

Biogeography and Prehistoric Exploitation of Birds from Fais Island, Yap State, Federated States of Micronesia¹

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ABSTRACT: Five archaeological sites on the remote, raised limestone island of Fais, Yap, Federated States of Micronesia, yielded nearly 200 identifiable bird bones from strata that range in age from about 400 to 1800 radiocarbon yr B.P. Represented are 14 species of seabirds, five species of migratory shorebirds, four species of land birds, and the introduced chicken. This is the most species-rich prehistoric assemblage of birds from any island in Micronesia. Because the “modern” avifauna of Fais never has been studied, it is difficult to determine which of the species from archaeological contexts still occur on Fais. Nevertheless, based upon modern distributions of birds from other islands in Yap and adjacent island groups, the environmental condition of Fais, and what is known about the relative vulnerability of individual species, it is likely that about nine of the seabirds (*Pterodroma* sp., *Bulweria bulwerii*, *Sula dactylatra*, *S. sula*, *Sterna sumatrana*, *S. lunata*, *S. fuscata*, *Anous minutus*, *Procelsterna cerulea*) and three of the land birds (*Poliolimnas cinereus*, *Gallicolumba* cf. *xanthonura*, *Ducula oceanica*) no longer live on Fais.

FAIS ISLAND LIES at 9° 46' N, 140° 31' E, about 80 km east of Ulithi Atoll and 210 km east of the main island of Yap in western Micronesia (Figure 1). Fais is an uplifted limestone island with a land area of 2.8 km² and maximum elevation of ca. 20 m (Figure 2). Other names recorded for Fais are Astrolabe, Feis, Feys, Fuhaesu, Huhaesu, Paiz, Tromelin, and Woaje (Baker 1951:14, Fosberg and Evans 1969).

Human habitation on Fais today is confined to the southern part of the island. Fais is part of Yap State of the Federated States of Micronesia. Within the traditional exchange system (*sawei*) between Yap and the central Caroline Islands, the people of Ulithi held traditional authority over Fais (Lessa 1966:39). The first European contact with Fais probably occurred in A.D. 1543 or earlier (Lessa 1966:5). The human population of Fais in the past 70 yr has ranged from a high

of 427 in 1925 to a low of 195 in 1977, followed by increases to 253 in 1987 (Gorenflo and Levin 1991).

The best description of the physical environment and vegetation of Fais is that in Fosberg and Evans (1969), based upon their 2½-hr visit on 30 July 1965. Most of Fais consists of a plateau that is surrounded by coralline limestone cliffs 15–20 m high. This plateau once contained extensive deposits of calcium phosphate, which largely were mined away during Japanese occupation of the island from 1914 to 1945. These mining activities undoubtedly had a major impact on the terrestrial biota of Fais, an island that had been described by Chamisso (1821:183) as having “... the richest soil, and the most luxuriant flora” of any of the Caroline Islands. The interior of the plateau and the sand flats between the cliff and the beach are or have been cultivated, mainly with the coconut palm, *Cocos nucifera*. The most common trees and shrubs scattered within the coconut plantations are *Artocarpus altilis*, *Hibiscus tiliaceus*, *Morinda citrifolia*, *Calophyllum inophyllum*, *Premna obtusifolia*, *Ochrosia oppositifolia*, *Randia cochinchinensis*, *Eugenia aquea*,

