Five Centuries of Procurement and Utilization of Animals at Nu‘alolo Kai, Nā Pali Coast, Kaua‘i

<Front-piece photograph of bird bone picks to go here>

In Press, University of Hawai‘i Press

Five Centuries of Procurement and Utilization of Animals at Nu‘alolo Kai, Nā Pali Coast, Kaua‘i

Julie S. Field and Michael W. Graves, Editors

With Contributions by

Kelley S. Esh

Julie S. Field

Michael W. Graves

Stephanie Jolivette

Windy K. McElroy

Alex E. Morrison

Owen L. O’Leary

ISBN page

Dedication

To the people of Nuʻalolo Kai

Holo iʻa ka papa, kau ʻia e ka manu

When the shoals are full of fish, birds gather over them.

Where there is food, people gather.

Hawaiian Proverb (Mary Kawena Pukui 1983)

Table of Contents

List of Figures

List of Tables

Acknowledgements

Many individuals have contributed to the study of Nuʻalolo Kai. Archaeological research began with the surveys of Wendell Bennett, who as a researcher working for the Bernice P. Bishop Museum was the first to record the cultural deposits below the cliffs. His maps and records provided the impetus for later research by Bishop Museum archaeologists Kenneth Emory, William Bonk, and Lloyd Soehren, who directed research at Nuʻalolo Kai in the years 1958-1964. Other scholars of Pacific prehistory, such as William ʻPilaʼ Kikuchi, Roger Green, Ben Finney, and Patrick V. Kirch, also contributed to the research and interpretation of Nuʻalolo Kai in the early 1970s and 1980s.

Additional mapping and recording of Nuʻalolo Kai and Nuʻalolo ʻĀina was performed by Myra Tomonari-Tuggle in the late 1980s. Excavations in 1990 were organized by Terry L. Hunt (University of Hawaiʻi- Mānoa) and Martha Yent (Hawaii State Parks) and directed by Terry L. Hunt. Analysis and cataloging of the Bishop Museum collections in 1991 was made possible by a grant to Michael W. Graves and Yosi Sinoto from the Hawaiʻi-Bishop Research Institute. Additional funds from the Hawaiʻi Council for the Humanities, Michael Pfeffer, and John Jacobsen allowed for additional analyses from 1996-2005.

Valuable research on the collection was also provided by Michael Graves, Melinda S. Allen, Jadelyn Moniz-Nakamura, Lisa Nagaoka, Windy K. McElroy, Cyril Calugay, Jacce Mikulanec, Lahela Perry, Elizabeth Gordon, Gail Murikami, Marjeta Jeraj, Alex E. Morrison, Kelley Esh, Owen O'Leary, Stephanie Jolivette, Helen James, John Jacobsen, Michael Pfeffer, Kuʻulei Rodgers, Peter Mills, Mark Oxley, Julie S. Field, Terry L. Hunt, and C. Kehau Cachola-Abad. Dozens of undergraduate students from the University of Hawaiʻi- Mānoa contributed hundreds of hours to the study and documentation of artifacts in the collections.

Stewardship and curation of the collection has also been critical over the decades, and the work of Betty Kam, Susan Lebo, Ann Iwashita, Jenny Kahn, Summer Moore, Mara Mulrooney (Bishop Museum), and Jo Lynn Gunness (University of Hawai‘i-Mānoa) has made this research, and any future research, possible.

We also thank the Department of Anthropology at the University of Hawai‘i-Mānoa, and also the staff of the Anthropology Department of the Bishop Museum, for hosting the analysis of these collections within their facilities. This research could not have been completed without the ability to store, analyze, and tabulate the hundreds of bags and boxes associated with Nu‘alolo Kai.

We also wish to acknowledge the research and stewardship of Hawaii State Parks, in particular Maurice Major and Alan Carpenter, and the care of Nā Pali Coast ‘Ohana, who maintain and preserve Nu‘alolo Kai for future generations.

Lastly, we thank two anonymous reviewers for their insightful commentary and suggestions regarding the content of this volume. To all and any we have forgotten we are grateful.

Abbreviations

AD	year designation from the Gregorian calendar (modern calendar date, e.g. AD 2014)
BP	years before present (radiocarbon)
BPBM	Bernice P. Bishop Museum
C	Celsius
cm	centimeters
cmbs	centimeters below surface
g	gram
km	kilometers
km^2	square kilometers
m	meters
mm	millimeter
m^2	square meters
MNI	minimum number of individuals
mya	million years ago
N	north
N=	number equals
NTAXA	number of taxa
NISP	number of identified specimens
σ	standard deviation
UHM	University of Hawai‘i, Mānoa

Chapter 5. Modified and Unmodified Turtle Remains from Nu‘alolo Kai

Michael W. Graves, Stephanie Jolivette, Kelley S. Esh, and Julie S. Field

Archaeologists have reported the heavy, early use of sea turtles in several Polynesian Islands (Allen 2007; Kirch 1988b; Kirch and Yen 1982; Leach, et al. 1984; Nagaoka 1988). They were thought to be a highly ranked food resource because of their large size and predictable nesting or basking locations on sandy beaches. A review by Dye and Steadman (1990) noted the lack of sea turtle remains from early prehistoric Hawaiian sites despite the number of suitable beach locations in the Islands. Historic sources confirm the widespread hunting of sea turtles in Hawaii and their likely extirpation from many locations.

Although sea turtles are reported from nearly 30 archaeological sites across all of the Main Islands (Kittinger, et al. 2013), there is surprising little written about these occurrences. Sites with turtle bone include several historic occupations in Honolulu (Goodwin, et al. 1996; Hartzell 1997; Lebo and McGuirt 2000; Rosendahl, et al. 1988) as well as sites located some distance from the coast (e.g., upper Anahulu Valley, O‘ahu [Kirch and Sahlins 1992], inland Lapakahi, Hawai‘i Island [Rosendahl 1994] or lacking substantial sandy beaches (Jones and Kirch 2007). Most reported locations are on or near beaches, e.g., Bellows (Pearson, et al. 1971), Kāne‘ohe Bay (Rosendahl 1999) and Ko Olina (Ziegler 2000), O‘ahu; Palauea (Henry, et al. 1992), Maui; Hulopo‘e, Lāna‘i (Tominari-Tuggle and Tuggle 1990); and Kawaihae (Rosendahl, et al. 1988) and coastal Lapakahi (Newman 1968; Pearson 1969), Hawai‘i Island. Nu‘alolo Kai, where sea turtle remains were recovered from all four excavated structures, represents another coastal context.

The 1958-1964 and 1990 excavations at Nu‘alolo Kai recovered only a small number of sea turtle remains relative to the total bone assemblage; however this sample represents the largest collection of sea turtle bones recovered from an archaeological site in the Hawaiian Islands. This collection is also unique in that it contains identified elements from both the Green sea turtle (*Chelonia mydas*) and the Hawksbill turtle (*Eretmochelys imbricata*). The following analyses discuss the presence of sea turtle remains in the archaeological collection, and trace the distribution of modified and unmodified (including artifactual) elements in the stratified deposits. We also examine the relative size of individuals, the presence of particular skeletal elements that are indicative of butchery practices, and marks that would indicate the use of turtle bone and shell for tools and raw material. The results indicate that sea turtles were used extensively in the later occupations of Nu‘alolo Kai, and that hunting focused on the subadult and adult portions of the population. In this sample of specimens, one-third were modified or identified as artifacts.

Sea Turtles in Hawai‘i

When sea turtle remains are reported (as opposed to simply listed) from Hawaiian archaeological sites it is generally in reference to their use for the production of tools. *Olonā* scrapers, used to prepare the durable cordage fiber of the same name, were made from large bony segments of the sea turtle carapace and plastron. These have been reported from a number of archaeological sites and in the ethnographic literature (Hartzell 2004:117; Malo 1951:47; Summers 1990:31). The keratinous shell that covers much of the body of the sea turtle was also made into net mesh gauges, *kahili* handle segments, haircombs, ornaments, bracelets, and fishhooks. However, no archaeological study has been undertaken to determine if there was any preference for the use of turtle keratin, or specific species of turtles, to make these tools (Emory, et al. 1959; Hiroa 1957:290; Malo 1951:47).

There are several early historic accounts of sea turtles in Hawai‘i and their use by Hawaiians. These can be conflicting (Johanness 1986:30). According to several accounts only the *honu* (Green sea turtle, *Chelonia mydas*) was eaten, while the *‘ea* or *honu‘ea* (Hawksbill turtle, *Eretmochelys imbricata*) was considered poisonous and used exclusively for tool production (Hiroa 1957:5, Malo 1951: 47). Green sea turtles are reported from several of the Northwest Hawaiian Islands throughout the 19th century, as reported in Kittinger et al. (2013). Their numbers, based on ethnographic or more recent historical accounts, diminish in Hawai‘i by the early 20th century. There were reports of Hawksbill sea turtle in the Northwest Hawaiian Islands in the early to late 19th century, as well as more recent records of juveniles on Laysan Island and Pearl and Hermes Atoll. Historical accounts suggest Hawksbill were targeted for tortoiseshell in great numbers (Van Houtan, et al. 2012).

Large-mesh nets are mentioned by Hiroa (1957:290) for catching turtles and Allen (2007) lists netting and grappling as collection methods. However, it is likely in many cases turtles were taken from beach locations, particularly where they nested in large numbers or in other locations where they came out to rest or bask. Historic accounts (summarized in Rudrud 2010) describe turtle consumption as being restricted, either to men or to priests and chiefs in Hawai‘i, although again there are conflicting reports. A widespread Polynesian tradition of limiting consumption of turtle meat to certain classes suggests to Rudrud (2010:94) that this is an early trait associated with ancestral Polynesian societies. Allen (2007), however, suggests a distinction in turtle consumption patterns between high volcanic islands and low atolls, with chiefly consumption restricted to the former, such as Hawai‘i. Still, the lack of species-specific information from Hawaiian archaeological sites clouds our understanding of sea turtle use in prehistory. It is possible that most or all of the five species of sea turtle found in the Hawaiian

Islands today may have been in use prehistorically (Ziegler 2002:239). Table 5.1 lists the five species of sea turtle known to inhabit the Hawaiian Islands at present. Certainly by the 19th century when sea turtles were extensively hunted for their meat and carapaces, their consumption was no longer limited to chiefs. They had become part of a global system of procurement and consumption.

Both species of sea turtles that have been identified in the Nu‘alolo Kai archaeological collection (*Chelonia mydas* and *Eretmochelys imbricata*) breed and nest in the Hawaiian Islands. Both are classified as either endangered or threatened due to sharp reductions in their world-wide populations. Balazs (1976) documented migrations of adult female green sea turtles from their nesting sites in the French Frigate Shoals, Northwest Hawaiian Islands to the Main Hawaiian Islands, as far south as Hawai‘i Island. Green sea turtles have now re-established nesting sites throughout the Main Hawaiian Islands including Miloli‘i on the Nā Pali coast. Currently, there are only small populations of adult nesting females in the Main Hawaiian Islands; generally they are found at the more remote beaches on the Main Islands, and more commonly on the more distant Northwest Hawaiian Islands. At least one study assumed hawksbill turtle breeding populations would be skewed 80:20 female to male ratios (Heppell and Crowder 1996). It takes between 20 and 30 years for these turtles to reach maturity, at which time they are found in coastal waters. Juveniles spend a portion of their lives in a pelagic phase, often at a distance from where nesting occurs.

