

High-precision dating of colonization and settlement in East Polynesia

Wilmshurst et al. (1) proposed recent and rapid colonization of East Polynesia based on analysis of 1,434 radiocarbon determinations. We commend the development of rigorous and replicable radiocarbon protocols that emphasize accuracy and precision, but we found (i) inaccuracies in their originally published supplementary data table, (ii) problems with their criteria for exclusion and inclusion of valid colonization estimators (i.e., Class 1 dates), and (iii) biases in their statistical analysis.

Our review of their originally published 207 Class 1 dates identified 112 incorrectly reported ^{14}C laboratory numbers and 123 misreported conventional radiocarbon ages, with 110 of these reported as at least 100 y too recent. Additionally, source citations were misassigned for 70 Class 1 dates. Nonetheless, our reanalysis using corrected data provides probability distributions broadly similar to figure 4 in ref. 1. The errors have been corrected in a revised table.

We suggest that some reliability classification criteria for Class 1 dates are overly strict and exclude accurate estimators of early cultural activity. Specifically, several reliable dates (on archaeological criteria) with SEs of 10–15% are excluded by their 10% threshold, whereas elimination of all marine samples, even in cases where local ΔR values are established (2), seems inappropriate.

Inclusion of dates as recent as 300 B.P. and samples from nonbasal strata biased their age estimation models in favor of a short chronology. These late dates skewed their sum of probability distributions to the more recent period, thereby affecting the cumulative probability outcomes. Fig. 1 shows the impact of removing late dates and how easily such probability curves can be affected by small sample sizes, which is the case for most archipelagoes.

Also, cutoff points are assigned to identify the upper limit of likely colonization (e.g., 1300 A.D. for most islands), times by which Wilmshurst et al. (1) had “100% confidence that colonization had occurred” (1). These are based on the skewed

probability sums (above), which influenced the slope of the cumulative probability line. Using only the earliest Class 1 dates (specific to each archipelago) results in different summed probability and cumulative curves as well as different colonization models (Fig. 2).

Overall, we agree with Wilmshurst et al. (1) and others (3) that East Polynesia was settled more recently than previously argued. However, their statistical model was built on ^{14}C dates with calibrated probabilities that were summed, normalized, and then compared with a certainly settled date. We suggest that the analysis of probability distributions is more appropriate for identifying the timing of established settlement rather than initial colonization (4). Our reanalysis using their approach and a corrected version of their table S1 for Class 1 dates suggest that, in several cases, colonization probably occurred earlier than they proposed (1). We argue that several aspects of their reliability classification and statistical analysis created a more homogenous picture of East Polynesian colonization than is appropriate. Resolution of this debate will require not only rigorous protocols (1) but also targeted redating of key sites and more samples from across the region.

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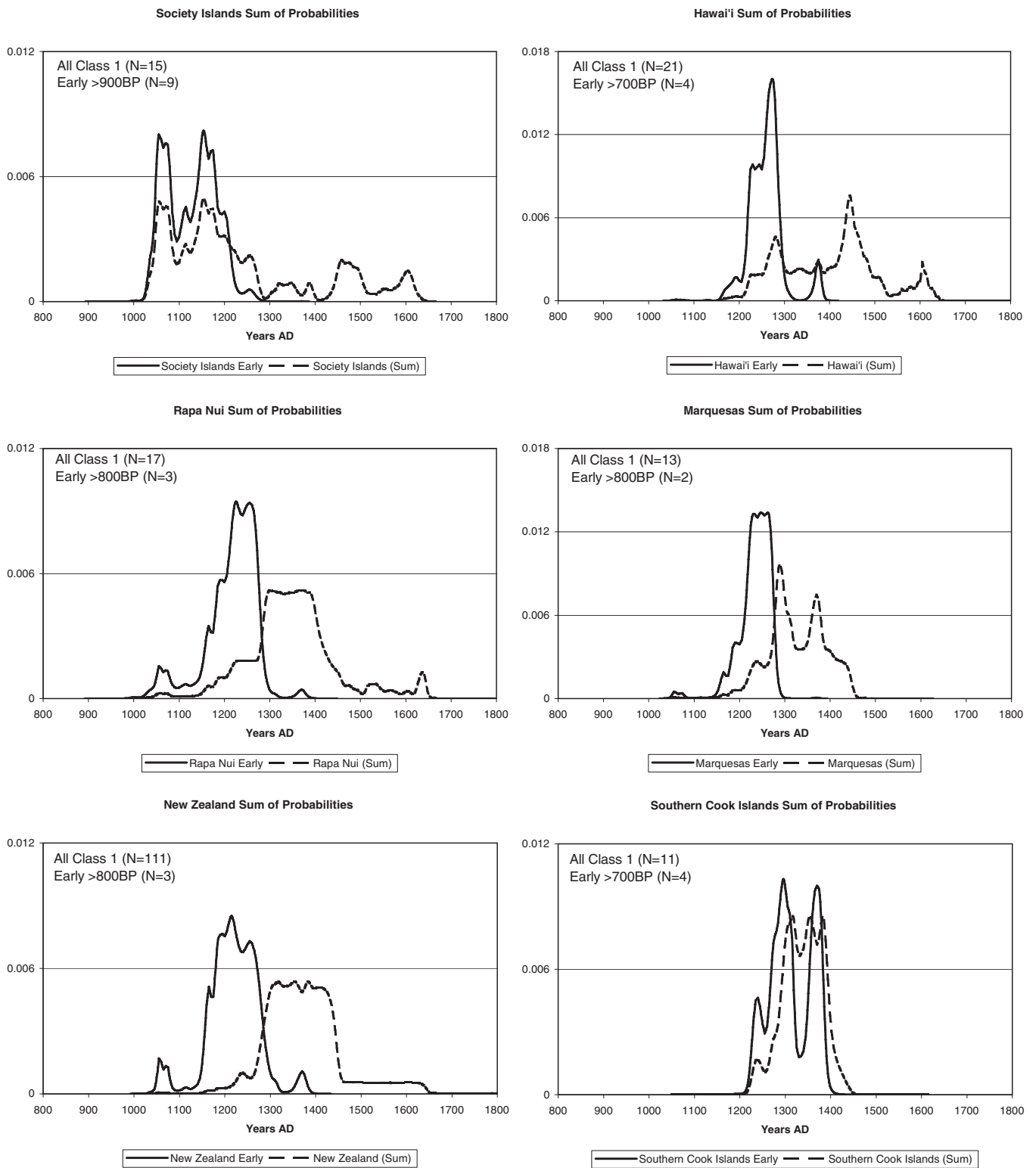


