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Reflections on Zooarchaeology in East Polynesia: Human-Animal Interactions and Human Ecodynamics

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ABSTRACT

The essay summarizes the key pillars of human ecodynamics (HE) research and then highlights the most trenchant ideas from each of the seven papers in the Special Issue, especially as they intersect with HE.

L'essai résume les principaux piliers de la recherche sur l'écodynamique humaine (HE), puis met en évidence les idées les plus marquantes de chacun des sept articles du journal à édition spéciale, en particulier lorsqu'elles recoupent l'HE.

KEY WORDS

Zooarchaeology, East Polynesia, human ecodynamics

Zooarchéologie, Polynésie orientale, écodynamique humaine

Many thanks to Melinda Allen and Jenny Kahn for inviting me to be a discussant at the session they organized for the 14th International Council for Archaeozoology Conference in Cairns, Australia (August 2023), and then to write this essay for the Special Issue of *AO*. My goal is to highlight the most trenchant ideas from the seven papers in the issue -- especially as they intersect with the human ecodynamics (HE) framework.

To begin, I want to share parts of my background that inform my review. First, most of my career *has not* focused on Oceania, but rather on coastal and riverine areas of the northeast temperate Pacific. I would not appear to be the best person to write a review such as this for *AO*! However, as a graduate student at the University of Washington (Seattle, U.S.A.) in the 1980s, I had the opportunity to work with Pat Kirch, then director of the Burke Museum on campus. I was developing expertise in fishbone analysis while working on projects in the Pacific Northwest (states of Washington and Oregon) for my MA and PhD, but was thrilled to expand my scholarship when Pat invited me to study the fish remains from Mussau Islands, PNG, excavated as part of the Lapita Homeland Project (Allen and Gosden, 1991; Butler, 2021; Kirch, 2021). I subsequently collaborated with Pat in the early 1990s to study fish remains from Tangatatau Rockshelter on Mangaia, Cook Islands (Butler, 2017; Kirch et al., 1995; Kirch, 2017).

Getting drawn into Oceania scholarship in the 1980s was intellectually stimulating. In the spirit of "islands as laboratories" thinking, scholars were embracing a range of ecologically based models to understand processes of voyaging, settlement, adaptation in the face of isolation or continuing interactions, and broader questions of human-environmental

relationships (Green, 1982; Kirch, 1980; Terrell, 1986; Williamson and Sabath, 1984). However, as a developing zooarchaeologist, I was struck by the limited attention to analytic methods and sampling (e.g., Thomas, 1969; Casteel, 1972; Grayson, 1979, 1984). Issues like counting units, which skeletal elements to study, the impact of screen size, and taphonomy were little considered in Oceania faunal studies at the time.

As part of an edited volume that emerged from a Kirch-led seminar on Lapita archaeology (Kirch and Hunt, 1988), I contributed an essay that highlighted the need for greater rigor in fish faunal analysis (Butler, 1988; see also 1994). Using examples from Lapita fishbone studies and North America, I showed the challenge of addressing questions such as the role of marine vs. terrestrial resources, the impacts of humans on animal populations, or fishing strategies using expedient and idiosyncratic methods of analysis. Except for completing faunal reports on Kirch's projects, and contributing to a recent paper on the importance of skeletal element selection (Nims et al., 2020), my work has since focused mainly on the north Pacific. It has been a pleasure to "return to Oceania", as an external reviewer of this Special Issue article set, and reflect on ways zooarchaeology has changed since the 1980s.

A second part of my background that informs this essay is the Special Issue's link to "Human Ecodynamics" (HE), a framework that I was drawn to in the early 2010s when I began work on a large-scale project in the Salish Sea of the North Pacific. Our research group had the opportunity to analyze close to one million faunal remains from Číxʷicən, the 2700-year-old ancestral village of the Lower Elwha Klallam Tribe, located on the northwest coast of Washington State, U.S.A. Our project turned to HE, as this framework was designed to address the complexity of our questions, which were to explain change and stability in human-animal relationships on the Northwest Coast – a place characterized by complex social systems and affected by catastrophic events like tsunamis, as well as more subtle shifts in climate and nearshore habitats (Butler et al., 2019).

Earlier in my career I was taken with human behavioral ecology (HBE) for its power to predict human prey selection under different conditions (e.g., Butler, 2001); but I came to see that HBE was simply too narrow a frame for addressing the range of questions that were meaningful to me. Our Číxʷicən research group appreciated HE for its larger vision of ways we could understand the complex dynamics at the heart of human-environmental relationships. Our project leaders contributed to a review of HE (Fitzhugh et al., 2019), which I draw on in the following paragraphs.