<Table 5.1 here>

Sea Turtle Remains in the Nu‘alolo Kai Collection

For identification of the turtle remains from Nu‘alolo Kai several comparative collections were used**:** the Archaeology Comparative Faunal Collections, Department of Anthropology,

University of Hawai‘i-Mānoa; George Balazs, Pacific Islands Fisheries Science Center (National Marine Fisheries Service), Honolulu Laboratory; the Herpetology Division, Bernice P. Bishop Museum, Honolulu; and the Herpetology Division, Burke Museum of Natural History and Culture, Seattle. All identifiable sea turtle remains in the Nu‘alolo Kai collection appear to be from the family Cheloniidae. No elements in the Nu‘alolo Kai collection can be identified as the Leatherback sea turtle (*Dermochelys coriacea*), although a large proportion of the sea turtle bones were not identifiable to species through traditional macroscopic techniques. Both the Green sea turtle (*Chelonia mydas*) and the Hawksbill sea turtle (*Eretmochelys imbricata*) have been identified from the Nu‘alolo Kai collection based on a restricted number of elements, but relative proportions have yet to be determined because so few elements can be reliably assigned to species.

Good preservation at the site allowed both bones and portions of the keratinous shell to be preserved. In this discussion the following terminology will be used. The carapace and the plastron make up the bony “shell” of the sea turtle and will therefore be referred to as bones. In the living animal a keratinous “shell” covers both the carapace and the plastron and in this discussion the term “keratin” will be used in reference to this substance. These distinctions are made to avoid the problems often encountered in the literature when references to “turtle shell” are made. The analyses and discussion presented below focus on the collections generated by the 1958-1964 Bishop Museum excavations, which produced an assemblage of 261 specimens of sea turtle remains. This includes both modified, artifactual, and unmodified bone and keratin (see Tables 5.2 and 5.3). Only 13 sea turtle elements were found in the 1990 UHM excavations, all in the upper levels, and thus little can be said about turtle distribution in this later excavation. It is

likely that the small size of the faunal assemblage recovered from this excavation explains the relatively limited number of turtle remains recovered in the 1958-1964 excavation.

<Table 5.2 here>

<Table 5.3 here>

Quantification

The majority of turtle bone found in the Nu‘alolo Kai excavations comes from the portion of the body contained within the shell (Table 5.4). A similar emphasis was found at the site of TK-4 on Tikopia in the Solomon Islands, and it was suggested that the bony shell portion of the turtle is so large and durable that it is readily identifiable as turtle even when broken into smaller pieces. As a result the number of sea turtles can be overestimated (Nagaoka 1988: 123). In the Nu‘alolo Kai case the majority of the “body” count is due to fragments of keratin rather than the bony shell, but similar arguments are applicable. Keratin covers the entire outer surface of the “body” segment of the sea turtle and is highly fragmented in the Nu‘alolo Kai collections.

When only the bone is considered there is still a slight emphasis on the body of the animal, but for the most part it appears that the elements are fairly equally represented. It thus seems likely that whole animal was being transported to the site with the possible exception of the skull portion, perhaps due to its lack of edible content. There may be some differentiation between fore and hind limb distribution, but low numbers of identified specimens (NISP) values makes any interpretation difficult.

Frequency and Body Part Representation

Table 5.2 shows the distribution of turtle specimens across the excavated areas of the site and within the analytic Zones 1-3. The excavated layers have been grouped utilizing the analytic zones described by Graves et al. (2005), and which are also outlined in Chapter 3, Table 3.2. The

majority of sea turtle bones were recovered from excavation units K3 and K5. (Graves, et al. 2005:153). The upper layers and the latest analytic zone of the site contain the majority of the turtle bones, suggesting a late prehistoric to historic emphasis on sea turtle hunting. It is possible, although unlikely, that this apparent emphasis may be a product of differential bone preservation, with the more recent material being better preserved. The upper layers do contain the greater overall bone counts, suggesting that the relative presence of sea turtle bones in different layers of the site may simply be a product of sample size.

<Table 5.4 here>

Size Distribution

After hatching sea turtles immediately swim away from land and do not return to the nearshore environment until they have grown into subadults. In the case of Green and Hawksbill turtles, adulthood is reached when carapaces reach or exceed 20-25 cm in length (Bolten 2003:248; Hirth 1997:14). To determine the age of the population represented by the Nu‘alolo Kai collection, length and width measurements of the archaeological humeri specimens (N = 5) were compared to measurements taken from modern sea turtles. The modern measurements were provided by George Balazx at the National Marine Fisheries Service, Honolulu. All of these samples were from deposits that dated to Zones 1 and A, and thus post-date AD 1700. Based on these measurements, the estimated straight carapace length (SCL) of sea turtles in this assemblage falls between 35 cm and 63 cm; well above the minimum adult length. The large size of the animals suggests that they were being procured on or near the island shoreline, rather than through deep ocean fishing. Breeding age females come ashore, sometimes in large numbers, to lay eggs, and in the case of Green sea turtles, both sexes come ashore to bask on beaches, making them easy targets for Hawaiian hunters (Balazs 1980:34).

No sea turtle egg shells or hatchling bones were recovered from the archaeological excavations at Nu‘alolo Kai. This may suggest that breeding was not taking place, or that eggs and hatchlings were not harvested. In addition, hatchling bones and sea turtle eggs are unlikely to preserve in archaeological sites due to their small and fragile nature, and none have been reported from sites in the Hawaiian Islands.

Modification

Approximately one third of the turtle specimens from Nu‘alolo Kai (92 objects) are modified by humans, the majority of these being cut, ground, or perforated (Figure 5.1). This is a high percentage relative to the unmodified bones, exceeding that for dog (6%) and pig (10%), and about the same for birds (see Chapters 6 and 7). Other modification includes carnivore and rodent gnawing as well as sporadic burning (see Table 5.5). While most of the modified turtle specimens were recovered from Zone 1, a number of fragments were found in Zone 2, most from excavations in K5. This would place turtle procurement within the late prehistoric and historic periods at Nu‘alolo Kai.

<Figure 5.1 here>

The majority of the modified elements are keratin, probably due to the preferential use of this material for tools. However, the number of keratin elements with cutmarks may be an underestimation, since these fragments were only considered “worked” if the ventral face of the keratin (the side that in life would have been protected by lying against the bony carapace, or plastron) contained cutmarks or if the scratches have a distinct and repetitive pattern. The reason for this requirement is that living sea turtles, especially Green sea turtles, spend a large amount of time rubbing up against rocks when feeding, resting in sea caves, and hauling out on beaches. Modern comparative specimens exhibit randomly scratched patterns that are indistinguishable

from those found on the outer surfaces of keratin fragments from the archaeological collection. The majority of archaeological keratin pieces also show evidence of "ripping," that produced a jagged edge along one or more sides. Unfortunately it is impossible to determine whether such ripping occurred during the butchery process, was intentionally done to remove specific pieces of the keratin for making tools, or occurred through post depositional processes.

<Table 5.5 here>

The keratin specimens also include a number of finished tools (Table 5.6, Figure 5.1). Among the artifacts from K5 were four combs, five mesh gauges, three fishhooks, and four *kahili* (feathered standards used to indicate chiefly rank) handle parts. Only six turtle artifacts were recovered from K3: one ornament, one comb, and four mesh gauges. Improved excavation techniques likely account for the larger number of artifacts recovered from K5. Turtle artifacts from both K3 and K5 occurred in both Zones 1 and 2, consistent with those that were modified but not formed into identifiable tools. Very few of the sea turtle bone specimens show any evidence of modification other than gnaw marks, although some have cut marks from either butchery or tool production. Only two bones exhibit evidence of burning. A single tool made from turtle bone, a scraper, was recovered from K3, Zone 1.

<Table 5.6 here>

Gnaw marks are found on only a small number of specimens, but on those bones gnawing is substantial enough to make some identifications difficult. Gnaw marks may have been generated by dogs, pigs, rats, and cats, all of which are known to have been present at Nu‘alolo Kai in the latest period of occupation. All but one of the humeri was gnawed so heavily that only a small portion of the mid-shaft remained. It is possible that heavy post-depositional gnawing by

carnivores has obscured the identification of sea turtles from Nu‘alolo Kai, and from other archaeological sites in Hawai‘i as well.

Discussion

Although the sea turtle remains are a relatively small component of the archaeological collections from Nu‘alolo Kai, they provide a rare glimpse into the prehistoric use of marine reptiles in the Pacific. The remains can also inform on human-sea turtle interactions and sustainability. The fact that sea turtles are reported from other archaeological sites in the Hawaiian Islands but rarely analyzed quantitatively increases the importance of this collection. It remains unclear at this time whether these larger counts are due to superior preservation, differential site use, or to the possibility of underreporting elsewhere in the literature. Due to a lack of palaeontological evidence from Hawai‘i it is unknown if sea turtles were more or less plentiful prior to Hawaiian colonization of the archipelago. Today turtles make heavy use of the Nu‘alolo Kai area, hauling out on the beaches to rest as well as sleeping in underwater caves (Balazs pers. comm.). This heavy use is due to the limited presence of humans in the area, and also the limited number of beaches along the Nā Pali coastline that are available for use as turtle resting sites. Nu‘alolo Kai beach is one of the longest in the local area, and it offers extensive habitat for turtles.

The Nu‘alolo Kai collection compares favorably (in terms of total number) with sea turtle assemblages reported from early occupations elsewhere in east Polynesia (see Allen 2007:965). Where the Nu‘alolo Kai assemblage of turtle remains departs from every other known Polynesian case is in the timing of turtle procurement relative to the first colonization of the archipelago. As Allen (2007:964) notes, archaeological turtle assemblages typically come from the earliest sites in a region or archipelago. The turtle assemblage from Nu‘alolo Kai derives

from a more recent interval of occupation—late prehistoric through recent historic periods, approximately AD 1500-1900. Additionally, in all of the cases discussed by Allen (2007) where there are stratigraphic or chronometrically dated sequences, the abundance of turtle specimens declines over time. This is interpreted as the effects of predation pressure from early Polynesian colonists. At Nu‘alolo Kai, sea turtle remains are absent from the earliest period of occupation (equivalent to Zone 3 at K3), and then increase in abundance from Zone 2 to Zone 1 at both K3 and K5. Hunting of sea turtles in this locality is late and did not apparently result in the reduction or loss of turtles in the vicinity of their procurement. Rather, the numbers of Ssea turtle elements increases over time, and like seabirds (see Chapter 6, this volume) show no evidence of resource depression.

