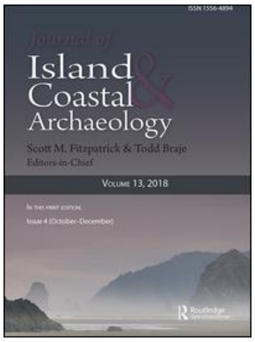

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The premise and potential of model-based approaches to island archaeology: A response to Terrell

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COMMENT

The premise and potential of model-based approaches to island archaeology: A response to Terrell

In a recent paper published in *The Journal of Island and Coastal Archaeology*, John Terrell (2020) objected to the proposition that islands can offer model systems to study human behavior and ecodynamics (see Cherry and Leppard 2018; DiNapoli and Leppard 2018; DiNapoli et al. 2018; Fitzpatrick and Erlandson 2018; Kirch 2007; McLaughlin, Stoddart, and Malone 2018; Pilaar Birch 2018). He argues that a review of insular model systems in the study of non-human taxa (Warren et al. 2015) is empirically flawed and theoretically incoherent and implies that these flaws also characterize islands as models for the study of humans. He further asserts that islands have no distinguishing features that facilitate the comparative study of human cultural and ecological processes over the long term, that the category "island" is not a useful scientific concept, and that a model systems approach is not relevant to contemporary island communities. We disagree with Terrell's characterization of model systems thinking, but we welcome his challenge, as it provides an opportunity to clarify the rationale and advantages of this approach to island archaeology. Here, we show how the concept of "island" is intellectually coherent and analytically useful within model systems approaches and provide examples drawn from a range of research to demonstrate this utility.

Terrell (2020, 7–8) proposes that the concept "island" is too broad to be useful and that describing landmasses as islands constitutes problematic "typological thinking" (Terrell 2020, 2–3). This criticism, however, fails to recognize that all scientific analysis, including the relational approach for which Terrell advocates, requires constructing units to measure and compare the empirical world. Like all such analytic units, we must define the scope and scale of islands as concepts to produce observations of "islands" that we then identify and compare (see Dunnell 1971; Ramenofsky and Steffen 1998). The global terrestrial surface is divided into fragments that vary in size, fragments that are surrounded by water and that are subdivided further into heterogeneous habitat patches. The difference for Terrell between the largest of these fragments (continents) and the smallest (islands) is one of degree. Yet, the scalar variance within this dimension is substantial: Afro-Eurasia and Rota (Mariana Islands) are both terrestrial environments surrounded by water, but the former (85 million km^2) is six orders of magnitude larger than the latter (85 km^2). Magnitudinal scalar difference has profound biotic implications, most obviously in terms of trophic structure via species–area relationships (Brose et al. 2004; Galiana et al. 2018) and via spatial constraints on frequency of habitat types. The distribution of terrestrial environments across the globe also has predictable influences on patterns of plant and animal dispersal and evolution, with the result that empirically smaller terrestrial units contribute disproportionately to global biodiversity (Tershy et al. 2015). The choice of analytic scale, therefore, is related to questions about the constraints on ecological interactions and ultimately to how we track evolutionary trajectories (Whittaker et al. 2017). Moreover, physical systems pertinent for understanding biodynamics—such as total area of coastal habitat—grow relative to other habitat types as landmass size decreases (see Gillis 2014). Finally, due to geotectonic processes, smaller landmasses often have volcanic origins, with concomitant effects on pedology, hydrology, and biota (Triantis et al. 2016). While insularity is a relative condition, for analytic purposes, the scale, distribution, and physiography of any landmass impose predictable constraints on biodynamics, and landmasses that cluster at the end of these dimensions consequently form a category as "islands."

If insularity is an intellectually coherent concept, is the term useful analytically? Terrell (2020, 7) proposes that islands as a separate category have no demonstrable benefits in studying human behavior and ecodynamics. We disagree—as allometrically scaled versions of larger landmasses and associated physical and biological processes, islands have comparative analytic potential from a model systems perspective. The advantages islands provide as analytic units stem not from absolute isolation, but from their scale and relative sensitivity to perturbation. In understanding islands as models, we bound our observations with a defined scale. All models are simplifications of more complex phenomena that facilitate understanding of those phenomena. The simplicity of a model system should lie in its reduced number of variables or its smaller scale (Kirch 2007; Vitousek 2002), factors that make the effects of these variables easier to understand and measure. This facilitates the comparison of certain processes and outcomes between systems, often providing unique insights (e.g., DiNapoli et al. 2018; Kirch 1997). Such a perspective does not, as Terrell suggests (2020, 3–7), involve assuming islands are completely isolated "laboratories." Rather, we study these units in terms of the degree to which they interacted with one another. Isolation between islands is self-evidently not the case, or there would be no biota on islands, human or otherwise, to study. Incidentally, and despite Terrell's implication, none of us has ever argued that the Solomon Islands are isolated from one another.