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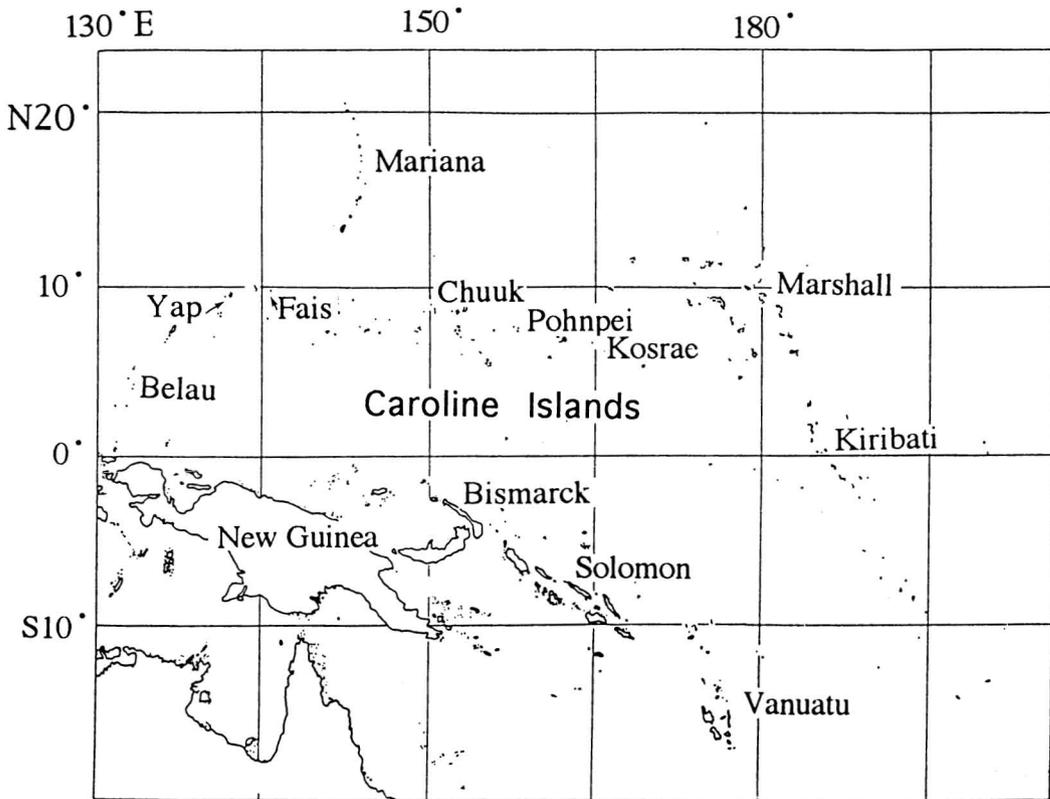


FIGURE 1. The western tropical Pacific, showing the location of Fais Island.

and *E. javanica*. A variety of nonwoody cultivars (bananas, papayas, aroids, sweet potatoes, tobacco) and weeds also occupy this heavily modified habitat.

A belt of low, dense forest occurs on the rough, creviced limestone along the rim of the circumferential cliff. This forest, less influenced by humans than the coconut plantations, is dominated by almost pure stands of *Barringtonia asiatica*. On the inland side, this forest also includes trees and large shrubs of *Premna obtusifolia*, *Hibiscus tiliaceus*, *Pipturus argenteus*, *Melochia compacta*, *Ficus tinctoria*, and *Morinda citrifolia*. On the seaward side of the *Barringtonia* forest are thickets of *Pandanus tectorius*, narrowly fringed by shrubs of *Tournefortia argentea* and *Scaevola taccada*. Other shrubs and herb communities occur along various parts of the cliff, but these are more heavily influenced by salt spray and

thus of less importance to native vertebrates. Aside from those already mentioned, Fosberg and Evans (1969) recorded these presumably indigenous, nonhalophytic trees on Fais: *Pisonia grandis*, *Hernandia sonora*, *Mammea odorata*, *Terminalia catappa*, and *Guettarda speciosa*.

Here we report the bird bones recovered from Intoh's recent archaeological excavations on Fais. In this paper, Intoh is responsible for most archaeological data, and Steadman is responsible for the ornithology (osteology, biogeography, ethnobiology) and other biology.

ARCHAEOLOGICAL BACKGROUND

This information is condensed from the detailed account of Intoh (1991), who exca-