Given their relatively low population densities and tendencies to select beaches for nesting that are removed from humans, it is not surprising to observe a relatively small emphasis in the Nu‘alolo Kai assemblage on hunting sea turtles relative to fish, or even seabirds. Hence, while turtles would be highly ranked with respect to size, the slow rate of growth to maturity, the skewed sex ratio, and low density of turtles (and longer search time), would likely have precluded reliance on turtle meat in the diet. If turtle meat was restricted to high ranking individuals or adult males in prehistoric and early historic times, then this would also have reduced its contribution towards the prehistoric diet of the Hawaiian population at Nu‘alolo Kai. The fact that all of the turtle remains whose size could be estimated were all in the range of adults further suggests that Hawaiians purposefully culled a portion of the turtle population that would withstand predation by humans. These individuals were not only taken for their meat but also were valued for the shell and carapace used to make several classes of tools both for ornamentation, ritual, and the production of other tools such as nets.

Nu‘alolo Kai thus provides a baseline from which comparisons to other archaeological collections of sea turtle remains in Hawai‘i can be made. Current evidence suggests that sea turtles were distributed widely in the Main and Northwest Hawaiian Islands after its colonization by Polynesians in the late first millennium AD. Yet they appear not to have been targeted for early prehistoric procurement as has been found in other islands where Polynesians settled. Hence, their numbers in the Main Hawaiian Islands may never have been as abundant and their major nesting locations could have been limited to the Northwest Hawaiian Islands. Sea turtles were hunted but not extirpated even during the historic era from Nu‘alolo Kai, although this locality was permanently occupied in the past. Restricted consumption of turtle meat may have contributed to this pattern during prehistory. At the same time, Hawaiians living in Nu‘alolo Kai may have obtained sea turtles during voyages to the Northwest Hawaiian Islands, but this would have certainly required them to travel beyond Nihoa and Mokumanumanu to locations such as the French Frigate Shoals where nesting sites are known.

Lastly, the analysis of sea turtle remains from Nu‘alolo Kai has implications for and can help inform on modern wildlife management decisions regarding human-turtle interactions and sustainability. Archaeological evidence suggests that sea turtles withstood some level of hunting in the past, but that this was limited to adults, and probably did not include hatchlings or target subadults. Consumption of turtle meat was probably limited to certain individuals. Future studies by biologists could incorporate these data into long-term projections for sea turtle population size, health, and management.

References

Addams, T.

1998 The interface between traditional and modern methods of fishery management in the Pacific Islands. *Ocean and Coastal Management* 40:127-142.

Ainley, D. G., R. Podolsky, L. Deforest, G. Spencer, and N. Nur

1998 The status and population trends of the Newell's Shearwater on Kauaʻi: Insights from modeling. *Studies in Avian Biology* 22:108-123.

Allen, M. S.

1992a *Dynamic Landscapes and Human Subsistence: Archaeological Investigations on Aitutaki Island, Southern Cook Islands.* Unpublished PhD dissertation. Department of Anthropology, University of Washington, Seattle.

1992b Temporal variation in Polynesian fishing strategies: The Southern Cook Islands in regional perspective. *Asian Perspectives* 31:183-204.

1996 Style and function in East Polynesian fishhooks. *Antiquity* 70:97-116.

2002 Resolving long-term change in Polynesian marine fisheries. *Asian Perspectives* 41:196-212.

2003 Human impact on Pacific nearshore marine ecosystems. In *Pacific Archaeology: Assessments and Prospects. Proceedings of the International Conference for the 50th Anniversary of the First Lapita Excavation, Kone, Noumea, Volume 15,* edited by C. Sand, pp. 317-325. Le Cahiers de L'Archaeologie en Nouvelle-Caledonie, Noumea.

2007 Three millennia of human and sea turtle interactions in Remote Oceania. *Coral Reefs* 26:959-970.

2012 Molluscan foraging efficiency and patterns of mobility amongst foraging agriculturalists: A case study from northern New Zealand. *Journal of Archaeological Science* 39:295-307.

Allen, M. S., T. N. Ladefoged, and J. J. Wall

2001 Traditional Rotuman fishing in temporal and regional context. *International Journal of Osteoarchaeology* 11:56-71.

Allen, M. S., E. Matisoo-Smith, and A. Horsburgh

2001 Pacific "Babes": Issues in the origins and dispersal of Pacific pigs and the potential of mitochondrial DNA Analysis. *International Journal of Osteoarchaeology* 11:4-13.

Anderson, A. J.

1981 A model of prehistoric collecting on the rocky shore. *Journal of Archaeological Science* 8:109-120.

Aswani, S.

1999 Common property models of sea tenure: A case study from Roviana and Vonavona Lagoons, New Georgia, Solomon Islands. *Human Ecology* 27:417-453.

2002 Assessing the effects of changing demographic and consumption patterns on sea tenure regimes in the Roviana Lagoon. *Ambio* 31:272-284.

Athens, J. S., M. Kaschko, and H. F. James

1981 Prehistoric bird hunters: High altitude resource exploitation on Hawai‘i Island. *Bishop Museum Occasional Papers* 31:63-84.

Athens, S., H. D. Tuggle, J. V. Ward, and D. J. Welch

2002 Avifaunal extinctions, vegetation change and Polynesian impacts in prehistoric Hawai‘i. *Archaeology in Oceania* 37:57-78.

Atkinson, I. A. E.

1977 A reassessment of factors, particularly *Rattus rattus* L., that influenced the decline of endemic forest birds in the Hawaiian Islands. *Pacific Science* 31:109-133.

Atkinson, I. A. E., and T. J. Atkinson

2000 Land vertebrates as invasive species on the islands of the South Pacific Regional Environment Programme. In *Invasive Species in the Pacific: A Technical Review and Draft Regional Strategy*, edited by G. Sherley, pp. 19-84. South Pacific Regional Environment Programme, Apia.

Ayres, W. S.

1985 Easter Island subsistence. *Journal de la Societe des Oceanistes* 80:113-124.

Balazs, G. H.

1976 Green turtle migrations in the Hawaiian Archipelago. *Biological Conservation* 9:125-140.

1980 *Synopsis of Biological Data on the Green Turtle in the Hawaiian Islands*. NOAA Technical Memorandum NMFS, 7, Southwest Fisheries Center Honolulu Laboratory, Honolulu.

Bartram, P., and J. Clark

1988 *Reef Study at Nu‘alolo Kai, Nā Pali Coast State Park, Kaua‘i*. Prepared for Division of State Parks, Hawaii Department of Land and Natural Resources, Honolulu.

Bayman, J. M.

2009 Technological change and the archaeology of emergent colonialism in the Kingdom of Hawai‘i. *International Journal of Historical Archaeology* 13:1092-7697.

Bayman, J. M., and T.S. Dye

2013 *Hawaii's Past in a World of Pacific Islands.* Society for American Archaeology, Washington D.C.

Bedford, S.

2006 *Pieces of the Vanuatu Puzzle: Archaeology of the North, South and Centre*. Terra Australis, 26. Australian National University Press, Canberra.

Bedford, S., and M. Spriggs

2002 Of shell, stone and bone. A review of non-ceramic artefacts recovered from the first 1000 years of Vanuatu's archaeological record. In *Fifty years in the Field. Essays in Honour and Celebration of Richard Shutler Jr's Archaeological Career*, edited by S. Bedford, C. Sand, and D. Burley, pp. 135-154. New Zealand Archaeological Association, Auckland.

Bennett, W. C.

1931 *Archaeology of Kaua'i*. Bulletin 80. Bernice P. Bishop Museum, Honolulu.

Berkes, F. and N. J. Turner

2006 Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human Ecology* 34:479-494.

Bernice P. Bishop Museum

1965 *Trip Report – Nu'alolo Kai Marine Fish Survey*. Report on file. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Bingham, H.

1822 Extracts from the journal of Mr. Bingham, while at Atoui. *Missionary Herald* 18(8):241-250.

1847 *A Residence of Twenty-One Years in the Sandwich Islands, or, The Civil, Political, and Religious History of those Islands; Comprising a Particular View of the Missionary*

Operations Connected with the Introduction and Progress of Christianity and Civilization among the Hawaiian People. H. Huntington, Hartford, CT.

Blakeslee, D. J.

1994 Reassessment of some radiocarbon dates from the Central Plains. *Plains Anthropologist* 39:203-210.

Blumenstock, D. I. and S. Price

1994 Climates of the States: Hawaii. In *A Natural History of the Hawaiian Islands: Selected Readings II*, edited by E. A. Kay, pp. 94-114. University of Hawai‘i Press, Honolulu.

Bolten, A. B.

2003 Variation in sea turtle life history patterns: Neritic vs. oceanic development stages. In *The Biology of Sea Turtles, Volume II*, edited by P. L. Lutz, J. A. Musick, and J. Wyneken, pp. 243-257. CRC Press, Boca Raton.

Bovy, K. M.

2002 Differential avian skeletal part distribution: Explaining the abundance of wings. *Journal of Archaeological Science* 29:956-978.

2007 Prehistoric human impacts on waterbirds at Watmough Bay, Washington, USA. *The Journal of Island and Coastal Archaeology* 2:210-230.

Braje, T.

2010 *Modern Oceans, Ancient Sites: Archaeology and Marine Conservation on San Miguel Island, California.* The University of Utah Press, Salt Lake City.

Braje, T., and T. C. Rick (editors)

2011 *Human Impacts on Seals, Sea Lions, and Sea Otters: Integrating Archaeology and Ecology in the Northeast Pacific*. The University of California Press, Berkeley.

Braun, C.

2005 *Techniques for Wildlife Investigation and Management*, 6th Edition. Wildlife Society, Bethesda.

Brigham, W. T.

1902 *Stone Implements and Stone Work of the Ancient Hawaiians*. Memoirs of the Bernice P. Bishop Museum 1. Bernice P. Bishop Museum, Honolulu.

Bronk Ramsey, C.

2009 Bayesian analysis of radiocarbon dates. *Radiocarbon* 51:337-360.

Broughton, J. M.

1994 Declines in mammalian foraging efficiency during the late Holocene, San Francisco Bay, CA. *Journal of Anthropological Archaeology* 13:371-401.

1994 Late Holocene resource intensification in the Sacramento Valley, California. *Journal of Archaeological Science* 21:501-514.

1997 Widening diet breadth, declining foraging efficiency, and prehistoric harvest pressure: Ichthyofaunal evidence from the Emeryville shellmound, California. *Antiquity* 71:845-862.

1999 Resource depression and intensification during the Late Holocene, San Francisco Bay: Evidence from the Emeryville shellmound vertebrate fauna. Archaeological Records, 32. University of California Press, Berkeley.

