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Communication

A Zooarchaeological and Ethnographic Study of Frigatebird Remains from Tobi Island in Micronesia

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1. Introduction

In a previous publication, Intoh and Ono (2006) reported on a broken bird bone that had been excavated from a site on Tobi Island, Hatohobei State, Palau. At that time the specimen was identified as chicken (*Gallus gallus*), a finding of great significance to the reconstruction of domestic animal distribution in Micronesia (e.g. Steadman and Intoh, 1994; Steadman, 2006; Storey *et al.*, 2008). A detailed reexamination of the bone, however, has demonstrated that it belongs not to a chicken but rather to a frigatebird. In this paper, we report this new finding and some of its ethnographic implications.

2. Background

Intoh conducted archaeological reconnaissance on Tobi Island in 2003. Tobi is a raised coral atoll, one of six small isolated islands extending southwest of the main Palau archipelago (Figure 1) and often called collectively the Southwest Islands. The Southwest Islands are related linguistically (through similar languages in the Micronesian subgroup) and culturally to the Central Caroline Islands rather than to the main Palau archipelago. Intoh's excavations yielded a number of shell artifacts and natural remains. Two radiocarbon dates suggest that the islands were occupied by the AD 1400s or 1500s. Unusually in the context of Micronesia, no archaeological remains indicate any contact with the main Palau archipelago or other high islands during prehistoric times (see Intoh and Ono, 2006 for detailed results).

Two excavation units (TOMF and TOYP) and seven shovel holes (TOST-1~7) were excavated (about 1.03 m^3 in total). The TOMF site (named after the toponym, Matri Fenbraw)

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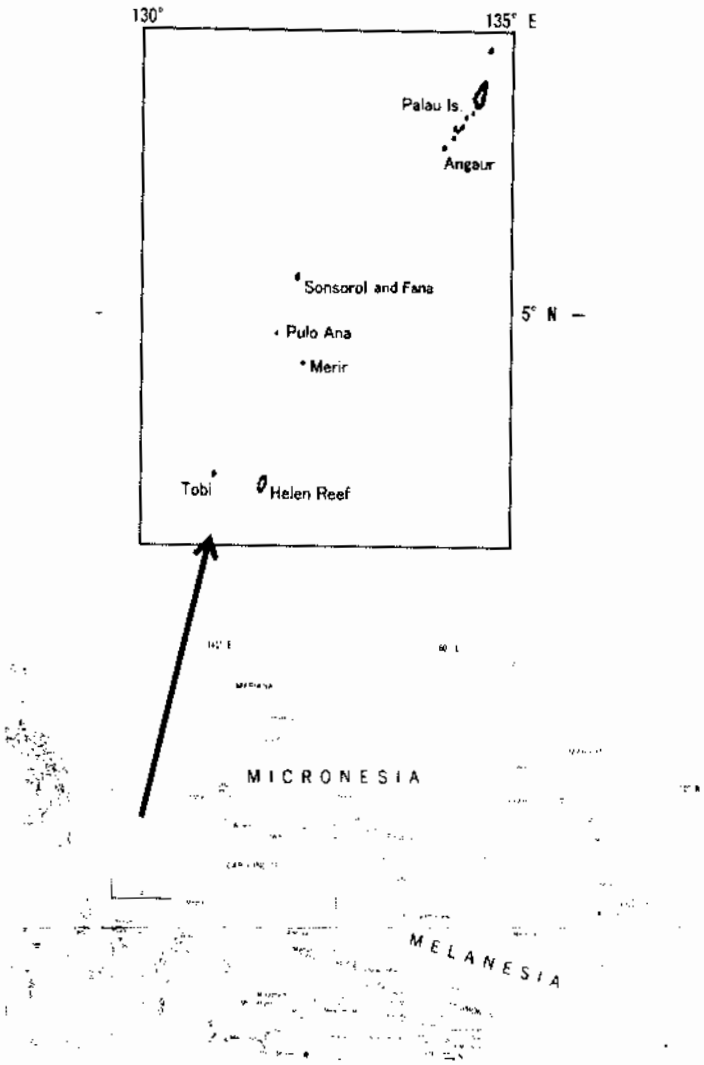

Figure 1. Map showing Tobi Island in the Palau Archipelago

is near the southern end of the village, about 230 meters northwest of the island's southern tip. Four cultural layers, ending approximately 50cm below the surface, were identified. A charcoal sample obtained from Layer 3 dated to AD 1450–1650 (calibrated, Wk12908) (Intoh and Ono, 2006: 67).