Simply put, HE refers to the processes of stability, resilience and change in socio-ecological systems. HE research seeks to understand the processes that drive socio-ecological systems. It is not a theoretical framework as much as a family of scholarly domains, that encompasses human behavioral ecology, niche construction theory, historical ecology, and resilience theory – used in part or in aggregate – to help model and explain the complex dynamics related to human-environmental relationships. Archaeology and history provide an unparalleled opportunity to track these complex dynamics back in time.

HE holds that human and environmental systems are inextricably coupled. Humans are viewed as integral parts of the environment, rather than external actors. This view

emphasizes the reciprocal relationships within and between domains which we typically distinguish in western thought, “nature” and “culture”.

HE embraces interdisciplinarity, of course long part of archaeological scholarship. In order to explain how these socio-ecological systems operate and evolve over varying temporal and spatial scales, we need well resolved paleoenvironmental records and chronologies.

HE challenges determinism and reductionistic explanations. Instead, it emphasizes human agency and historical contingency. It seeks to engender the archaeological record; and grapples with ways class and power both affect and respond to changes in the socio-ecological system.

HE draws on Indigenous knowledge through collaborating with living peoples; and uses oral and traditional knowledge from ethnographic and historical accounts. Such records provide a starting place for theory building and hypothesis testing rooted in local cultural context, that enable us to give meaning to archaeological traces extending into recent and ancient times.

Besides HE’s value to academic interests, HE contributes to conservation and habitat management. Moreover, HE themes underlie most of the so-called *grand challenges* (Kintigh et al., 2014) that archaeology should address, to make the greatest contribution to the academy and society at large.

While rarely named “human ecodynamics”, scholars in Oceania have deeply engaged with questions on the dynamics of human-environmental relationships for decades. Notably, Kirch (2007) explicitly used HE in his study of evolutionary change in Hawaiian socio-ecosystems, as did Allen (2017) (East Polynesia) and Nims (2022) (Northern Aotearoa) in their study of fisheries. As further examples of this rich body of work, for behavioral ecology, see Nagaoka (2002); for historical ecology see Anderson (2009), Braje et al. (2017), and Kirch and Hunt (1997); for gender, status and power see Kirch and O’Day (2003) and Jones (2009); and for niche construction and land and seascape management systems see Aswani (2011), Huebert and Allen (2020) and Quintus and Cochrane (2018).

In that spirit, all seven papers in the *AO* Special Issue explore dynamics of human-environmental relationships, though most of them do not refer to HE by name. The remainder of my essay reviews each paper, their key contributions and links with HE research.

Nims et al. (2024, this Special Issue) examine fishing strategies in the Marquesas Islands, as they can be understood from the types of fish captured and estimates of body size from vertebrae measurements. Previous studies in the Marquesas and elsewhere in Eastern Polynesia have highlighted a distinct pattern: where mass capture, use of nets/traps of nearshore fish were most common in the historic era – with an early settlement focus on offshore trolling/angling. Scholars have offered various explanations for why this shift happened, calling on agricultural intensification, prey depression on offshore fishes and other factors. Nims et al. examine whether this trend holds for the Marquesas through close analysis of fish remains from Hakaea Beach, an early, stratified archaeological site on

the north coast of Nuku Hiva Island. The most striking result is that most of the captured fish are small-bodied for the entire sequence. The fish were most likely taken inshore and by mass capture, a pattern inconsistent with the previous trend much discussed in the literature.

A key value of Nims et al. is showing that greater rigor in analysis, especially including vertebrae for taxonomic identification and estimating body size, is critical for accurately reconstructing fishing strategies. While methodological rigor has increased in Oceania since the 1980s, several papers in the Special Issue acknowledge ongoing challenges (inadequate reference collections, small sample sizes, use of a limited suite of skeletal elements for taxonomic assignment). Nims et al. is an excellent case study for showing why analytic rigor *matters*.

Nims et al. is also important for considering their results in the broader regional context and the socio-ecological factors that may explain sustained use of mass capture in some settings and the shift from trolling of pelagic fishes to inshore mass capture in others. Especially relevant to HE, Nims et al. explain that fishing strategies are tied to a complex of socio-ecological factors and thus reconstructing which strategies dominate in different times and places can inform us about these long-term dynamics.

