
Transpacific Trajectory Modeler of Biological Life

Methodological Note, Version 1.1

Abstract. This methodological note documents the conceptual framework, evidence categories, map controls, scoring behavior, export functions, and interpretive limits of the Transpacific Trajectory Modeler of Biological Life. The tool visualizes biological dispersal hypotheses across the Pacific basin and western Indian Ocean using anchor nodes, route corridors, climate and current overlays, and evidence badges. It is designed for hypothesis generation, teaching, and comparative route analysis rather than final proof of biological or cultural contact.

Keywords: biogeography; transpacific interaction; coconut; Pacific rat; neuston; ENSO; South Pacific Convergence Zone; Indigenous knowledge; model transparency; digital humanities.

1. Purpose and Scope

The visualizer compares biological movement hypotheses for coconut (*Cocos nucifera*), Pacific rat (*Rattus exulans*), and a neustonic drifting organism proxy. Coconut and Pacific rat layers are treated as taxa that can intersect with human mobility, archaeology, genetics, historical accounts, and Indigenous voyaging knowledge. The neustonic proxy is used differently: it demonstrates surface-drift plausibility and should not be interpreted as a cultural-contact marker.

2. Spatial and Temporal Domain

The spatial frame includes Island Southeast Asia, Taiwan, the Philippines, Indonesia, Melanesia, Micronesia, Polynesia, Australia, Madagascar, the western Indian Ocean, Panama, Mesoamerica, and the Pacific coast of South America. The time control begins with Holocene drift background and then allows the user to examine human dispersal, late prehistoric contact hypotheses, and early colonial redistribution.

3. Evidence Classes

Routes can carry Archaeological, Genetic, Historical, Indigenous Knowledge, and Oceanographic evidence badges. Indigenous Knowledge is intentionally placed at the same visual level as the other evidence classes, while marked as interpretive context. The asterisk is not a demotion; it clarifies that Indigenous knowledge may be structured through navigation practice, oral tradition, genealogy, place-based observation, and cultural transmission rather than laboratory or excavation protocols.

4. Modeling Logic and Dynamic Updates

The model has two stages. First, visibility is filtered by selected taxon, route direction, evidence type, consensus confidence, and time window. Second, the visible routes receive an adjusted plausibility score. This score combines the route base confidence tier with active route-specific environmental weights, evidence-fit, and time-fit. Environmental toggles therefore change visual emphasis and the selected-route score, but they do not convert a contested route into a proven route.

5. Confidence and Uncertainty

The five confidence tiers are Strongly Supported, Supported, Plausible, Contested, and Speculative. Solid, dashed, and dotted line styles communicate consensus strength. Wider faint corridors are shown beneath routes to prevent hard lines from implying excessive precision. A route corridor should be read as a heuristic pathway, not as an exact reconstructed voyage or biological drift track.

6. Preset Scenarios

Version 1.1 adds preset scenarios for Coconut under strong El Nino, Pacific Rat during human dispersal, and Neustonic Holocene drift background. These presets demonstrate the difference between biological layer selection, climate/current plausibility, and categorical confidence. They are teaching scenarios, not claims that a single climatic condition produced a specific dispersal event.

7. Exports, Permalinks, and Reuse

The Export panel provides view-state JSON, visible-route GeoJSON, visible-route CSV, citation CSV, map PNG, and selected-route report HTML. Shareable permalinks preserve selected route, time period, and active filters. Embeddable iframe code is generated for classroom or research-center pages.

8. noDB JSON Comment Intake

The Scholarly Questions and Additions panel saves local JSON records. It is designed as a lightweight scholarly intake queue for corrections, proposed citations, route notes, and hypotheses. Local submission does not equal peer review or public publication.

9. Interpretive Limits

This visualizer is a model environment, not a claim that any route is conclusively proven. It should be used to compare evidence, identify contradictions, and formulate research questions. The most important outputs are not the lines themselves, but the conflicts between route confidence, evidence badges, environmental plausibility, and source quality.

10. Core Data Fields

Field	Meaning
route.id	Stable identifier used for route linking and exports.
confidence	Consensus tier, separate from adjusted score.
modelWeights	Route-specific climate/current weights used when overlays are active.
evidenceTypes	Evidence classes attached to a route.
startBP / endBP	Time window in years before present.
citations	Linked source identifiers with DOI or source URL when available.

Selected References

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Version note. Version 1.1 adds clickable route hit zones and labels, DOI-linked route references, model transparency readouts, preset scenarios, export formats, shareable permalinks, embed code, and a clearer noDB JSON comment description.