The TOMF site yielded approximately 1,200g of natural remains in total—including fish, shellfish, turtle, rat and bird—of which 2% were obtained from Layer 4. This study reexamines a bird bone found in Layer 4 that was initially identified as chicken (Intoh and Ono, 2006: 73).

The bone specimen is 39.8mm long, 23.0mm wide at its widest point, and missing both its

ends. Because radiocarbon dating has placed the layer above this specimen's at AD 1450–1650, the bird bone is considered to be precontact. A comparison with the layer of sterile beach sand beneath clearly shows layer 4 to be a midden deposit. Thus the bone in question was likely deposited in connection with some sort of human-induced activity.

3. Identification

The bone was compared to the osteological collections of Kazuto Kawakami (Forestry and Forest Products Research Institute) and one of the authors (M.E.). Anatomical nomenclature follows Baumel et al. (1993).

The specimen is now identified as the extremitas sternalis coracoidei of the left coracoid of a frigatebird (*Fregata* sp.). An intermuscular line runs through the center of the dorsal surface and forms a tubercle near the facies articularis sternalis. The impressio musculus sternocoracoidei forms a shallow but recognizable fossa on the ventral surface of the sternal facet. The dorsal lip formed on the facies articularis sternalis is deeper than the ventral lip. These characteristics are shared by *Fregata*, the only genus of the family Fregatidae, but not with chickens or other Pelecaniformes, i.e. Phaethontidae, Pelecanidae, Sulidae and Phalacrocoracidae (Figure 2).

The bone is similar in size to one in a reference collection of *F. ariel* (FRIJ-10601). It will not be identified by species here, however, because the ranges of body sizes of *F. ariel* and *F. minor* overlap (Baker, 1951; Steadman and Pahlavan, 1992). The epiphysis of the facies articularis sternalis is fused and no medullary bone can be found in the medullary cavity. These facts suggest that the bone belonged to neither a nestling nor a female during its laying period.

4. Frigatebirds on Tobi Island

Two species of frigatebird are known in Oceania: *F. ariel* (Lesser Frigatebird) and *F. minor* (Great Frigatebird).[1] These are distributed widely from the Eastern Indian Ocean to the Pacific Ocean and are also found in Micronesia. Baker's (1951) well-known publication on Micronesian avifauna included the following islands in the geographic range of

[1] It is difficult to distinguish Lesser and Great Frigatebirds. The Lesser is the smaller of the two, but that is rarely apparent in the field, and no language spoken in Oceania distinguishes between the two species (Clark, 1982; Steadman *et al.*, 1990). Thus in this paper the term "frigatebird" applies to both Lesser and Great Frigatebirds unless it is specifically defined otherwise.