Ohman and Kahn (2024, this Special Issue) present new faunal and fishing gear data from two sites in the Society Islands to examine subsistence change from earliest settlement to later occupations. Their study is one of the only ones in Central Eastern Polynesia that encompasses time periods after first colonization, providing a richer picture of changing socio-ecological conditions than has been possible before. As well, the project used fine mesh screens, the only published account of faunal remains in the Society Islands to do so. The most compelling part of the study focuses on the fishery, with fish remains dominating collections at both sites by a large margin. Both sites show the typical array of mainly nearshore fishes, with ScMo-360 showing high abundance of moral eels and wrasses and ScMo-350 emphasizing parrotfish and sea bass. Porcupinefish and pufferfish are prominent in both sites, even taking into account quantification and taphonomic issues. Both of these fish families are associated with lethal neurotoxins. The authors highlight the spatial clustering of porcupinefish remains at ScMo-350, hypothesizing that this reflects intentional human behavior, where past fishers processed and disposed of toxic fish body parts to reduce risk. In a similar vein, Nims et al. (2024, this Special Issue) speculate about ways early Marquesan people addressed risk from ciguatera poisoning. Understanding the history and evolution of cultural knowledge required to safely use potentially poisonous fish is a fascinating and important research topic directly aligned with HE scholarship. Recent work by Boulanger et al. (2023) suggests knowledge of fish poisons from terminal Pleistocene sites in the Philippines, so this developing human-poison fish relationship appears to have an ancient history.

While Ohman and Kahn point to a temporal trend for a decline in turtle and wild birds, and increased use of domesticated animals, sample sizes for these animal groups are too small to make a strong case. Importantly, scholars have pointed to this trend for decades from multiple island groups across Oceania, so it would seem to be a very robust pattern. I

cannot help but wonder, however, if more rigorous attention to sampling and analysis, would show subtler trends.

Traversat et al. (2024, this Special Issue) focus on shellfishing in their rigorous study of shellfish remains from five sites on Ua Huka, dating from early settlement to the 18th century. I was struck most by the general consistency in taxonomic representation across sites and through time, but with some exceptions. Pre-contact '*enata* collected a vast array of shellfish common to rocky shores. The most noteworthy results relate to breakage, heating and deliberate modification for tools, which they document for *Pinctada margaritifera* and *Mauritia mauritania*, among others. The authors share some of the insights gained through in-person interviews with contemporary residents. One particularly intriguing pattern concerns the large chiton *Acanthopleura gemmata*, a dominant taxon during early occupations. This species was the only taxon most informants were unfamiliar with. This begs questions about the socio-ecological factors which could have led to such dramatic shifts in cultural knowledge and use. Importantly, without their ethnographic study, scholars would not have even known there was a puzzle to solve! As such, the authors show the importance of working closely with and learning from local communities, when possible, which helps us build a more robust picture of changing socio-ecosystems.

Pillay (2024, this Special Issue) explores the socio-ecodynamics of human-bird relationships in the Marquesas using a two-phase strategy. First, she synthesizes records from oral and written histories, and museum collections. Then she uses insights from these qualitative records to give socio-cultural meaning to the archaeological record of birds. This is an important paper for many reasons. Her analysis and comprehensive synthesis of qualitative records is a model for how one should do this. She carefully and critically analyses disparate records, cross-checking descriptions, looking for redundancy, bias, etc., in order to create the most accurate picture of cultural views of birds possible. Close scrutiny of contact-era records also provides a remarkable record of changing human-bird relationships during this tumultuous time. The historical sources lead Pillay to many insights about pre-contact human-bird relationships, including cosmology, bird management, diversity of birds used and taxonomic substitutions over time, and the role of birds in spiritual domains. In short, we have always known that birds represented much more than food (like all animals everywhere). Pillay's efforts highlight how critical historical and ethnographic sources are for revealing cultural motivations behind patterns we see.

Claringbold et al. (2024, this Special Issue) seek to better understand ways that sea turtle were part of ritual and socio-political life in Central Eastern Polynesia through innovative quantitative and taphonomic analysis of turtle remains, mainly from ritual-associated features at three sites on Fakahina Atoll in the Tuamotu Archipelago. The authors begin by summarizing the ethnographic record for turtle use across Polynesia, highlighting ways turtle figured in people's worldview, expressed in mythology, oral traditions, and rituals, and the physical spaces such rituals occurred in. Turning to archaeological records, the authors focus on taphonomy—especially related to challenges we have to address when using archaeological remains of turtle (or any creature) to reconstruct ritual behavior. To what extent do the remains we recover and study reflect intentional deposition over a

discrete period of time, allowing for accurate linkage between faunal remains and human ritual practices? As well, how do we interpret body part representation? Does the abundance of cranial vs. vertebrae for example reflect original selection and disposal of those body parts, or does the skeletal parts we see reflect post-depositional destruction and differential survival of skeletal parts owing to inherent differences in bone density or other factors (e.g., Lyman, 1994)?