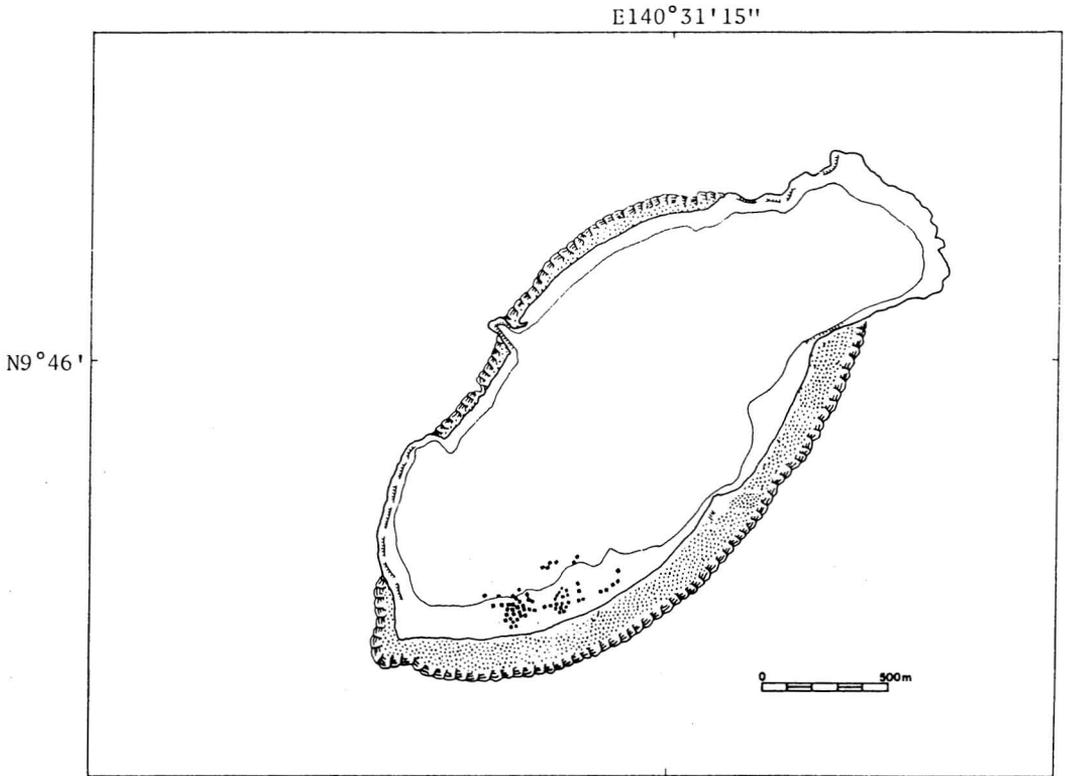


FIGURE 2. Fais Island, Yap, Federated States of Micronesia. All archaeological excavations are within the village on the south side of the island (detailed in FIGURE 3). The small squares represent modern houses.

vated on Fais in 1991. All excavations are within a radius of ca. 75 m, in the part of the island still inhabited (Figures 2, 3). Throughout this paper, we use the term "site" for each of the five excavated areas, even though further excavation probably would disclose that most or all of these "sites" in fact are part of a single, large site complex. The name for each site was taken from the local name for the land.

Excavated squares were along transects from the coast to the inland slope to facilitate stratigraphic comparisons among the sites (Figure 3). Individual excavated squares varied from 1 by 1 m to 2 by 2 m, with each square oriented N-S by E-W. A combination of natural strata (numbered layers) and 0.2-m arbitrary levels was used to record excavated material. All sediment was troweled

and then dry-sieved through screens of mesh size 24, 6, and 3 mm. Potsherds, shell, stone, bone, charcoal, coral, and artifacts were bagged separately.

Yelar Site (FYSE)

This site is on a 30° slope that extends to the inland plateau. The ground surface is covered with a shallow soil and numerous tree roots. The single 1 by 1 m square is 10.2 m above sea level and 180 m inland from the high-tide line. The excavation ended at a depth of 0.3 m when coral bedrock was exposed. Soil erosion probably accounts for the shallowness of this site. Only one layer was recognized. FSYE yielded only a few potsherds and a small quantity of faunal remains (mainly fish and rat bones; no birds).