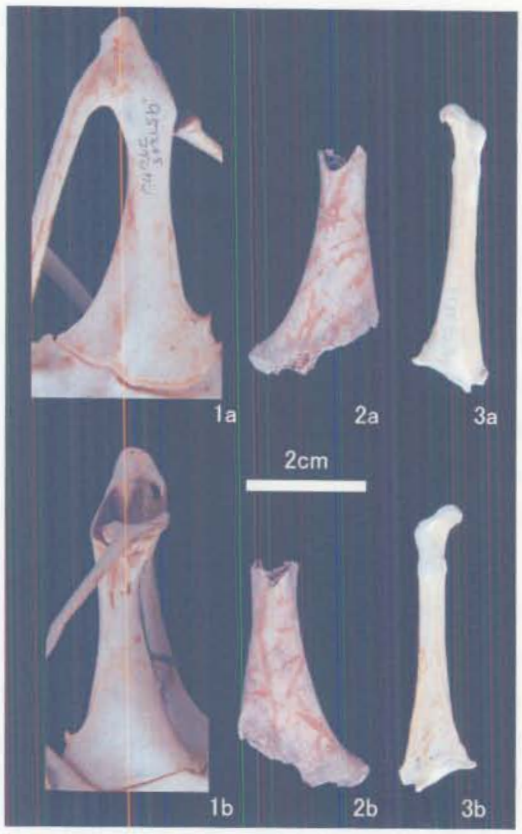

Figure 2. Left coracoids used for the study, showing the ventral surface (a) and the dorsal surface (b)
(1) *Fregata minor*, (2) the excavated bone from Tobi Island, (3) chicken (*Gallus gallus*)

frigatebirds:

F. minor

* Mariana Islands (Agrigan, Maug, Saipan and Guam)
* Caroline Islands (Yap, Faraulep, Truk (Chuuk), Lukunor (Mortlocks), Ponape (Pohnpei), and Kusaie (Kosrae))
* Marshall Islands (Namu, Bikar, Likieb Kwajalein and Bikini)

F. ariel

* Mariana Islands
* Caroline Islands (Yap, Ngulu and Ulithi)

The Palau islands are not on the list for either species; however, a detailed avifaunal record of the Southwestern islands of Palau published by Engbring in 1983 noted that both

frigatebirds were present. Of the two, *F. minor* was found on all the Southwest Islands, while *F. ariel* was observed only on Merir and Helen Reef. Nesting colonies of both species were found only on Fanna and on Helen Reef, both uninhabited by humans at that time (Engbring, 1983).

F. minor and *F. ariel* appear in prehistoric sites across the Pacific (Steadman, 2006). Steadman (1995) points out that, soon after colonization, human settlement caused considerable damage to bird populations on most Pacific islands. In most cases, some birds were eaten and the others moved their nesting places to uninhabited lands. In Micronesia, prehistoric frigatebird remains have been found on Aguigan, Fais, Pohnpei, Makin, and Fanning (Steadman, 2006: 392). It is difficult to assess which prehistoric bones actually represent breeding populations, however, as frigatebirds are great wanderers, often traveling hundreds of kilometers from a nesting colony and roosting on islands where they do not nest (Nelson, 1976).

In the case of Tobi, frigatebirds have rarely nested on the island—not at least since human colonization—but they could have been caught while roosting there overnight. The bone described in this study, as mentioned above, was likely associated with some kind of human activity. As we will show, frigatebirds may have been caught not only for food but also for other cultural purposes.

5. Frigatebirds in Ethnographic Records

Frigatebirds are well recognized in Oceania for their unique figure and behavior. Their long pointed wings and long, deeply forked tail are unmistakable (Figure 3). It is known that traditional navigators in the Pacific relied upon frigatebirds when searching for land (Finney, 1994, 2007; Lewis, 1972: 166, 171),[2] and stylized frigatebird tails are observed on both ends of Carolinian sailing canoes (Haddon and Hornell, 1975: 383) (Figure 4).

Frigatebirds are also well known for their piratical activities. They commonly force other sea birds to disgorge or drop food, which they then catch in mid-air or off the sea's surface. (Frigatebirds do not land on the water because their plumage is not waterproof and

[2] In some islands, in contrast, frigatebirds were not used in navigation (for example, in the case of Anuta; Feinberg, 1988) because they may be sighted too far from land to be of use. In addition, Puluwat navigators consider frigatebirds to be somewhat erratic in their homing and of limited practical value. Frigatebirds can be useful, however, if the situation is rightly identified. Finney (2006: 172) noted, "Beware of juveniles and young adults without chicks to feed, for without family responsibilities they can wander far and wide. Ignore single birds, and pay attention to groups. Sighting not just one but several groups of the right species of adult, nesting birds definitely indicates that land is near."