Claringbold et al. address these questions through employing various counting units (e.g., %MAU, MNE) and close analysis of bone condition and surface modification—all useful for understanding depositional histories. The ability to target field recovery on particular features such as cists and *ahu* (cairns), known for their close connection to ritual, offers an exceptional starting place for studying ritual behavior, in spite of the taphonomic challenges. As Gifford-Gonzalez (1991) emphasized some time ago, "bones are not enough" when attempting to sort out causation with ancient faunal deposits. Continuing to take advantage of site context is ideal. In that vein, Claringbold et al. note future work should incorporate studies of faunal remains from *domestic settings* for comparison, in line with recent work by Weisler et al. (2024). Comparing faunal records across a spectrum of contexts should make it easier to isolate what is distinctive about animal use and cultural meanings in different settings.

Kahn (2024, this Special Issue) explores the social meaning of pig and dog in pre-contact Society Island chiefdoms through integrating ethnohistoric and archaeological analysis. She applies "Human Centered Interaction Network" analysis to a sample of over 82 published and unpublished data sets to assess degree of animal representation and cultural uses (e.g., clothing, cosmology, food, etc.). Her results are intriguing: both dog and pig are linked to ritual and elite foods, but pig shows much stronger ties to chiefly power. Kahn suggests that pig husbandry was intensified in the century before European contact, to support this link to chiefly power and ritual. Archaeological records show pig increases in abundance through time, whereas dog is generally rare. She wonders if the scarcity of dog reflects the difficulty of even larger islands maintaining both dog and pigs through selective breeding and husbandry; and pigs won out, given their closer link to chiefly power.

I appreciated Kahn's attention on two taxa (versus o*nly* dog *or* pig *or* turtle). By including two creatures in her synthesis, she was able to isolate distinct patterns that could be linked to differences in cultural values and history, raising new questions that would not have been apparent with a single species focus.

The goal of Greig and Walter's paper (2024, this Special Issue) is to argue that using aDNA from remains of commensal animals (e.g., rat, pig, dog, chicken) as a proxy to track historical patterns of human inter-island travel and interaction has "gone about as far as it can go" in contributing to Oceania cultural historical analysis. The authors point to geochemical analysis of toolstone, which has begun to provide equal if not richer insights about human interaction spheres and the complex and entangled movements of people. Instead of continuing to use commensals as a *proxy* for humans, the authors urge scholars to use genetics of commensal animals to directly study animal-human relationships, such as animal husbandry and landscape management. Using genetics and isotopic analysis to track trade

in animals that were tied to prestige goods is a rich area for future research. To what extent were socio-political leaders (and belief systems) responding to or directing changes in animal management? Greig and Walter also review ways commensal animal genetics could contribute to our understanding of health and disease transmission. They cite new work carried out by the One Health program (e.g., Rayfield et al. 2023), which provides long-term perspectives on human-animal-environmental interactions to consider microbiome adaptation, and evolutionary history of pathogens, as potential avenues for research with Oceania records.

Considering the papers as a whole, all of them intersect one or more of the key "pillars" of HE. For example, most of them explore questions of stability or change in cultural practices related to animal use and reflect on the drivers of that stability or change. Several of the papers focus more on analytic and methodological issues (counting units, mesh size, element selection, taphonomy) than HE per se. This attention is completely understandable given the status of scholarship in particular island groups. With more robust data in hand, future projects will be in a better position to tackle the complex questions and goals aligned with HE. Nims et al. (2024, this Special Issue) are notable for attending to critical analytic concerns – then turning to broader drivers of change in fisheries, considering paleoenvironmental factors and social ones too. I was especially impressed with the degree all of the papers integrate historic and ethnographic records of animal use with traditional zooarchaeology to build a much richer understanding of the social-cultural context than animal bones alone would ever provide. One pillar of HE relates to ways scholarship can and should contribute to broader societal concerns. Except for Greig and Walter's example for using animal genetics to study disease transmission, however, papers did not much consider ways zooarchaeology contributes to issues beyond the academy. Communities in Oceania (and beyond) are deeply concerned about the local impacts of climate change, overfishing, and habitat degradation from deep sea mining just to name a few examples. I encourage future scholarship that explicitly draws on deep-time perspectives from zooarchaeology to address these concerns (e.g., Braje, 2024).

In sum, I am inspired and impressed by the thoughtful scholarship shared in this Special Issue. Zooarchaeology certainly has come along away in the past 40 years since I dipped my toe into Oceania scholarship. Besides close attention to methods and sampling, scholars are considering a range of topics and models to better understand the dynamics of human-animal relationships in the tropical Pacific that will have implications far beyond this region.

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