Fig. 1. Summed probability curves for a refined set of Class 1 dates (with cutoffs based on island-specific ¹⁴C datasets) compared with original Class 1 curves (1) with a broader range of dates to 300 B.P.; examples include all localities that had 10 or more Class 1 dates in ref. 1.

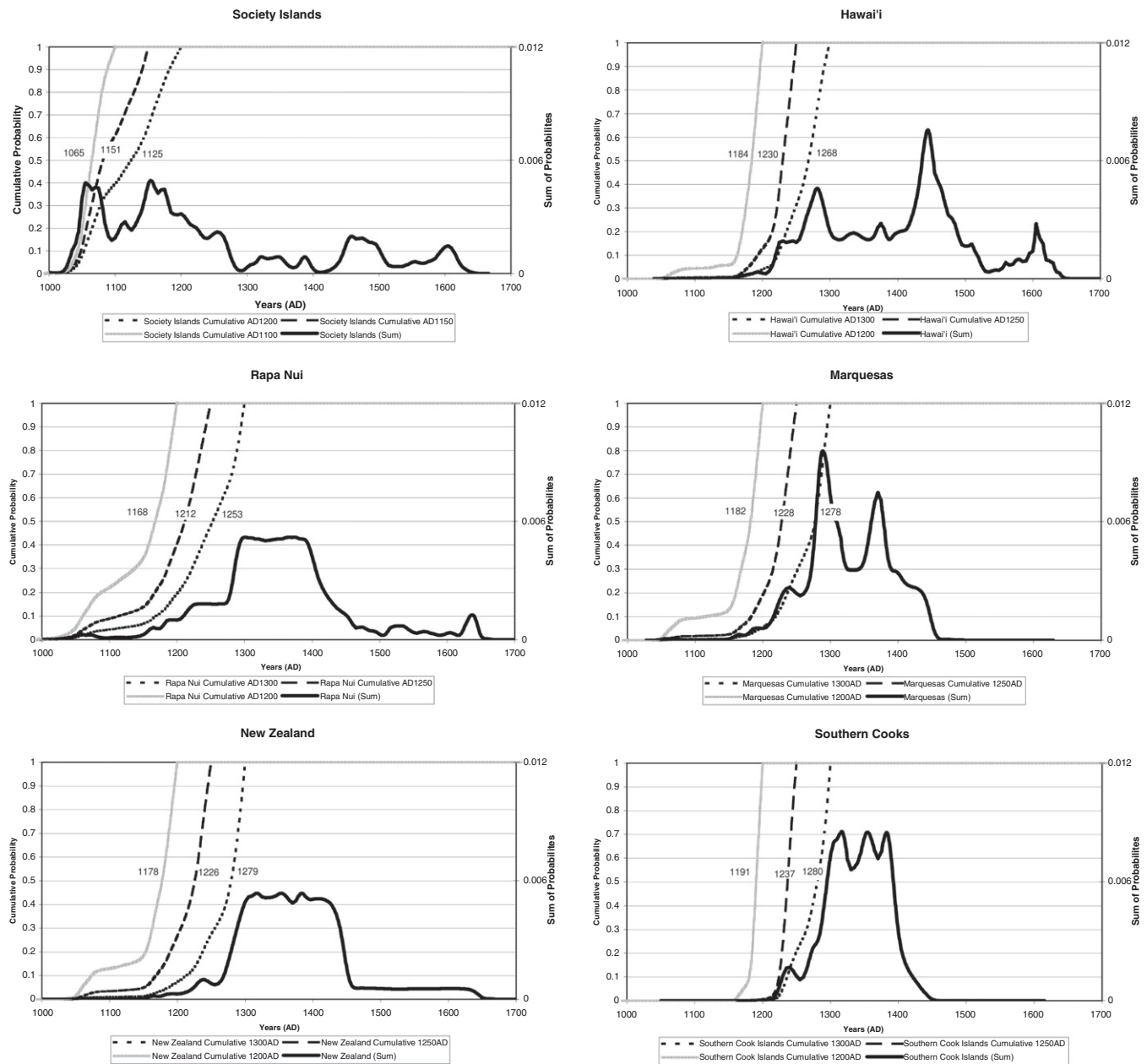


Fig. 2. Cumulative probability distributions of Class 1 dates with the upper limit of certain colonization varied to show alternative probable colonization outcomes that could be defined based on more restricted summed probability curves; examples include all island groups with 10 or more Class 1 dates. Cumulative probability curves are calculated with the upper limits as set by ref. 1 as well as set at both 50 and 100 y earlier. The Late Age Estimation Model (LAEM), which reflects the “latest likely date for colonization” (1), is noted where each cumulative probability curve intersects the x axis at 50% probability.