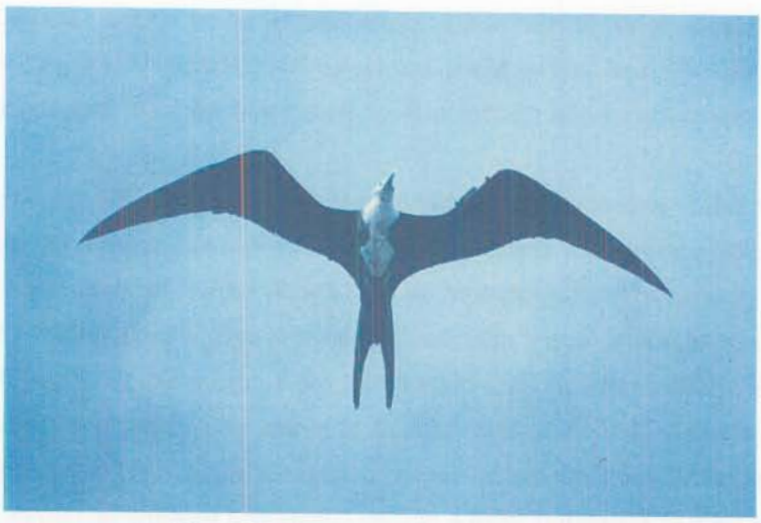

Figure 3. A flying frigatebird (*Fregata* sp.) (photo: Courtesy of K. Kawakami)
Frigatebirds are seabirds but usually do not alight on the surface of the ocean.

Figure 4. A typical outrigger canoe of Caroline Islands
Both ends are shaped like frigatebird tails. (photo: Ngulu Atoll in 1980 by M. Intoh)

their long wings make takeoff impossible (Watling, 1982).) Such aggressive behavior made frigatebirds highly respected, particularly in Micronesia and Melanesia.

Frigatebirds are a symbol of bonito fishing in the Solomon Islands (Balfour, 1905; Thomas, 1995: 91). They hover around schools of bonito (*Katsuwonus*) and are thought to embody the spirits of deceased fishermen. Bonito fishing canoes have frigatebirds carved on their bodies and on their floats. The shell-inlaid carvings on the body is unique. Prominent men displayed their prestige by serving feast foods like taro or yam puddings in wooden

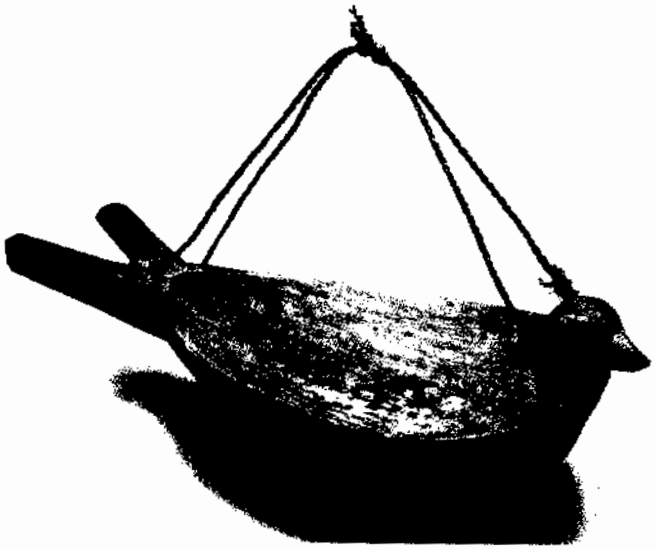

Figure 5. A wooden bowl of frigatebird shape collected from Lamotrek in 1934 by A. Someki
(photo: courtesy of the National Museum of Ethnology, Japan)

bowls carved to resemble frigatebirds. Similar bowls were used in the Central Caroline Islands and Mortlock islands of Micronesia (Figure 5), the implications of which remain unclear (Someki, 1945: 477).

Information on the use of frigatebirds as food in Oceania is scanty and somewhat contradictory. Frigatebirds were clearly not favored foods in some islands. By the 1950s, boobies had been nearly exterminated on Raroia in the Tuamotu Archipelago, while frigatebirds remained in great numbers because, it was presumed, "their meat was regarded as a very poor food" (Danielsson, 1956: 179–180). The case is less clear on Kapingamarangi in Micronesia, however. Emory (1965) writes that none of the most common birds on the atoll—including sooty terns, frigatebirds, and starlings—or their eggs were sought for food, but Leach and Ward (1981) state that frigatebird meat and that of other birds was prized.