2001 Resource intensification and late Holocene impacts on Pacific bird populations: Evidence from the Emeryville shellmound avifauna. In *Posing Questions for a Scientific Archaeology*, edited by T. L. Hunt, C. Lipo and S. L. Sterling. Pp. 251-278. Bergin and Garvey, Westport.

Broughton, J. M., M. D. Cannon, and E. J. Bartelink

2010 Evolutionary ecology, resource depression, and niche construction theory: Applications to central Californian hunter-gatherers and Mimbres-Mogollon agriculturalists. *Journal of Archaeological Method and Theory* 17:371-421.

Broughton, J. M., and J. O'Connell

1999 On evolutionary ecology, selectionist archaeology, and behavioral archaeology. *American Antiquity* 64:153-165.

Burney, D. A., and L. P. Burney

2007 Paleoecology and "inter-situ" restoration on Kauaʻi, Hawaiʻi. *Frontiers in Ecology and the Environment* 5:483-490.

Burney, L. P., D. A. Burney

2003 Charcoal stratigraphies for Kauaʻi and the timing of human arrival. *Pacific Science* 57:211-226.

Burney, D. A., H. F. James, L. P. Burney, S. L. Olson, W. Kikuchi, W. L. Wagner, M. Burney, D. McCloskey, D. Kikuchi, F. V. Grady, R. Gage II, and R. Nishek

2001 Fossil evidence for a diverse biota from Kauaʻi and its transformation since human arrival. *Ecological Monographs* 71:615-641.

Burney, D.A., and W. K. P. Kikuchi

2006 A millennium of human activity at Makauwahi Cave, Māhāʻulepū, Kauaʻi. *Human Ecology* 34:219-247.

Butler, V. L.

1988 Lapita fishing strategies: The faunal evidence. In *Archaeology of the Lapita Cultural Complex: A Critical Review,* edited by P. V. Kirch and T. L. Hunt. Research Reports, 5. The Thomas Burke Memorial Washington State Museum, Seattle.

1994 Fish feeding behavior and fish capture: The case for variation in Lapita fishing strategies. *Archaeology in Oceania* 29:81-90.

2000 Resource depression on the Northwest coast of North America. *Antiquity* 74:649-661.

2001 Changing fish use on Mangaia, Southern Cook Islands: Resource depression and the prey choice model. *International Journal of Osteoarchaeology* 11:88-100.

Butler, V. L., and G. L. Delacorte

2004 Doing zooarchaeology as if it mattered: Use of faunal data to address current issues in conservation biology in Owens Valley, California. In *Zooarchaeology and Conservation Biology,* edited by R. L. Lyman and K. P. Cannon, pp. 25-44. University of Utah Press, Salt Lake City.

Cachola-Abad, C. K.

n.d. *A preliminary analysis of the Nu‘alolo Kai Site K-3 macrobotanical assemblage.* Unpublished manuscript on file. Department of Anthropology, University of Hawai‘i-Mānoa, Honolulu.

1993 Evaluating the orthodox dual settlement model for the main Hawaiian Islands: An analysis of artifact distribution and Hawaiian oral traditions. In *The Evolution and Organisation of Prehistory Society in Polynesia,* edited By M. W. Graves and R. Green, pp. 13-32. Monograph, 19. New Zealand Archaeological Association, Auckland.

Calugay, C. and W. McElroy

2005 An analysis of coral, basalt, and sea urchin spine abrading tools from Nu‘alolo Kai, Kaua‘i. In *Na Mea Kahiko O Kaua‘i: Archaeological Studies in Kaua‘i,* edited by M. T. Carson and M. W. Graves, pp. 212-235. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Campbell, S. K.

1981 *The Duwamish No. 1 Site: A Lower Puget Sound Shell Midden*. Institute for Environmental Studies, University of Washington, Seattle.

Cannon, M. D.

2001 Archaeofaunal relative abundance, sample size, and statistical methods. *Journal of Archaeological Science* 28:185-195.

2003 A model of central place forager prey choice and an application to faunal remains from the Mimbres Valley, New Mexico. *Journal of Anthropological Archaeology* 22:1-25.

Cannon, M. D. and J. M. Broughton (editors)

2010 *Evolutionary Ecology and Archaeology: Applications to Problems in Human Evolution and Prehistory.* University of Utah Press, Salt Lake City.

Carpenter, A.

2002 *Nu‘alolo Kai, Nā Pali Educational Sourcebook.* Website: [http://napali.org/sourcebook.html], accessed 2012.

Carson, M. T.

2005 A radiocarbon dating synthesis for Kaua‘i. In *Na Mea Kahiko O Kaua‘i: Archaeological Studies in Kaua‘i,* edited by M. T. Carson and M. W. Graves, pp. 11-32. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Casteel, R. W.

1972 Some biases in the recovery of archaeological faunal remains. *Proceedings of the Prehistoric Society* 36:382-388.

Catterall, C. P., and I. R. Poiner

1987 The potential impact of human gathering on shellfish populations, with reference to some NE Australian intertidal flats. *Oikos* 50:114-122.

Chapman, M. D.

1987 Traditional Political Structure and Conservation in Oceania. *Ambio* 16:201-205.

Charnov, E. L.

1976 Optimal foraging: The marginal value theorem. *Population Biology* 9:129-136.

Ching, F. K. W.

1966 *A Three Day Field Trip Into the Nā Pali Coast On Kauaʻi: Makaha Cave, Miloliʻi Flats and Valley, Nuʻalolo Kai, August 12-14, 1966.* Division of State Parks, Department of Land and Natural Resources, Honolulu.

Ching, P.

1994 *The Hawaiian Monk Seal*. University of Hawaiʻi Press, Honolulu.

Clague, D. A., and G. B. Dalrymple

1994 Tectonics, geochronology, and the origin of the Hawaiian-Emperor volcanic chain. In *A Natural History of the Hawaiian Islands: Selected Readings II*, edited by E. A. Kay, pp. 5-40. University of Hawaiʻi Press, Honolulu.

Clason, A. T. and W. Prummel

1977 Collecting, sieving, and archaeozoological research. *Journal of Archaeological Science* 4:171-175.

Collins, S. L.

1997 Faunal remains from the Kawailoa Site, O‘ahu Island. *Hawaiian Archaeology* 6:4-16.

Conant, S., H. D. Pratt, and R. J. Shallenberger

1998 Reflections on a 1975 ornithological expedition to the lost world of the Alaka‘i and other notes on the natural history, systematics and conservation of Kaua‘i birds. *Wilson Bulletin* 110:1-22.

Cook, J.,and J. King

1793 *A Voyage to the Pacific Ocean; Undertaken by Command of his Majesty, for Making Discoveries in the Northern Hemisphere: Performed under the Direction of Captains Cook, Clerke, and Gore, in the Years 1776, 1777, 1778, 1779, 1780. Being a copious, comprehensive, and satisfactory abridgement of the Voyage.* Champante and Whitrow, Hermitage-Bridge, London.

Cooper, B. A., and R. H. Day

1995 *Kaua‘i Endangered Seabird Study, Volume 1: Interactions of Dark-Rumped Petrels and Newell’s Shearwaters with Utility Structures on Kaua‘i, Hawai‘i.* Report TR-105847-V1. Electric Power Research Institute, Palo Alto.

Coral Reef Assessment and Monitoring Program (CRAMP)

2006 Coral Reef Assessment and Monitoring Program, Hawai‘i, Kaua‘i Study Site. Website: [http://cramp.wcc.hawaii.edu/LT_Montoring_files/lt_study_sites_Kauai.htm /], accessed 2006.

Cuddihy, L. W., and C. P. Stone

1990 *Alteration of Native Hawaiian Vegetation: Effects of Humans, Their Activities and Introductions*. University of Hawaii Cooperative National Park Resources Studies Unit. University of Hawai‘i Press, Honolulu.

Culin, S.

1899 Hawaiian games. *American Anthropologist* 1:201-247.

Dalzell, P.

1998 The role of archaeological and cultural-historical records in long-range coastal fisheries resources management strategies and policies in the Pacific Islands. *Ocean and Coastal Management* 40:237-252.

Department of Land and Natural Resources, Division of Fish and Game, State of Hawai‘i

1979 *Marine Survey of the Nā Pali Coast, Island of Kaua‘i*. Report on file. Department of Land and Natural Resources, Honolulu.

Denney, J.

1999 *The Birds of Kaua‘i*. University of Hawaii Press, Honolulu.

Dibble, H.

1981 A new method for describing and analyzing artifact shape. *American Antiquity* 46:178-187.

Dixon, B., A. Carpenter, F. Eble, C. Mitchell, and M. Major

1995 Community growth and *heiau* construction: Possible evidence of political hegemony at the site of Kaunolu, Lāna‘i, Hawai‘i. *Asian Perspectives* 34:229-254.

Duncan, R. P., A. Boyer, and T. Blackburn

2013 Magnitude and variation of prehistoric bird extinctions in the Pacific. *Proceedings of the National Academy of Sciences* 110:6436-6441.

Dunnell, R., and S. K. Campbell

1977 *Aboriginal Occupation of Hamilton Island, Washington*. Reports in Archaeology, 4. Department of Anthropology, University of Washington Press, Seattle.

Dunnell, R., and D. Lewarch

1974 *Archaeological Remains in Home Valley Park, Skamania County, Washington.* Department of Anthropology, University of Washington Press, Seattle.

Dunnell, R. C.

1971 *Systematics in Prehistory*. The Free Press, New York.

1978 Style and function: a fundamental dichotomy. *American Antiquity* 43:192-202.

Dye, T. S.

1994 Comments on Gordon's "Screen Size and Differential Faunal Recovery: A Hawaiian Example". *Journal of Field Archaeology* 21:391-392.

2000 Effects of ^{14}C sample selection in archaeology: An example from Hawai'i. *Radiocarbon* 42:203-217.

Dye, T. S., and D. W. Steadman

1990 Polynesian ancestors and their animal world. *American Scientist* 78:207-215.

Ellis, W.

1825 *A Narrative of an 1823 Tour Through Hawai'i. With Remarks on the History, Traditions, Manners, Customs and Language of the Inhabitants of the Sandwich Islands*. Crocker and Brewster, New York.

Emory, K. P., W. Bonk, and Y. H. Sinoto

1959 *Hawaiian Archaeology: Fishhooks*. Special Publication 47. Bernice P. Bishop Museum, Honolulu.

Emory, K. P. and Y. H. Sinoto

1961 *Hawaiian Archaeology: Oahu Excavations.* Special Publication, 49. Bernice P. Bishop Museum, Honolulu.

1965 *Preliminary Report on the Archaeological Investigations in Polynesia*. Report on file. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

1969 *Age of Sites in the South Point area, Ka‘u, Hawai‘i.* Pacific Anthropological Records, 8. Bernice P. Bishop Museum, Honolulu.

Emory, T.

1949 *Hawaiian Life in Kalalau, Kaua‘i, According to John Hanohano and His Mother, Wahine i Keouli Pa.* Manuscript on file. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Esh, K. S.