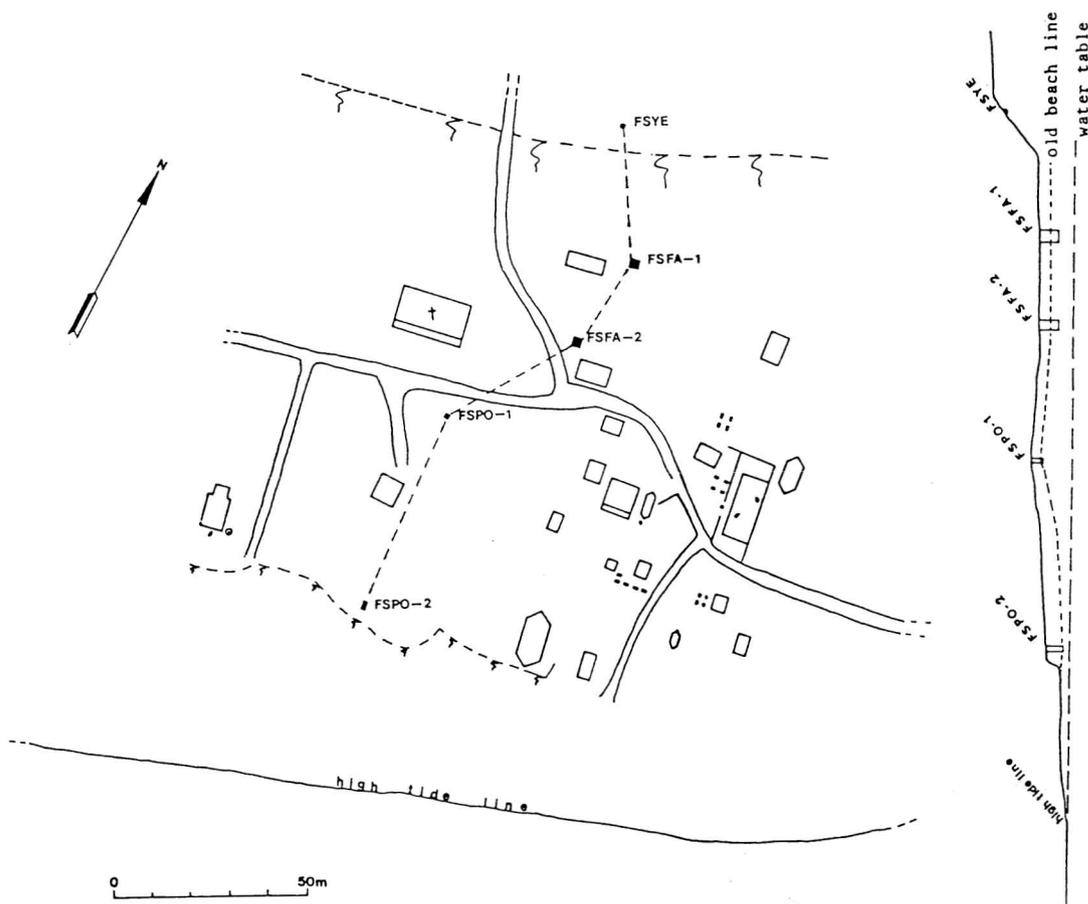


FIGURE 3. Location of the archaeological excavations on Fais, 1991.

Faligochol-1 Site (FSFA-1)

This site lies near the bottom of the inland slope on which FSYE is located. The area is covered with black organic soil and is used currently to grow tobacco. A number of shell adzes and potsherds were scattered on the ground surface. A single 2 by 2 m square was excavated in one of the tobacco gardens, 4.9 m above sea level. Of six natural strata (numbered top to bottom), Layers 2 and 3 appear to represent the primary period of occupation. Together these dark brown sandy layers are 0.6 to 0.7 m thick. They produced a large quantity of artifacts (potsherds, fish-hooks, shell tools, shell ornaments, and bone

tools) and faunal remains. Charcoal from Layer 2 was dated at A.D. 781–1020 (Table 1). The lower part of Layer 3 contains several pit features that intrude Layers 4 through 6. A lure shank made of pearl shell from Layer 3 is very similar to those from the central Solomon Islands. Two charcoal samples from Layer 3 were dated at A.D. 560–870 and A.D. 442–768 (Table 1). This age is older than that obtained for Layer 3 of FSFA-2 (see below), which is artifactually similar to Layer 3 of FSFA-1. Considering the stratigraphically mixed condition of much of Layers 3–6 at FSFA-1, this date could possibly represent a stratum lower than Layer 3. Layer 6 is a culturally sterile white beach sand with sev-