According to L. Ierago (pers. comm.), frigatebirds were eaten except for the ones kept as pets in the Southwestern islands of Palau. Islanders sometimes keep young frigatebirds as pets; during a trip to the Southwest Islands of Palau in 2004, Intoh observed firsthand a young frigatebird kept as a pet on Merir Island (Figure 6). Similar practices have been observed on Kapingamarangi (Buck, 1950; Emory, 1965), Chuuk (LeBar, 1964: 169), and Kiribati (Lewis, 1972: 166).

The practice of keeping tame frigatebirds may relate both to the value of frigatebird feathers and to the use of frigatebirds as messengers between islands. The missionary

George Turner writes in his journal of 1876 that at Funafuti he saw a frigatebird arrive from Nukufetau with a note placed in a light piece of reed fixed to its wing. Natives of Kiribati, too, formerly sent pearl fish-hooks from island to island by frigatebird (Lewis, 1972: 165–6).

In any case, catching frigatebirds is not easy on Tobi, where the birds neither nest nor land on the ground. The most popular way to catch the birds is by climbing to the top of a tall tree where they rest at night and capturing them by hand. As the following ethnographic examples demonstrate, frigatebirds have been used not only for meat but also for feathers and bones.

Figure 6. A young frigatebird kept as a pet on Merir Island in Palau
(photo: Courtesy of R. Ono 2002)

6. Cultural Value of Frigatebirds

Bird feathers were used extensively for ornamental purposes throughout Oceania (Thomas 1995: 151–166). In Polynesia—Hawai'i, Tahiti, New Zealand—thousands of small, colorful feathers were used to make a single gorgeous cloak for a high chief.

In Micronesia, though, it was the long, black feathers of frigatebirds that were admired for their ornamental value. In the Marshall Islands, for example, men wore head ornaments of frigatebird feathers in war and in dances. In general, chiefs wore frigatebird feathers, while commoners wore chicken feathers (Matsuoka, 1943).

Two varieties of frigatebird head ornaments were worn in Chuuk. Men wore one type of wooden comb, decorated with red *Spondylus* sp. shell beads and frigatebird feathers (Figure 7), for dancing. Another type of comb (*epico, ëbidjau*) had an elaborate feather attachment resembling a small fan (Figure 8): a row of wing feathers was fastened to a thin stick of mangrove wood which in turn was lashed to the handle of the comb (LeBar, 1964: 169–170). An elderly man from Fais sketched by Atsushi Someki in 1934 was wearing a comb (*roai*) decorated with a frigatebird feather (*vol*) (Figure 9).

These examples, and the fact that they feature exclusively men of high rank, illustrate how highly frigatebird feathers were valued as ornaments. Someki also recorded that Central Caroline Islanders brought frigatebird feathers to Yap as valuable gifts (1945: 423, 484).[3]

Figure 7. A wooden comb decorated with frigate-bird feathers, collected from Chuuk in 1934
(photo: courtesy of the National Museum of Ethnology, Japan)

Figure 8. An elaborately decorated head ornament (*ëbidjau*) made of frigatebird feathers
(Someki 1945: Color plate 2-5)

Figure 9. An old man from Fais wearing a comb decorated with a frigatebird feather
(Someki 1945: Plate 13)

Frigatebird feathers were also attached to fishing lures made of pearl shell. A feather was cut and tied to the bottom of the lure, above which a hook made of tortoise shell is tied. Someki collected several lures from Tobi and Pulo Ana in 1934 (Figure 10) and described these as being very similar to lures made in the Central Caroline Islands.[4]