2005 *Human Impacts on Pacific Sea Birds: An Analysis of Resource Use at Nu‘alolo Kai, Kaua‘i.* Unpublished MA thesis. Department of Anthropology, University of Hawai‘i, Mānoa, Honolulu.

Evans, M. K.

2013 An *‘aina*-based approach to cultural heritage management. *The SAA Archaeological Record* 13(2):36-38.

Field, J. S.

2003 A classification for Hawaiian artifacts based on morphology and wear: Analyses of discoidal artifacts from Nu‘alolo Kai, Kaua‘i. *Rapa Nui Journal* 17:94-105.

Foale, S.

1998 Assessment and management of the *Trochus* fishery at West Nggela, Solomon Islands: An interdisciplinary approach. *Ocean and Coastal Management* 40:187-205.

Fowler, C. and D. Lepofsky

2011 Traditional resource and environmental management. In, *Ethnobiology*, edited by E. Anderson, D. Pearsall, E. Hunn, and N. Turner, pp. 287-306. Wiley-Blackwell, Hoboken.

Fornander, A.

1878 *Ancient History of the Hawaiian People*. Mutual Publishing, Honolulu.

Fuller, E.

2000 *Extinct Birds.* Oxford University Press, Oxford.

Gilman, G. D.

1908 Journal of a canoe voyage along the Kaua‘i *pali*’s, made in 1845. *Hawaiian Historical Society Papers* 14:3-8.

Goodwin, C. M., F. Beardsley, S. Wickler, and B. Jones

1996 *Honoruru to Honolulu: From Village to City.* International Archaeological Research Institute, Inc., Honolulu.

Gordon, E. A.

1993 *Diversity and the Analysis of Subsistence: A Case from Hawai‘i,* Unpublished manuscript on file. Department of Anthropology, University of Hawai‘i, Mānoa, Honolulu.

1993 Screen size and differential faunal recovery: A Hawaiian example. *Journal of Field Archaeology* 20:453-460.

1994 Reply to Dye. *Journal of Field Archaeology* 21:392-394.

Goto, A.

1986 *Prehistoric Ecology and Economy of Fishing in Hawai‘i: An Ethnoarchaeological Approach*. Unpublished PhD dissertation. Department of Anthropology, University of Hawai‘i-Mānoa, Honolulu.

Graves, M. W., J. S. Field and W. K. McElroy

2005 An overview of site 50-30-01-196, Nu‘alolo Kai, Kaua‘i: Features, excavations, stratigraphy, and chronology of historic and prehistoric occupation. In *Na Mea Kahiko O Kaua‘i: Archaeological Studies in Kaua‘i*, edited by M. T. Carson and M. W. Graves, pp. 149-187. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Graves, M. W. and W. K. McElroy

2005 Hawaiian fishhook classification, identification, and analysis, Nu‘alolo Kai (Site 50-30-01-196), Kaua‘i. In *Na Mea Kahiko O Kaua‘i: Archaeological Studies in Kaua‘i*, edited by M. T. Carson and M. W. Graves, pp. 188-211. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Graves, M. W. and J. Moniz

1992 Seven centuries of angling and capture of fish at Nu‘alolo Kai, Kaua‘i. Manuscript on file. Research Seminar Series, Bernice P. Bishop Museum, Honolulu.

Graves, M. W., M. W. Oxley, and W. K. McElroy

n.d. The fishhook and marine implements assemblage from Nu‘alolo Kai, Nā Pali, Island of Kaua‘i: A consideration of technological and functional variation. Manuscript on file. Department of Anthropology, University of New Mexico, Albuquerque, NM

Grayson, D. K.

1984 *Quantitative Zooarchaeology*. Academic Press, New York.

2001 The archaeological record of human impacts on animal populations. *Journal of World Prehistory* 15:1-68.

Gulko, D.

2005 *Hawaiian Endemic Species Status Chart Spreadsheet*. Division of Aquatic Resources, Department of Land and Natural Resources, Honolulu.

Harrison, C. S.

1990 *Seabirds of Hawai‘i: Natural History and Conservation*. Cornell University Press, London.

Hartzell, L. L.

1977 Vertebrate faunal analysis. In *Native Hawaiian and Euro-American Culture Change in Early Honolulu: Archaeological Data Recovery, Harbor Court Property, Site No. 50-80-14-2456, Honolulu, Hawai‘i*, edited by S.A. Lebo, pp. 127-141. Prepared for McCormack Properties, Ltd. Department of Anthropology, B.P. Bishop Museum, Honolulu.

2004 Excavation methods and analyses of archaeofaunas. In *Activities and Settlement in an Upper Valley: Data Recovery and Monitoring Archaeology in North Halawa Valley, O‘ahu*, edited by L. L. Hartzell, S. A. Lebo, H. A. Lennstrom, S. McPherron, and D. I. Olszewski. Bernice P. Bishop Museum, Honolulu.

Henry, J. D., A. T. Walker, P. H. Rosendahl

1992 *Additional Archaeological Inventory Survey: Testing for Additional Burials, Plauea Development Parcel, Land of Palauea, Makawao District, Island of Maui, TMK:2-1-11:3. Hilo, Hawaii.* Prepared for Eugene C. Hu. Paul H. Rosendahl, Phd., Inc., Hilo.

Heppell, S. S. and L. B. Crowder

1996 Analysis of a fisheries model for harvest of hawksbill sea turtles *(Eretmochelys imbricata). Conservation Biology* 10:874-880.

Hiroa, T. R.

1957 *Arts and Crafts of Hawai‘i*. Special Publication 45. Bernice P. Bishop Museum, Honolulu.

Hirth, H. F.

1997 *Synopsis of the Biological Data on the Green Turtle Chelonia Mydas (Linnaeus 1758).* Fish and Wildlife Service, Department of the Interior, Washington, DC.

Holling, C. S.

1973 Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4:1-23.

Hommon, R. J.

2013 *The Ancient Hawaiian State: Origins of a Political Society*. Oxford University Press, New York.

Hunt, T. L.

2005 Archaeological stratigraphy and chronology at Nu‘alolo Kai, Nā Pali District, Kaua‘i. In *Na Mea Kahiko o Kaua‘i: Archaeological Studies in Kaua‘i*, edited by M. T. Carson and M. W. Graves, pp. 236-258. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

2006 Rethinking the fall of Easter Island. *American Scientist* 91:412-419.

Hunt, T. L., and P. V. Kirch

1997 The historical ecology of Ofu Island, American Samoa, 3000 B.P. to the present. In *Historical Ecology in the Pacific Islands: Prehistoric Environmental and Landscape Change*, edited by P. V. Kirch and T. L. Hunt, pp. 105-123. Yale University Press, New Haven.

James, H., T. Stafford, D. W. Steadman, S. L. Olson, P. S. Martin, A. T. Jull, and P. McCoy

1987 Radiocarbon dates on bones of extinct birds from Hawai‘i. *Proceedings of the National Academy of Sciences of the United States of America* 84:2350-2354.

James, H. F., and S. L. Olson

1991 Descriptions of thirty-two new species of birds from the Hawaiian Islands: Part II: Passeriformes. *Ornithological Monographs* 46:1-88.

Jerardino, A.

1997 Changes in shellfish species composition and mean shell size from a late Holocene record of the west coast of Southern Africa. *Journal of Archaeological Science* 24:1031-1044.

Johanness, R. E.

1981 *Words from the Lagoon: Fishing and Marine Lore in the Palau District of Micronesia*. University of California Press, Berkeley.

1986 *A Review of Information on the Subsistence Use of Green and Hawksbill Sea Turtles on Islands Under United States Jurisdiction in the Western Pacific Ocean*. SWR-86-2. National Marine Fisheries Service, National Oceanographic and Atmospheric Administration, Terminal Island.

1998 Government supported, village-based management of marine resources in Vanuatu. *Ocean and Coastal Management* 40:165-186.

Jones, S., and P. V. Kirch

2007 Indigenous Hawaiian fishing practices in Kahikinui Maui: A zooarchaeological approach. *Hawaiian Archaeology* 11:39-53.

Kahn, J., V. Wichman, A. Carpenter, M. Maigret, and K. Dye

2009 *The hale pili site a century later: Investigations at Miloli‘i Valley, Kaua‘i.* Presented at the Annual Meeting of the Society for Hawaiian Archaeology, October 2009, Honolulu.

Kamakau, S. M.

1991 *Tales and Traditions of the People of Old.* Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawaii, Revised Edition.* Kamehameha Schools, Honolulu.

Kay, E. A.

1979 *Hawaiian Marine Shells. Reef and Shore Fauna of Hawaii Volume 4: Mollusca.* Bernice P. Bishop Museum, Honolulu.

1994 Marine Ecosystems in the Hawaiian Islands. In *A Natural History of the Hawaiian Islands: Selected Readings II*, edited by E. A. Kay, pp. 187-195. University of Hawai‘i Press, Honolulu.

Kay, E. A., and W. Magruder

1977 *The Biology of ‘Opihi*. Department of Planning and Economic Development, Honolulu.

Kikiloi, K.

2010 Rebirth of an archipelago: Sustaining a Hawaiian cultural identity for people and homeland. *Hulili: Multidisciplinary Research on Hawaiian Well-Being* 6:73-115.

Kirch, P. V.

1967 *Report on Archaeological Fishbones from K3, Nu‘alolo, Kaua‘i*. Report on file. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

1973 Prehistoric subsistence patterns in the northern Marquesas Islands, French Polynesia. *Archaeology and Physical Anthropology in Oceania* 8:24-40.

1982a The ecology of marine exploitation in prehistoric Hawai‘i. *Human Ecology* 10:455-476.

1982b The impact of the prehistoric Polynesians on the Hawaiian ecosystem. *Pacific Science* 36:1-14.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawai‘i Press, Honolulu.

1988a Long-distance exchange and island colonisation: The Lapita case. *Norwegian Archaeological Review* 21:103-117.

1988b *Niuatoputapu: The Prehistory of a Polynesian Chiefdom*. Monograph 5. Thomas Burke Memorial Washington State Museum, Seattle.

1997 *The Lapita Peoples: Ancestors of the Pacific World*. Blackwell Publishers Ltd., Cambridge.

2012 *A Shark Going Inland is My Chief: The Island Civilization of Ancient Hawai‘i.* University of California Press, Berkeley.

Kirch, P. V., and S. L. Collins

1989 Faunal assemblages of the Anahulu rockshelter sites. In *Prehistoric Hawaiian Occupation in the Anahulu Valley, O‘ahu Island: Excavations in Three Inland Rockshelters,* Contributions of Archaeological Research Facility, 47, edited by P. V. Kirch, pp. 61-72. Department of Anthropology, University of California, Berkeley.

Kirch, P. V., and S. Jones O’Day

2003 New archaeological insights into food and status: A case study from pre-contact Hawai‘i. *World Archaeology* 34:484-497.

