LOTEK TEMPLATE FIT PROCESSING: Improving light-based geolocation studies

Improved Accuracy of Geolocation Positions

For a number of years, Lotek has been investigating new ways to improve the effectiveness and accuracy of light-based archival tagging. Dr. Phil Ekstrom has completed extensive work on the new "Template Fit" algorithm that is now available onboard *LAT geolocation tags* and is also available in the new *LAT Viewer Studio Software* for post-processing light data from older Lotek geolocation tags.

What is template fit?

TEMPLATE FIT: is a process that relies on a data model that expresses a distinctive shape for a data curve. For light-based geolocation, the template is the theoretical and empirical shape of the sunrise-sunset transient. The template algorithm is implemented during sunrise and sunset. The algorithm begins by using Lotek's previous Threshold Method. It then provides estimates for four parameters (latitude, longitude and two cloudiness factors) using least-squares-fitting process. Error estimates are derived from a comparison of the Template-Fit positional estimates with the actual data.

Normalized Data & Error Estimates Provided

Template-Fit Geolocation is beneficial as it provides an error estimate and normalized data which feeds directly into Kalman-Filter-based track reconstruction.

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Template Fit—Field Test Results Successful

Lotek, in conjunction with TOPP and Dan Costa's UCSC Lab, recently tested tags which have on-board template-fit processing. As seen in the following data-set, the validation of this technique was very successful, showing an average improvement of 26% over the Threshold Method.

Sea Lions provide the ability to double tag with GPS and archival tags, allowing reliable comparisons. The species is a good platform for testing light correction because they inhabit regions that would be affected by bright nights, and they perform rapid, deep dives, testing the ability to correct for light in very dynamic depth scenarios. This rapid diving behavior, in combination with their on-land activities, also provides the opportunity to fatigue-test the packaging. Seeing such success on these creatures demonstrates the robustness of both Lotek's Template-Fit positioning algorithm and archival tags. Template-Fit will be more effective on species that have less dynamic diving behavior patterns.

Tag	# Days at liberty	# of records	TR method error [km]	TF method error [km]	% improvement
D0469	37	28	130.2	88.62	31.94%
D0478	36	25	168.1	95.53	43.17%
D0484	37	30	142	128.5	9.51%
D3170	82	72	114.5	91.81	19.82%
D3171	86	77	120.4	101	16.11%
D3172	81	68	126.3	100.5	20.43%
D3173	79	67	94.77	59.85	36.85%
D3177	78	58	226.9	151.5	33.23%
D3178	89	68	124.8	77.5	37.90%
D3179	88	75	129.91	113.02	13.00%

Geolocation test results