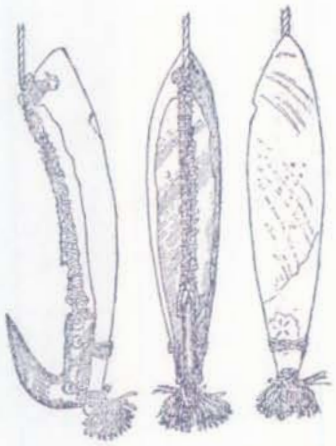

Figure 10. A trolling fishhook from Lamo-trek, sketched by A. Someki
The cut feather of a frigatebird is attached at the bottom as a lure. (Someki 1945: Figure 1)

Bones of frigatebirds were also utilized in Oceania. Steadman (2006: 106) notes that prehistoric whistles were made from the thin-walled bones of large seabirds such as frigatebirds or boobies. Steadman (2006: 106) identified several whistles (each 58mm long) made from the radius of Lesser Frigatebirds (*F. ariel*) in Anuta, Tonga, and Marquesas, but such whistles have not been seen in Micronesia.

Frigatebird bones were made into tattoo chisels in some areas of Micronesia, such as the Marshalls (Woodford, 1906; Spennemann, 1992), Chuuk (LeBar, 1964: 170), and Yap (Müller, 1917: 32; Furness, 1910: 160). Body tattooing was practiced extensively on Tobi as on other Central Caroline Islands (Intoh, 2008) and frigatebird bone would have been an ideal material for making the necessary tools. Because frigatebird wing bones are thin-walled and hard, they were also used as scalpels in surgery in Chuuk (Krämer, 1932: 481).

7. Conclusion

In a previous paper (Intoh and Ono 2006), a bird bone specimen recovered from excavated deposits on Tobi Island in Palau was erroneously identified as chicken (*Gallus gallus*). Upon reexamination, this bone has been classified as that of a frigatebird. Because these birds have not nested on Tobi since human colonization, we deem it likely that the bird was caught purposefully, either for food or, more likely, for a number of other purposes (feathers for ornamentation, bones for making tools, etc.) that have been documented elsewhere in Micronesia.

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3 It is not clear whether this gift was brought to Yap in the context of *sawei* (traditional exchange system developed between Central Caroline Islands and Yap) (cf. Alkire, 1965, 1978; Lessa 1950). Nonetheless, personal gifts of rare or attractive items were frequently brought to Yap. It is very likely that frigatebird feathers were used in such cases.

4 These fishing lures are now stored at the National Museum of Ethnology in Osaka, Japan, but the feathers are lost.

Acknowledgements

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References

Alkire, W.H. (1965) *Lamotrek Atoll and Inter-Island Socio-Economic Ties.* Illinois Studies in Anthropology 5. Urbana: University of Illinois Press.

Alkire, W.H. (1978) *Coral Islanders*. Illinois: AHM Publishing.

Baker, R.H. (1951) The avifauna of Micronesia, its origin, evolution, and distribution. *University of Kansas Publications, Museum of Natural History*, 3(1): 1–359.

Balfour, H. (1905) Bird and human designs from the Solomon Islands, illustrating the influence of one design over another. *Man*, 5: 81–83.

Baumel, J.J., A.S. King, A.M. Lukas, J.E. Breazile and H.E. Evans (1993) *Nomina Anatomica Avium* [second edition]. London: Academic Press.

Buck, P. (1950) *Material Culture of Kapingamarangi.* Honolulu: B.P. Bishop Museum Press.

Clark, R. (1982) Proto-Polynesian birds. *Transactions of the Finnish Anthropological Society*, 11: 121–143.

Danielsson, B. (1956) *Work and Life on Raroia: An Acculturation Study from the Tuamotu Group French Oceania.* London: George Allen and Unwin.

Emory, K.P. (1965) *Kapingamarangi.* Bishop Museum Bulletin 228. Honolulu: B.P. Bishop Museum Press.

Engbring, John (1983) Avifauna of the Southwest Islands of Palau. *Atoll Research Bulletin*, 267: 1–22.

Feinberg, R. (1988) *Polynesian Seafaring and Navigation: Ocean Travel in Anutan Culture and Society*. Ohio: The Kent State University Press.

Finney, B. (1994) *Voyage of Rediscovery: A Cultural Odyssey through Polynesia.* California: University of California Press.