Kirch, P. V., and M. Kelly

1975 *Prehistory and Ecology in a Windward Hawaiian Valley: Halawa Valley, Molokai*. Pacific Anthropological Records, 24. Bernice P. Bishop Museum, Honolulu.

Kirch, P.V., and M. D. Sahlins

1992 *Anahulu: The Anthropology of History in the Kingdom of Hawai‘i,* 2 volumes. University of Chicago Press, Chicago.

Kirch, P. V., and W. Sharp

2005 Coral ^{230}Th dating of the imposition of a ritual control hierarchy in precontact Hawa‘i. *Science* 307:102-104.

Kirch, P. V., and D. E. Yen

1982 *Tikopia: The Prehistory and Ecology of a Polynesian Outlier*. Bulletin 238. Bernice P. Bishop Museum, Honolulu.

Kittinger, J. N., T. M. Bambico, T. K. Watson, and E. W. Glazier

2012 Sociocultural significance of the endangered Hawaiian monk seal and the human dimensions of conservation planning. *Endangered Species Research* 17:139-156.

Kittinger, J. N., K.S. Van Houtan, L. E. McClenachan, and A. L. Lawrence

2013 Using historical data to assess the biogeography of population recovery. *Ecography* 36:868-872.

Knudsen, E. A.

1991 *A Trip Around the Island and Some Personal Experiences on the Nā Pali Coast.* Manuscript on file. The Kauai Papers, Kaua‘i Historical Society, Lihue.

Krebs, C. J.

1999 *Ecological Methodology.* Addison Wesley Longman, Menlo Park.

Ladefoged, T. N, and M. W. Graves

2008 Variable development of dryland agriculture in Hawai‘i: A fine-grained chronology from the Kohala Field System, Hawai‘i Island. *Current Anthropology* 49:771-802.

Leach, B. F., M. Intoh, and I. Smith

1984 Fishing, turtle hunting, and mammal exploitation at Fa‘ahia, Huahine, French Polynesia. *Journal de la Societe des Oceanistes* 40:183-197.

Leach, B. F., and H. Leach

1979 The Wairarapa archaeological research programme. In *Prehistoric Man in Palliser Bay*, edited by B. F. Leach and H. Leach, pp. 1-10. Bulletin, 21. National Museum of New Zealand, Wellington.

Lebo, S. A., M. D. McGuirt

2000 *Pili Grass, Wood Frame, Brick, and Concrete: Archaeology at 800 Nuuanu*. Prepared for the Bank of Hawaii. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Lepofsky, D., and J. Kahn

2011 Cultivating an ecological and social balance: Elite demands and commoner knowledge in ancient Ma‘ohi agriculture, Society Islands. *American Anthropologist* 113:319-335.

Lockwood, C. A., J. M. Lynch and W. H. Kimbel

2002 Quantifying temporal bone morphology of great apes and humans: An approach using geometric morphometrics. *Journal of Anatomy* 201:447.

Lyman, R. L.

1996 Applied zooarchaeology: The relevance of faunal analysis to wildlife management. *World Archaeology* 28:110-125.

Lyman, R. L., and K. P. Cannon (editors)

2001 *Zooarchaeology and Conservation Biology*. University of Utah Press, Salt Lake City.

MacArthur, R. H., and E. O. Wilson

1967 *The Theory of Island Biogeography*. Princeton University Press, Princeton.

MacPhee, R. D. E.

1999 *Extinctions in Near Time: Causes, Contexts, and Consequences*. Kluwer Academic-Plenum, New York.

Major, M.

2005 Seeing the *lama*: Charcoal, evolution, and Hawaiian settlement. In *Na Mea Kahiko O Kaua‘i: Archaeological Studies in Kaua‘i*, edited by M. T. Carson and M. W. Graves, pp. 120-148. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Major, M. and A. Carpenter

2007 *Preservation Plan for Selected Sites at Nu‘alolo Kai, Nā Pali Coast State Wilderness Park, District of Waimea, Kaua‘i*. Archaeology Program, Division of State Parks, Department of Land and Natural Resources, and Nā Pali Coast ‘Ohana, Honolulu and Kaua‘i.

Malo, D.

1951 *Hawaiian Antiquities. Revised Edition*. Translated by N. B. Emerson. Special Publication 2. Bernice P. Bishop Museum Press, Honolulu.

Mannino, M. and K. D. Thomas

2001 Intensive Mesolithic exploitation of coastal resources? Evidence from a shell deposit on the Isle of Portland (Southern England) for the impact of human foraging on populations of intertidal rocky shore mollusks. *Journal of Archaeological Science* 28:1101-1014.

2002 Depletion of a resource? The impact of prehistoric human foraging on intertidal mollusc communities and its significance for human settlement, mobility, and dispersal. *World Archaeology* 33:452-474.

Masse, W. B.

1986 A millennium of fishing in the Palau Islands, Micronesia. In *Traditional Fishing the Pacific: Ethnographic and Archaeological Papers from the 15th Pacific Science Congress*, Pacific Anthropological Records, 37, edited by A. J. Anderson, pp. 85-117. Bernice P. Bishop Museum, Honolulu.

Matisoo-Smith, E., and M.S. Allen

2001 Name that rat: molecular and morphological identification of Pacific rodent remains. *International Journal of Osteoarchaeology* 11:34-42.

Matisoo-Smith, E., R. M. Roberts, G. J. Irwin, J. S. Allen, D. Penny, and D. M. Lambert

1998 Patterns of prehistoric human mobility in Polynesia indicated by mtDNA from the Pacific Rat. *Proceedings of the National Academy of Sciences of the United States of America* 95:15145-15150.

McAlister, A. J.

2002 *Prehistoric Fishing at Fakaofo, Tokelau: A Case for Resource Depression on a Small Atoll.* Unpublished MA thesis. Department of Anthropology, University of Auckland, Auckland.

McAllister, J. G.

1933 *Archaeology of Kahoolawe*. Bulletin 115. Bernice P. Bishop Museum, Honolulu.

McCay, B. J. and J. M. Acheson

1987 Human ecology of the commons. In *The Question of the Commons*, edited by B. J. McCay and J. M. Acheson, pp. 1-34. University of Arizona Press, Tucson.

McCoy, M. D.

2008 Hawaiian limpet harvesting in historical perspective: A review of modern and archaeological data on Cellana spp. from the Kalaupapa Peninsula, Molokaʻi Island. *Pacific Science* 62:21-38.

McCoy, M. D., A. T. Browne Ribeiro, M. W. Graves, O. A. Chadwick, and P. M. Vitousek

2013 Irrigated taro (Colocasia esculenta) farming in North Kohala, Hawaiʻi: Sedimentology and soil nutrient analyses. *Journal of Archaeological Science* 40:1528-1538.

McClure, S. B., M. A. Jochim, and C. M. Barton

2006 Human behavioral ecology, domestic animals, and land use during the transition to agriculture in Valencia, Eastern Spain. In *Behavioral Ecology and the Transition to Agriculture,* edited by D. J. Kennett and B. Winterhalder, pp. 197-216. University of California, Berkeley.

McElroy, W. K.

2003a Rethinking the traditional classification of Hawaiian poi pounders. *Rapa Nui Journal* 17:85-93.

2003b *Variability in Poi Pounders from Kauaʻi Island, Hawaiʻi.* Unpublished MA thesis. Department of Anthropology, University of Hawaiʻi-Mānoa, Honolulu.

2004 Poi pounders of Kauaʻi Island, Hawaiʻi: Variability through time and space. *Hawaiian Archaeology* 9:25-49.

2007 *The Development of Irrigated Agriculture in Wailau Valley, Molokaiʻi Island, Hawaiʻi.* Unpublished PhD dissertation. Department of Anthropology, University of Hawaiʻi-Mānoa, Honolulu.

Meadows, D., A. L. Kane, C. Mitchell, and C. Ogura

2005 *Technical Report X*. Hawaii Statewide Aquatic Wildlife Conservation Strategy, Pacific Cooperative Studies Unit, University of Hawai‘i-Mānoa, Honolulu.

Mills, P. R., S. P. Lundblad, J. S. Field, A. B. Carpenter, W. K. McElroy, and P. Rossi

2010 Geochemical sourcing of basalt artifacts from Kaua‘i, Hawaiian Islands. *Journal of Archaeological Science* 37:3385-3393.

Moniz, J.

1997 The role of seabirds in Hawaiian subsistence: Implications for interpreting avian extinction and extirpation in Polynesia. *Asian Perspectives* 36(1):27-50.

Moniz, J., M. S. Allen, and M. W. Graves

1995 Methodological issues in artifact analysis: Explaining stylistic variability in Hawaiian fishhooks. Manuscript on file. Department of Anthropology, University of Hawai‘i-Mānoa, Honolulu.

Moniz-Nakamura, J.

1999 *The Archaeology of Human Foraging and Bird Resources on the Island of Hawai‘i: The Evolutionary Ecology of Avian Predation, Resource Intensification, Extirpation, and Extinction.* Unpublished PhD dissertation. Department of Anthropology, University of Hawai‘i,-Mānoa, Honolulu.

Mooallem, J.

2013 Who would kill a monk seal? *New York Times Magazine,* May 12th 2013, pp. 30-38.

Morrison, A. E., and T. L. Hunt

2007 Human impacts to the near-shore environment: An archaeological case study from Kaua‘i; Hawaiian Islands. *Pacific Science* 61:325-345.

Moss, M. L. and A. Cannon

2011 *The Archaeology of North Pacific Fisheries*. University of Alaska Press, Fairbanks.

Munro, J.

1993 Giant clams. In *Nearshore Marine Resources of the South Pacific: Information for Fisheries Development and Management*, edited by A. Wright and L. Hill, pp. 430-449. Institute of Pacific Studies, Suva, Forum Fisheries Agency, Honiara, and International Centre for Ocean Development, Canada.

Nagaoka, L.

1988 Lapita subsistence: The evidence of non-fish archaeofaunal remains. In *Archaeology of the Lapita Cultural Complex: A Critical Review*, edited by P.V Kirch and T. Hunt, pp. 117-153. Research Reports 5. Thomas Burke Memorial Washington State Museum, Seattle.

2001 The effects of resource depression on foraging efficiency, diet breadth, and patch choice in Southern New Zealand. *Journal of Anthropological Archaeology* 21:419-442.

2002 Explaining subsistence change in southern New Zealand using foraging theory models. *World Archaeology* 34:84-102.

Nāleimaile, S. P., and L. Brandt

2013 Is Hawaiian archaeology really Hawaiian? A native Hawaiian perspective. *The SAA Archaeological Record* 13:31-32.

Nash, W. J.

1990 *Spawning and Hatchery Rearing of Trochus (Trochus niloticus) in Vanuatu, with a Discussion of Management of the Vanuatu Trochus Fishery: Report of a Visit to Vanuatu in Jan/Feb 1990*. FAO South Pacific Aquaculture Development Project, Suva, Fiji.

