analytical Precision (‰)	Combined uncertainty (‰)	% of repeats
Variation in isotope ratios with decomposition state					
	Carbon	0.94	0.18	0.48	100 (p>0.05)
	Nitrogen	2.63	0.20	2.64	100 (p>0.05)
Variation in isotope ratios with strand method					
	Carbon	1.03	0.18	1.04	100 (p>0.05)
	Nitrogen	2.67	0.20	2.68	97 (p>0.05)
Inter-sample variation in isotope ratios					
	Carbon	0.14	0.18	0.23	100 (p>0.05)
	Nitrogen	0.33	0.20	0.38	100 (p>0.05)
Temporal variation in isotope ratios					
CMed	Carbon	0.68	0.18	0.70	100 (p>0.05)
	Nitrogen	1.37	0.20	1.39	100 (p>0.05)
NEA	Carbon	0.46	0.18	0.50	100 (p>0.05)
	Nitrogen	2.05	0.20	2.06	100 (p>0.05)
NL	Carbon	1.07	0.18	1.09	100 (p>0.05)
	Nitrogen	2.58	0.20	2.59	69 (p>0.05)
Seasonal variation in isotope ratios					
	Carbon	0.98	0.18	1.00	100 (p<0.05)
	Nitrogen	2.88	0.20	2.89	92 (p<0.05)
Variation in isotope ratios with region					
Analysis of Variance	Carbon	0.58	0.18	0.61	100 (p<0.05)
	Nitrogen	1.77	0.20	1.79	100 (p<0.05)
Analysis of Covariance	Carbon	0.58	0.18	0.61	96 (p<0.05)
	Nitrogen	1.77	0.20	1.79	99 (p<0.05)
Variation in isotope ratios with sex					
CMed	Carbon	0.65	0.18	0.68	100 (p>0.05)
	Nitrogen	1.31	0.20	1.33	91 (p>0.05)
NEA	Carbon	0.45	0.18	0.48	94 (p>0.05)
	Nitrogen	1.60	0.20	1.61	100 (p>0.05)
NL	Carbon	1.05	0.18	1.07	100 (p>0.05)
	Nitrogen	1.75	0.20	1.76	99 (p>0.05)
Variation in isotope ratios with size					
CMed	Carbon	0.97	0.18	0.99	100 (p>0.05)
	Nitrogen	2.69	0.20	2.70	100 (p>0.05)
EIon	Carbon	0.97	0.18	0.99	100 (p>0.05)
	Nitrogen	2.69	0.20	2.70	100 (p>0.05)
NEA	Carbon	0.97	0.18	0.99	86 (p>0.05)
	Nitrogen	2.69	0.20	2.70	95 (p<0.05)
NL	Carbon	0.97	0.18	0.99	100 (p<0.05)
	Nitrogen	2.69	0.20	2.70	100 (p<0.05)