Finney, B. (2007) Traditional navigation. In K.R. Howe (ed.), *Vaka Moana: Voyages of the Ancestors.* Honolulu: University of Hawai'i Press, pp. 156–185.

Furness, W.H. (1910) *The Island of Stone Money: Uap of the Carolines*. Philadelphia: J.B. Lippincott.

Haddon, A.C. and J. Hornell (1975) *Canoes of Oceania*. Bernice P. Bishop Museum Special Publications 27, 28 and 29 (reprint). Honolulu: B.P. Bishop Museum Press.

Intoh, M. (2008) Historical significance of the Southwest Islands of Palau. In: Clark, G., F. Leach and S. O'Connor (eds.), *Islands of Inquiry: Colonisation, Seafaring and the Archaeology of Maritime Landscapes*, pp. 325–338. Terra Australis vol. 29. Canberra: Australian National University.

Intoh, M. and R. Ono (2006) Reconnaissance archaeological research on Tobi Island, Palau. *People and Culture in Oceania*, 22: 53–83.

Krämer, A. (1932) Truk. In: Thilenius, G. (ed.), *Ergebnisse der Südsee-Expeditions 1900-1910*, II B, 5. Hamburg: Friederichsen, de Gruyter.

Leach, B.F. and G. Ward (1981) *Archaeology on Kapingamarangi Atoll.* Dunedin: Privately published by B. F. Leach.

LeBar, F.M. (1964) *The Material Culture of Truk.* Yale University Publications in Anthropology 68. New Haven: Yale University Publications.

Lessa, W.A. (1950) Ulithi and the outer native world. *American Anthropologist*, 52: 27–52.

Lewis, D. (1972) *We, the Navigators.* Honolulu: University of Hawai'i Press.

Matsuoka, S. (1943) *Mikuronesia Minzokushi [Ethnography of Micronesia]*. Tokyo: Iwanami Shoten.

Müller, W. (1917) Yap. In: Thilenius, G. (ed.), *Ergebnisse der Südsee-expedition*, 1908–1910, II B, 2. Hamburg: Friederichsen de Gruyter.

Nelson, J.B. (1976) Breeding biology of frigatebirds: A comparative review. *Living Bird*, 14: 113–156.

Someki, A. (1945) *Mikuronesia no Fudo to Mingu [Natural Features and Folk Tools of Micronesia]* Tokyo: Shokoshoin.

Spennemann, D.H.R. (1992) *Marshallese Tattoos.* Marshallese Culture and History 1. Majuro: Alele Museum, National Archives, HPO, Ministry of Education and Ministry of Social Services.

Steadman, D.W. (1995) Prehistoric extinctions of Pacific island birds: biodiversity meets zooarchaeology. *Science*, 267: 1123–1131.

Steadman, D.W. (2006) *Extinction and Biogeography of Tropical Pacific Birds.* Chicago and London: The University of Chicago Press.

Steadman, D.W. and M. Intoh (1994) Biogeography and prehistoric exploitation of birds from Fais Island, Yap State, Federated States of Micronesia. *Pacific Science*, 48(2): 116–135.

Steadman, D.W. and D.S. Pahlavan (1992) Extinction and biogeography of birds on Huahine, Society Islands, French Polynesia. *Geoarchaeology*, 7: 449–483.

Steadman, D.W., D.S. Pahlavan and P.V. Kirch (1990) Extinction, biogeography, and human exploitation of birds on Tikopia and Anuta, Polynesian Outliers in the Solomon Islands. *Bishop Museum Occasional Papers*, 30: 118–153.

Storey, A.A., T. Ladefoged and E.A. Matisoo-Smith (2008) Counting your chickens: Density and distribution of chicken remains in archaeological sites of Oceania. *International Journal of Osteoarchaeology*, 18: 240–261.

Thomas, N. (1995) *Oceanic Art.* London: Thames and Hudson.

Watling, D. (1982) *Birds of Fiji, Tonga, and Samoa.* Wellington: Millwood Press.

Woodford, C.M. (1906) Notes on Leueneuwa or Lord Howe's Group. *Man*, 89: 133–135.