TABLE 1

RADIOCARBON DATES ON WOOD CHARCOAL FROM ARCHAEOLOGICAL EXCAVATIONS ON FAIS ISLAND, YAP, FSM

LAB. NO.	SITE	LAYER	¹⁴ C AGE (yr B.P.)	δ ¹³ C	TWO σ CALIB A.D.
NZ-7914	FSFA-1	2	1,091 ± 49	—	781–1020
NZ-7915	FSFA-1	3	1,339 ± 80	—	560–870
NZ-7883	FSFA-1	3	1,409 ± 71	–25.8	442–768
NZ-7916	FSFA-1	4	1,560 ± 68	—	265–640
NZ-7884	FSFA-2	3	862 ± 55	–25.0	1020–1276
NUTA-2163	FSFA-2	4	1,446 ± 106	—	390–795
NZ-7885	FSFA-2	5	1,775 ± 73	–25.5	70–410
NUTA-2167	FSFA-2	6	1,794 ± 152	—	–166–560
NZ-7886	FSPO-2	6	739 ± 120	–26.6	1020–1420
NZA-2137	FSPO-2	9	1,376 ± 62	–26.0	560–770
NUTA-2347	FSPO-2	12	1,433 ± 109	—	410–800

NOTE: Eight dates were determined at DSIR Physical Sciences, Lower Hutt, New Zealand (NZ-xxxx, conventional date; NZA-xxxx, accelerator date). Three dates were determined at Nagoya University AMS Dating Center, Japan (NUTA-xxxx). Calib A.D. = calendar years (95% confidence interval), following Stuiver and Reimer (1993).

eral thin grayish cemented layers. Excavation ceased when the sand became wet and cemented at a depth of 3 m.

Faligochol-2 Site (FSFA-2)

Another 2 by 2 m square was excavated 25 m south of FSFA-1 at the southern corner of a tobacco garden. Six natural strata were recognized. The ground surface was covered with black organic sandy soil containing a number of potsherds, shell tools, and modern materials such as glass bottles, iron nails, and pieces of plastic sheet. These modern artifacts were present through Layer 2. Layer 3 is a black organic soil (0.3 m thick) rich in artifacts and faunal remains. The artifacts from this layer correlate with those from Layer 3 of FSFA-1. A radiocarbon age on charcoal from Layer 3 of FSFA-2 is A.D. 1020–1276. Over 300 potsherds were recovered from Layer 1 to the upper part of Layer 6. Layer 5 yielded several worked pieces of turtle carapace, a shell adze, a shell bracelet, and a shell pendant. A radiocarbon age on charcoal from Layer 5 is A.D. 70–410. Layer 6 is beach sand with gray banding. Except for a *Tridacna* shell tool, some potsherds, and some rat bones from the upper portion, Layer 6 was culturally sterile. It was excavated to a depth of 3 m, when the sand became wet and cemented.

Powag-1 Site (FSPO-1)

Two squares were excavated in Powag, named for one of the house compounds in Faliyow Village. The first square (1 by 1 m) is FSPO-1. It is 40 m southwest of FSFA-2, 100 m inland from the beach line, and about 6 m above sea level. Scattered on the ground surface were potsherds, a small trolling lure shank of probable *Tridacna* shell, and fragments of coral and glass. Five natural layers were recognized. The rich collection of artifacts from this square contains *Tridacna* shell adzes, *Cassia* shell tools, perforated shark teeth, a trolling lure shank of red *Spondylus* shell, pieces of single fishhooks of turtle carapace, and about 80 potsherds. Excavation was halted at a depth of 1.3 m in Layer 5, a culturally sterile white beach sand. The eastern corner was excavated 0.3 m deeper into a very coarse beach sand that also lacked cultural evidence.

Powag-2 Site (FSPO-2)

The second excavation at Powag is a single 1 by 1.5 m square at the edge of a beach flat, 46 m from the high-tide line and 53 m south of FSPO-1. The site surface is 3.6 m above sea level. The square size was reduced to 1 by 1 m at a depth of about 0.9 m. Thirteen natural

strata were recognized. A black organic soil (Layer 2) occurs immediately below the shallow surface deposit of dark gray sand. Layer 2 includes an ashy oven feature. Layers 3 and 5 are dark gray organic soils containing many small coral gravels. Layer 4 is a thin sand appearing only at the south end of the square.

