Matthias Detjen
54 West 9th Street, Apt 4
New York, NY, 10011
United States

Dear Editorial Board,

Thank you and both reviewers for the comments on our manuscript "Stable isotopes in barnacles as a tool to understand green sea turtle (*Chelonia mydas*) regional movement patterns". Our responses are below in **bold**.

The coauthors agree with this revision and with this resubmission to *Biogeosciences*.

Kind regards,

Matthias Detjen and coauthors

Anonymous Referee #2

The study described in this manuscript investigates variation in isotopes of oxygen and carbon in the shells of barnacles that live in association with sea turtles. The objective is to match isotopic variation in the shells with predicted values in the Pacific Ocean to assess the range of migration by the host turtles. Though not the first time this idea has been proposed, the study provides potentially new insight on the movement of sea turtles in the Pacific. However, in my opinion there are a few significant core issues and a number of technical editing corrections that need to be addressed before this manuscript is ready for publication.

1. A clearer description of where shell material was taken from the barnacles is needed. Using barnacle anatomical terms would help (e.g. base [bottom], aperture [top], paries [wall plate]). If I understand correctly the milled sections were taken at distances measured from the base of a paries. Was material used from the surface or deeper within the paries? Was sampling done in the middle of the paries or at the lateral edge? [this makes a difference since the paries have a growing margin along the base and along their sides]? Were the barnacles of similar size (i.e. age?) The size range of 1.5 – 2.5 mm is mentioned in the discussion but reporting sizes of specimens in the results section would be useful. It should also be noted that nothing is known about growth rates in this species of barnacle.

This is correct, the material was taken along the outer facing surface of the paries in distances measured from the base of the paries along the axis of growth. We selected barnacles that were of similar sizes with the following barnacle sizes separated by respective turtles: (i) GD42 were 1.6 mm, 1.3 mm and 1.6 mm, (ii) GI 41 were 1.6 mm, 2.2 mm, and 2.5 mm, and (iii) GI 43 were 2.0 mm, 2.1 mm and 1.6 mm. We added a sentence clarifying our lack of knowledge about the growth rates of this species.

2. I did not understand the number of samples (rows) reported in table 1. From the text the authors state that 9 barnacle samples from 3 different turtles were ultimately analyzed so I would expect either 3 or 9 rows of data but the table reports 6 rows of data. The mismatch needs clarification. It would also be most useful to arrange the rows of data by each turtle sampled and

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either list the number of barnacles sampled for each turtle or list each sample in its own row (9 rows isn't much more than 6).

We reconfigured the table to show three rows each with the averages of three barnacles per turtle. It now shows the distance from paries' base, oxygen isotope ratio and carbon isotope ratio in the barnacles collected from three green sea turtles (GD42, GI41 & GI43). Distance is given in millimeters and isotope ratios are reported versus the VPDB scale

Distance from Base			$\delta^{18}O$ Concentration			$\delta^{13}C$ Concentration		
GD42	*GI41*	*GI43*	*GD42*	*GI41*	*GI43*	*GD42*	*GI41*	*GI43*
0.350	0.350	0.350	-1.359	-1.343	-1.310	0.729	-0.451	-0.299
0.719	0.727	0.743	-1.283	-1.220	-1.431	0.798	-0.398	-0.619
1.052	1.135	1.107	-1.414	-1.168	-1.200	0.624	-0.124	-0.914
1.403	1.559	1.451	-1.500	-1.097	-1.160	1.090	0.009	-0.481
1.550	1.937	1.725	-1.503	-1.004	-1.476	1.430	-0.002	0.096
n/a	2.354	2.067	n/a	-1.321	-1.379	n/a	0.227	-0.811

3. The authors make the link with isotopic ratios and water temperature but doesn't salinity also affect isotopic ratios? Maybe salinity is uniform enough that it is of no concern but possibilities for its influence should be discussed. Also more explanation is needed on the parameters and formula used for the paleotemperature equation (after Epstein et al. 1953?) and is this based on parameters for mollusk shells or modified for barnacles (sensu Killingly & Newman 1982 [should be cited]) as discussed in Killingly & Lutcavage 1983?

Epstein, S., R. M. Buchsbaum, H. A. Lowenstam, and H. C. Urey. 1953. Revised carbonate-water isotopic temperature scale. Bulletin of the Geological Society of America 64:1315-1326.

Killingley, J. S., and W. A. Newman. 1982. 18O fractionation in barnacle calcite: a barnacle paleotemperature equation. Journal of Marine Research 40:893-902.

Our study uses the adjusted paleotemperature equation as shown in Killingly & Newman (1982) and we will cite the paper directly to make this clear. Salinity affects the isotopic ratios of the water and we capture the varying salinity in the Pacific through the seawater $\delta^{18}O$ parameter in the paleotemperature equation, using the dataset published in LeGrande and Schmidt (2006).

Killingley, J. S., and W. A. Newman. 1982. 18O fractionation in barnacle calcite: a barnacle paleotemperature equation. Journal of Marine Research 40:893-902.

LeGrande, A. N. and Schmidt, G. A.: Global gridded data set of the oxygen isotopic composition in seawater, Geophysical Research Letters, 33, L12604, 2006.

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Would it be possible for figures 1 and 2 to show multiple solid line isopleths (contours) of temperature (or oxygen isotope ratios) along with the shaded predicted migration region?

Figures edited as requested.

4. Technical edits:

Pg. 4656 Line 23 . . . migration patterns, as well as fine-scale . . .

Edited

Pg. 4657 Line 12 Because of their intimate connections, species that are associates of particular hosts have been used . . .

Edited

Line 22 As obligate commensals, these barnacles . . .

Edited

Pg. 4658 Line 6-9 This sentence does not read well. Perhaps splitting it into two would help.

Changed sentence to: These movements can be traced by comparing barnacle oxygen isotope ratios to mapped prediction for these values. Temporal reconstruction could potentially also be added as our understanding of the pace at which successive barnacle calcite layers are laid down improves.

Line 13 "would have" this phrase does not make sense to me

Edited

Line 14. . .in the barnacle Platylepas hexastylos, an epibiont of turtles, collected . . .

Edited

Pg. 4659 Line 5 It is not customary to cite conference proceedings. I suggest using "(unpublished data)" in place of Gomez et al.

Changed to "personal observation" as this statement better corresponds to an observation.

Line 9 "axis of growth" rather than "growth trajectory"

Edited

Line 11 I don't know what is meant by "endoskeleton". Inner layer of shell? Barnacles have a thin exoskeleton around their body but no endoskeleton.

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This was referring to the paries and corrected accordingly.

Pg. 4660 Line 10 “the edge” does this mean basal margin?

Yes, it does and this was corrected in the text.

Lines 11-13 growth axis of the barnacle shell not the barnacle

Edited

Line 14 Do you have a reference to cite for the Vienna Pee Dee Belemnite scale?

Added citation.

Line 19 . . . spanned three orders of magnitude . . .

Edited

Interactive comment on Biogeosciences Discuss., 12, 4655, 2015.