Contrary to Terrell's (2020, 7) claim, islands are therefore well-suited as model systems for exploring human behavior at a global scale. Local geographic constraints matter in evolutionary contexts, and human behavioral plasticity allows novel adaptations in the face of environmental variation; indeed, it is this adaptive capacity that has allowed humans to colonize and persist on diverse islands (Braje, Leppard, et al. 2017). Studying the stimuli for and consequences of such adaptations is challenging, however, and reducing the number of analytical variables is helpful. Comparing localized environmental contexts in which this occurred is an effective approach. In essence, islands should both prompt humans into highly novel adaptations and represent ideal settings to compare novel adaptations and relate them to environmental constraints.

Demonstrably, model systems approaches have proven cross-culturally effective in exploring topics of major anthropological significance. The transdisciplinary Hawai'i Biocomplexity Project, for example, examined the complex relationships between ecology, land-use, and emergent community formation (Kirch 2011). Using Hawai'i as a model, the project demonstrated how biogeochemical gradients influence agricultural intensification, human demography, and the emergence of social complexity (Kirch et al. 2012). Likewise, DiNapoli et al. (2018) examined divergent forms of competition in two comparable insular contexts on Rapa Nui and Rapa Iti. Both are small (164 km^2 and 38 km^2, respectively) islands located at 27 degrees south, colonized at approximately the same time by culturally related groups. Despite these similarities, they witnessed deeply divergent post-colonization patterns in inter-group competition due to significant differences in the spatial distribution of agricultural land. These examples highlight the importance of islands for testing general hypotheses of human ecology (e.g., Mattison et al. 2016). Beyond these Pacific examples, resource-limited islands in the Mediterranean exhibit patterning in ecosocial dynamics (Leppard and Pilaar Birch 2016), and challenge assumptions about the ecological conditions that give rise to social inequality (French et al. 2020; Leppard 2019). Islands also serve as models when addressing questions that relate to deeper-time social dynamics, including patterning in initial settlement in the Mediterranean and Caribbean and its ecological and environmental basis (e.g., Cherry 1981, 1990; Giovas and Fitzpatrick 2014; Keegan and Diamond 1987; Plekhov, Leppard, and Cherry 2021) and subsequent processes of adaptation (see also Gjesfjeld et al. 2019 for a sub-Arctic example). This utility of islands as analytic units is not limited to our own species, with recent model systems approaches isolating environmental variables to help explain the spatial and temporal organization of Lower and Middle Paleolithic settlement in Island Southeast Asia by non-modern humans (Shipton, O'Connor, and Kealy 2021).

Terrell (2020, 8) also suggests that the model systems approach "risks being dismissed by people living on islands in the Pacific for not caring enough about such global down-to-earth challenges as climate change, rising sea levels, and plastic pollution." This ignores model systems research that addresses the first two topics, including a variety of archaeological and paleoecological research that involves using islands as models to develop insights into human impacts and sustainability with global conservation implications (e.g., Braje, Rick, et al. 2017; Douglass, Morales, et al. 2019; Erlandson 2012; Harris and Weisler 2018; Hofman and Rick 2018; Lambrides and Weisler 2016; Nogué et al. 2017; Rick et al. 2013, 2020; Russell and Kueffer 2019; Swift, Miller, and Kirch 2017, Swift et al. 2018; Wu, Chen, and Meadows 2019). Multiple studies also demonstrate that island archaeology provides model systems that are specifically effective for investigating the impacts of climate change (e.g., Douglass and Cooper 2020; Fitzhugh et al. 2019; Fitzpatrick and Braje 2019). Finally, archaeological interpretations of island colonization, settlement, and landscape management actively inform and sometimes exacerbate contemporary inequalities (e.g., Kato 2010). Island archaeology has a relevance to living communities, and it is imperative that island archaeologists act responsibly in investigating long-term ecosocial dynamics by building equitable partnerships with Indigenous and descendant island communities (Douglass, Walz, et al. 2019). In this regard, a model systems approach has the advantage that it can be used to investigate the socio-ecological legacies of settler colonialism that continue to impact many of the world's island communities (e.g., Douglass and Cooper 2020) in a way that substantiates the self-determination of past and present island communities (Hau'ofa 1994).

Island archaeology has been dominated by isolationist and connectivist positions, and this has hindered synthesis and meaningful comparison. Approaches such as model systems allow us to move beyond this dichotomy. By encouraging comparison, they facilitate the construction of contextualized explanations of how and when island communities built, maintained, or severed links at various spatial scales; and which factors promoted or inhibited these behaviors in general terms. We respectfully disagree with Terrell that model systems approaches represent a retrograde development. Rather, they allow us to move in precisely the relational direction for which he advocates (Terrell 2020, 4–6).

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