1993 *Trochus.* In *Nearshore Marine Resources of the South Pacific: Information for Fisheries Development and Management,* edited by A. Wright and L. Hill, p. 710-789. Institute of Pacific Studies, Suva, Forum Fisheries Agency, Honiara, and the International Centre for Ocean Development, Canada.

Newman, T.S.

1970 *Hawaiian Fishing and Farming on the Island of Hawaii in A.D. 1778.* Division of State Parks, Department of Land and Natural Resources, Honolulu.

NOAA

2010 NOAA Fisheries Department of Protected Resources, Green Turtle (*Chelonia mydas*). Website: [http://www.nmfs.noaa.gov/pr/species/turtles/green.htm]. Accessed in June 2010.

O'Leary, O. L.

2005 Analysis of the Nu'alolo Kai ¼ inch fishbone assemblage, Nā Pali coast, Kaua'i. In *Na Mea Kahiko O Kaua'i: Archaeological Studies in Kaua'i,* edited by M. T. Carson and M. W. Graves, pp. 259-274. Special Publication 2. Society for Hawaiian Archaeology, Honolulu.

Olson, S. L. and P. J. Hearty

2003 Probable extirpation of a breeding colony of short-tailed albatross *(Phoebastria albatrus)* on Bermuda by Pleistocene sea-level rise. *Proceedings of the National Academy of Sciences of the United States of America* 100:12825-12829.

Olson, S. L. and H. F. James

1982 Fossil birds from the Hawaiian Islands: Evidence for wholesale extinction by man before western contact. *Science* 217:633-635.

1984 The role of Polynesians in the extinction of the avifauna of the Hawaiian Islands. In *Quaternary Extinctions: A Prehistoric Revolution*, edited by P. S. Martin and R. G. Klein, pp. 768-780. University of Arizona Press, Tucson.

1991 Descriptions of thirty-two new species of birds from the Hawaiian Islands: Part I: non-passeriformes. *Ornithological Monographs* 45:1-88.

Olson, S. L., P. Wellnhofer, C. Mourer-Chauvire, D. Steadman, and D. L. Martin (editors)

1999 *Avian Paleontology at the Close of the 20th Century: Proceedings of the 4th International Meeting of the Society of Avian Paleontology and Evolution, 4-7 June 1996*. Smithsonian Institution, Washington, D.C.

Pauly, D.

1995 Anecdotes and the Shifting Baseline Syndrome of Fisheries. *Trends in Ecology and Evolution* 10: 430.

Payne, S.

1972 Partial recovery and sample bias: The results of some sieving experiments. In *Papers in Economic Prehistory*, edited by E. S. Higgs, pp. 46-64. Cambridge University Press, London.

Pearson, R. (editor)

1994 *Excavations at Lapakahi, North Kohala, Hawaii Island—1968*. State Archaeological Journal, 69-2. Division of State Parks, Department of Land and Natural Resources, Honolulu.

Pearson, R. J., P.V. Kirch, and M. Pietrusewsky

1971 An early prehistoric site at Bellows Beach, Waimanalo, Oahu, Hawaiian Islands. *Archaeology and Physical Anthropology of Oceania* 6:204-234.

Pfeffer, M. T.

1995a Distribution and design of Pacific octopus lures: The Hawaiian octopus lure in regional context. *Hawaiian Archaeology* 4:47-56.

1995b *Preliminary analysis of artifacts recovered from primary use contexts on O‘ahu, Hawai‘i: A proposal to chronologically order Hawaiian “Octopus lure weights”*. Manuscript on file. Department of Anthropology, University of Hawai‘i-Mānoa, Honolulu.

2001 Implications of new studies of Hawaiian fishhook variability for our understanding of Polynesia settlement history. In *Style and Function: Conceptual Issues in Evolutionary Archaeology*, edited by T. D. Hurt and G. F. M. Rakita, pp. 165-182. Greenwood Publishing Group, Westport.

Pospisil, L. J.

1963 *Kapauku Papuan Economy*. Publications in Anthropology, 67. Yale University, New Haven.

Pukui, M. K.

1983 *‘Ōlelo No‘eau: Hawaiian Proverbs and Poetical Sayings*. Special Publication 71. Bernice P. Bishop Museum Press, Honolulu.

Randall, J. E.

1995 Zoogeographic analysis of the inshore Hawaiian fish fauna. In *Marine and Coastal Biodiversity in the Tropical Island Pacific Region. Volume 1: Species Systematics and Information Management Priorities*, edited by J. E. Maragos, M. N. A. Peterson, L. G. Eldredge, J. E. Bardach and H. F. Takeuchi, pp. 193-203. East-West Center, Honolulu.

Reimer, P., M. Baillie, E. Bard, A. Bayliss, J. Beck, P. Blackwell, C. Bronk Ramsey, C. Buck, G. Burr, R. Edwards, M. Friedrich, P. Grootes, T. Guilderson, I. Hajdas, T. Heaton, A. Hogg, K. Hughen, K. Kaiser, B. Kromer, F. G. McCormac, S. Manning, R. Reimer, D. Richards, J. Southon, S. Talamo, C. Turney, J. Van der Plicht, and C. Weyhenmeyer

2009 IntCal09 and Marine09 radiocarbon age calibration curves, 0-50,000 years cal BP. *Radiocarbon* 51:1111-1150.

Rieth, T. M., Hunt, T. L., Lipo, and C., J. M. Wilmshurst

2011 The 13th century Polynesian colonization of Hawai‘i Island. *Journal of Archaeological Science* 38:2740-2749.

Rolett, B. V.

1998 *Hanamiai: Prehistoric Colonization and Cultural Change in the Marquesas Islands (East Polynesia).* Publications in Anthropology 81. Yale University Press, New Haven.

Rorrer, K.

1998 Subsistence evidence from inland and coastal cave sites on Easter Island. In *Easter Island in Pacific Context South Seas Symposium*, edited by C. Stevenson, G. Lee, and F. J. Moran, pp. 193-198. Easter Island Foundation, Los Osos.

Rosendahl, P. H., L. A. Carter, G. F. Somers

1988 *Excavations at John Young's Homestead, Kawaihae, Hawai'i: Archaeology at Pu'ukohala Heiau National Historic Site.* National Park Service, Department of the Interior, Washington, DC.

1994 Aboriginal Hawaiian structural remains and settlement patterns in the upland archeological zone at Lapakahi, Island of Hawaii. *Hawaiian Archaeology* 3:14-70.

1999 *Archaeological Monitoring of Trench Excavations and Testing for Phase*

III (KB357MS) Repairs to Sanitary Sewer System, Marine Corps Base Hawaii, Kaneohe Bay, Oahu. Prepared for Commander, Pacific Division, Naval Facilities Engineering Command. Paul H. Rosendahl, PhD, Inc., Hilo.

Ruddle, K.

1998 The context of policy design for existing community based management systems in the Pacific Islands. *Ocean and Coastal Management* 40:105-126.

Rudrud, R.

2010 Forbidden sea turtles: Traditional laws pertaining to sea turtle consumption in Polynesia (including the Polynesian Outliers). *Conservation and Society* 8:84-97.

Samou, S.

1999 Marine Resources. In *Strategies for Sustainable Development: Experiences from the Pacific*, edited by J. Overton and R. Scheyvens, pp. 142-154. Zed Books, New York.

Shepard, A. O.

1956 *Ceramics for the Archaeologist.* Publication 609 Carnegie Institute, Washington D.C.

Sinoto, Y. H.

1962 Chronology of Hawaiian fishhooks. *Journal of the Polynesian Society* 71:162-166.

1967 Artifacts from excavated sites in the Hawaiian, Marquesas, and Society Islands: A comparative study. In *Polynesian Culture History: Essays in Honor of Kenneth P. Emory*, edited by G. Highland, R. Force, A. Howard, M. Kelly, and Y. H. Sinoto, pp. 341-361. Special Publication 56. Bernice P. Bishop Museum Press, Honolulu.

1979 The Marquesas. In *The Prehistory of Polynesia*, edited by J. D. Jennings, pp. 110-134. Harvard University Press, Cambridge.

1991 A revised system for the classification and coding of Hawaiian fishhooks. *Occasional Papers of the Bishop Museum* 31:85-105.

Skinner, H. D.

1915 Bone carving tools of the Maori. *Journal of the Polynesian Society* 24:24-26.

Smith, E. A.

1983 Anthropology, evolutionary ecology, and the explanatory limitations of the ecosystem concept. In *The Ecosystem Concept in Anthropology*, edited by E. F. Moran, pp. 51-85. Westview Press, Boulder.

1987 Optimization theory in anthropology: Application and critiques. In *The Latest on the Best: Essays on Evolution and Optimality*, edited by J. Dupre, pp. 201-249. MIT Press, Cambridge.

1991 *Inujjuamiut Foraging Strategies: Evolutionary Ecology of an Arctic Hunting Economy*. Aldine de Gruyter, New York.

Soehren, L. and K. Kikuchi

n.d. [1966] *Archaeological Investigations at Nu‘alolo Kai, Kaua‘i.* Manuscript on file. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Spear, L. B., D. G. Ainley, N. Nur, and S. N. G. Howell

1995 Population size and factors affecting at-sea distributions of four endangered Procellariids in the tropical Pacific. *The Condor* 97:613-638.

Spriggs, M.

1997 Landscape catastrophe and landscape enhancement: Are either or both true in the Pacific? In *Historic Ecology in the Pacific Islands: Prehistoric Environment and Landscape*

Change, edited by P. V. Kirch and T. L. Hunt, pp. 80-104. Yale University Press, New Haven.

Steadman, D. W.

1989 Extinction of birds in Eastern Polynesia: A review of the record, and comparisons with other Pacific Island groups. *Journal of Archaeological Science* 16:177-206.

1991 Extinct and extirpated birds from Aitutaki and Atiu, Southern Cook Islands. *Pacific Science* 45:325-347.

1995 Prehistoric extinctions of Pacific Island birds: Biodiversity meets zooarchaeology. *Science* 267:1123-1131.

1999 The Lapita extinction of Pacific Island birds: Catastrophic versus attritional. In *The Pacific from 5000 to 2000 BP: Colonisation and Transformations*, edited by J. C. Galipaud and I. Lilley, pp. 375-386. Editions de Institut de Recherche pour le Developement, Paris.

2006 *Extinction and Biogeography of Tropical Pacific Birds*. University of Chicago Press, Chicago.

Steadman, D. W., and L. J. Justice

1998 Prehistoric exploitation of birds on Mangareva, Gambier Islands, French Polynesia. *Man and Culture in Oceania* 14:225-238.

Steadman, D. W., and P. S. Martin

2003 The late Quaternary extinction and future resurrection of birds on Pacific Islands. *Earth-Science Reviews* 61:133-147.

Steadman, D. W., A. Plourde, and D. Burley

2002 Prehistoric butchery and consumption of birds in the Kingdom of Tonga, South Pacific. *Journal of Archaeological Science* 29:571-584.

Steadman, D. W., and B. V. Rolett

1996 A chronostratigraphic analysis of landbird extinction on Tahuata, Marquesas islands. *Journal of Archaeological Science* 23:81-94.

Summers, C. C.

1990 *Hawaiian Cordage*. Pacific Anthropological Records 39. Bernice P. Bishop Museum, Honolulu.

Swadling, P.

1976 Changes induced by human predation in prehistoric shellfish populations. *Mankind Quarterly* 10:156-162.

Sweeney, M.

1992 Settlement pattern change in Hawai‘i: Testing a model for the cultural response to population collapse. *Asian Perspectives* 31:39-57.

Szabó, K., and G. R. Summerhayes

2002 Worked shell artefacts: New data from early Lapita. In *Fifty years in the Field: Essays in Honour and Celebration of Richard Shutler Jr's Archaeological Career*, edited by S. Bedford, C. Sand, and D. Burley, pp. 91-100. New Zealand Archaeological Association, Auckland.

Thibault, J-C., and A. Cibois

2012 From early Polynesian settlements to the present: Bird extinctions in the Gambier Islands. *Pacific Science* 66:271-281.

Thomas, D. H.

1969 Great Basin hunting patterns: A quantitative method for treating faunal remains. *American Antiquity* 34:392-401.

Thomas, F. R.

2001 Remodeling marine tenure on the atolls: A case study from Western Kiribati, Micronesia. *Human Ecology* 29:399-423.

Thurston, L. P.

1922 Exploring in Nualolo. *The Honolulu Advertiser*. July 16 1922 issue, Honolulu.

Tinker, S. W.

1978 *Fishes of Hawai‘i: A Handbook of the Marine Fishes of Hawai‘i and the Central Pacific Ocean*. Hawaiian Service, Inc., Honolulu.

Titcomb, M.

1969 *Dog and Man in the Ancient Pacific*. Special Publication 59. Bernice P. Bishop Museum, Honolulu.

1978 Native use of marine invertebrates in old Hawai‘i. *Pacific Science* 32:325-375.

Tomonari-Tuggle, M. J.

1989 *An Archaeological Reconnaissance Survey: Nā Pali Coast State Park, Island of Kaua‘i*. Division of State Parks, Department of Land and Natural Resources, Honolulu.

Tomonari-Tuggle, M. J., H. D. Tuggle, and J. S. Athens

2000 *Archaeology of a South Coast Landscape: Hulopoe, Lanai, Hawaii. Volumes I-III.* Report prepared for Lanai Company, Inc. International Archaeological Research Institute, Inc., Honolulu.

Ugan, A.

2005 Climate, bone density, and resource depression: What's driving variation in large and small game in Fremont archaeofaunas? *Journal of Anthropological Archaeology* 24:227-251.

Van Houtan, K. S., J. N. Kittinger, A. L. Lawrence, C. Yoshinaga, V. R. Born, and A. Fox

2012 Hawksbill sea turtles in the Northwestern Hawaiian Islands. *Chelonian Conservation and Biology* 11:117-121.

VanPool, T. L., and R. D. Leonard

2002 Specialized ground stone production in the Casas Grandes region of Northern Chihuahua, Mexico. *American Antiquity* 67:710-730.

Vitousek, P., L. Loope, and R. Westbrooks

1996 Biological invasions as global environmental change. *American Scientist* 84:468-478.

Wang, J. K. (editor)

1983 *Taro: A Review of Colocasia Esculenta and its Potentials*. University of Hawai‘i Press, Honolulu.

Wanless, R. M., A. Angel, R. J. Cuthbert, G. M. Hilton, and P. G. Ryan

2007 Can predation by invasive mice drive seabird extinctions? *Biology Letters* 3:241-244.

Williams, B. K., J. D. Nichols, and M. J. Conroy

2002 *Analysis and Management of Animal Populations.* Academic Press, Chicago.

Wilmshurst, J. M., T. L. Hunt, C. P. Lipo, and A. J. Anderson

2010 High-precision radiocarbon dating shows recent and rapid initial human colonization of East Polynesia. *Proceedings of the National Academy of Sciences of the United States* 108:1815-1820.

Winterhalder, B., F. Lu, and B. Tucker

1999 Risk-sensitive adaptive tactics: Models and evidence from subsistence studies in biology and anthropology. *Journal of Archaeological Research* 7:301-348.

Winterhalder, B., and E. A. Smith

2000 Analyzing adaptive strategies: Human behavioral ecology at twenty-five. *Evolutionary Anthropology* 9:51-72.

Wolverton, S., and R. Lee Lyman (editors)

2012 *Conservation Biology and Applied Zooarchaeology.* University of Arizona Press, Tucson.

Worthy, T. H., and R. N. Holdaway

2002 *The Lost World of the Moa.* Indiana University Press, Bloomington.

Wragg, G.M.

1995 The fossil birds of Henderson Island, Pitcairn Group: Natural turnover and human impact, a synopsis. *Biological Journal of the Linnaean Society* 56:405-414.

Yent, M.

1983 *Archaeological Mapping and Inventory of the Cultural Resources at Nu'alolo Kai, Nā Pali Coast State Park, Kaua'i*. Division of State Parks, Department of Land and Natural Resources, Honolulu.

1985 *Archaeological Testing of Eroding Cultural Sites at Nu'alolo Kai, Nā Pali Coast State Park, Kaua'i.* Outdoor Recreation and Historic Sites, Division of State Parks, Department of Land and Natural Resources, Honolulu.

Ziegler, A. C.

2000 *Non-human Vertebrate Remains. West Beach Data Recovery Program, Phase IV-Archaeological and Paleontological Excavations, Ko Olina Resort.* Volume IV:

Technical Reports, pp 5.1-5.30. Prepared for Ko Olina Resort. Paul H. Rosendahl, Inc,, Hilo.

2002 *Hawaiian Natural History, Ecology, and Evolution*. University of Hawai‘i Press, Honolulu.

Table 5.1. Sea turtles found in Hawaiian waters. Page 74

Taxa	**Common Name**	**Native Hawaiian Name**
Cheloniidae		
Cheloniinae		
Chelonia mydas	Green sea turtle	*honu*
Eretmochelys imbricata	Hawksbill turtle	*honu ʻea*
Carettinae		
Caretta caretta	Loggerhead turtle	N/A
Lepidochelys olivacea	Olive Ridley turtle	N/A
Dermochelyidae		
Dermochelys coriacea	Leatherback turtle	N/A

Table 5.1. Sea turtles found in Hawaiian waters.

Table 5.2. All identified turtle specimens, including modified materials and artifacts from K2, K3, K4, and K5 . Page 76

Feature	Analytic Zone	Total NISP	Modified Artifact NISP	Unmodified NISP
K2	1	3	1	2
K3	1	83	27	56
1960	2	6	1	5
	3			
	UNPROV	15	3	12
K3	A	13		13
1990	B			
	C			
K4	1	5	2	3
K5	1	76	35	41
	2	25	11	14
	UNPROV	35	12	23
	TOTAL	**261**	**92**	**169**

Table 5.2. All identified turtle specimens, including modified materials and artifacts from K2, K3, K4, and K5. This includes specimens from the 1958-1964 Bishop Museum excavations, as well as those done in 1990 by University of Hawai‘i archaeologists. These specimens are sorted by analytic zone (where known). Bishop

Feature	Analytic Zone	Total NISP	Keratin NISP	Bone NISP
K2	1	2		2
K3	1	56	28	28
1960	2	5	1	4
	3			
	UNPROV	12	12	
K3	A	13	10	3
1990	B			
	C			
K4	1	3	2	1
K5	1	41	28	13
	2	14	7	7
	UNPROV	23	17	6
	TOTAL	**169**	**105**	**64**

Table 5.3. All unmodified turtle remains with proportion of keratin and bone specified. This includes specimens from the Bishop Museum and University of Hawai‘i excavations. These

Table 5.3. All unmodified turtle remains with proportion of keratin and bone specified. Page 76

Feature	Analytic Zone	Total NISP	Keratin NISP	Bone NISP
K2	1	2		2
K3	1	56	28	28
1960	2	5	1	4
	3			
	UNPROV	12	12	
K3	A	13	10	3
1990	B			
	C			
K4	1	3	2	1
K5	1	41	28	13
	2	14	7	7
	UNPROV	23	17	6
	TOTAL	**169**	**105**	**64**

Table 5.3. All unmodified turtle remains with proportion of keratin and bone specified.

This includes specimens from the Bishop Museum and University of Hawai‘i

Table 5.4. Turtle body part representation (excluding unidentifiable elements) derived from the 1958-1990 Nu‘alolo Kai excavations. Page 77

Body Portion	Subportion		Count
Skull			4
	Cranium	2	
	Mandible		
	Hyoid		
	Cvert	2	
Forelimb			18
	Pectoral	4	
	Humerus	5	
	Radius/Ulna	4	
	Foreflipper	5	
Body			139
	Carapace	22	
	Plastron	2	
	Keratin	114	
	TVERT		
	Rib	1	
Hindlimb			10
	Pelvic girdle	1	
	Femur	3	
	Tibia/Fibula	3	
	Hindflipper	3	

Table 5.4. Turtle body part representation (excluding unidentifiable elements) derived from the 1958-1990 Nu‘alolo Kai excavations.

Table 5.5. Modified turtle remains. Page 79

			Carnivore Gnaw		Rodent Gnaw		Human Modification		Burn		Unknown
Feature	**Analytic Zone**	**Modified**	**B**	**K**	**B**	**K**	**B**	**K**	**B**	**K**	
K2	1	1	1								
K3	1	27	6		1	1	1	16	1		1
1960	2	1						1			
	3										
	No provenience	3						3			
K3	A										
1990	B										
	C										
K4	1	2						2			
K5	1	35	1			1	1	14	1		17

Table 5.5. Modified turtle remains. ‘B’ indicates bone, ‘K’ indicates keratin .Bishop Museum, Zone 1: AD 1700-present, Zone 2: AD 1500-1700, Zone 3: AD 1300-1500. University of Hawai‘i, Zone A: 1800-present; Zone B: AD 1570-1800; Zone C: AD 1410-1570.

Table 5.6. Turtle artifacts. Page 79

Feature	Analytic Zone	Comb	Mesh Gauge	Fishhook	*Kahili* Handle	Ornament	Scraper
K3	1	3				1	1
	2		1				
	No provenience	1					
K5	1	2	1		3		
	2	1	4	1	1		
	No provenience	1		2			
	TOTAL	**8**	**6**	**3**	**4**	**1**	**1**

Table 5.6. Turtle artifacts. Zone 1: AD 1700-present; Zone 2: AD 1500-1700; Zone 3: AD 1300-1500.

Figure 5.1. Turtle artifacts from K3 and K5, 1958-1964 Bishop Museum excavations. Page 78