At 0.7 m below the surface begins Layer 6, a compacted gray clayey soil with some coral gravel. Layer 6 produced a number of artifacts and faunal remains. Judging from the kind of potsherds excavated, Layer 6 probably is coeval with Layer 3 of FSFA-1 and 2. The charcoal radiocarbon age from Layer 6 is A.D. 1020–1420. From Layer 6 is the point of a composite bone fishhook that resembles ethnographic fishhooks from the Solomon Islands.

The organic soil layers continue down to a depth of 1.7 m, where the soil becomes darker and sandier but still yielded abundant artifacts and faunal remains. The deep deposits of alluvial/colluvial soils at FSPO-2 are the result of erosion of inland soils, most likely associated with agriculture. Charcoal from Layer 9 is radiocarbon dated at A.D. 560–770. Potsherds from Layers 11 and 12 correlate with those from Layer 5 of FSFA-2, which is radiocarbon dated at ca. A.D. 100–400. The excavation was continued until a white beach sand (Layer 13) was encountered at a depth of 2.7 m. Layer 13 was culturally sterile except for two sherds at the top of the layer.

ORNITHOLOGICAL BACKGROUND

The vertebrate biology of Fais is little studied. Sternfeld (1920) reported seven species of lizards from Fais (six skinks and one gecko). We have found no other herpetological data from Fais and no information on indigenous or feral mammals.

The ornithology of Fais also is poorly known. Our information in the *Systematic Accounts* on modern distributions of Micronesian birds is taken from the publications that we review here in chronological order. References simply to “Yap” refer to the main island of Yap, which may or may not include the nearby islands of Gagil-Tamil, Maap, and

Rumung. We refer to the entire archipelago as “Yap State.”

Because of the near absence of data on the modern birds from Fais, our attempt to determine whether a particular species still occurs on Fais is based upon a blend of these considerations: (1) whether it has been recorded on Fais in the nineteenth or twentieth centuries; (2) whether it still occurs on Ulithi Atoll (the island nearest to Fais), Yap, or both islands; (3) its overall status in Micronesia; (4) the relative vulnerability of the species, based on modern and prehistoric data from elsewhere in Oceania; and (5) what is known about the condition of terrestrial habitats and human land-use patterns on Fais. The actual modern status of birds on Fais can be learned only through surveys at different seasons, a task that logistically is not feasible for us.

Tables 2 and 3 summarize the birds recorded from Ulithi and Fais, respectively. The text that follows will help to interpret these tables. As noted by Baker (1951:17), Yap, Ulithi, and Fais were visited by the Russian Expedition of 1817–1818 under the command of Otto von Kotzebue. Unfortunately, the notes on natural history published by Adelbert von Chamisso (1821) contain no ornithological information for Fais.

Hartlaub and Finsch (1872) reported 20 species of birds from Uap (= Yap) and three species from Mackenzie (= Ulithi), based on specimens collected by J. S. Kubary and Capt. Peters, under sponsorship of the Godeffroy Museum, Hamburg. The list of birds in Gräffe (1873) seems to pertain mainly or solely to Yap rather than to Ulithi or Fais.

Wiglesworth (1891) reviewed records of birds from Oceania. All of his information on the avifauna of Yap State is from Yap itself and is based upon Hartlaub and Finsch (1872), with one exception: a record from Ulithi (p. 41) of *Tatare* (= *Acrocephalus*) *syrix*. Christian (1899), who visited neither Ulithi or Fais, reported four species of shorebirds and a supposed albatross from Yap (pp. 355, 377).

Taka-tsukasa and Kuroda (1915) listed 10 species of birds from Ulithi (their *Phlogoenas pampusan* and *P. yapensis* both = *Gallicolumba xanthonura yapensis*). This compilation, however, includes eight records not sub-

TABLE 2

BIRDS RECORDED IN THE NINETEENTH AND TWENTIETH CENTURIES FROM ULITHI ATOLL, YAP, FSM

SPECIES	RECORDS ^a					
	A	B	C	D	E	F
Seabirds						
<i>Phaethon lepturus</i>	—	—	—	—	—	×
White-tailed Tropicbird						
<i>Fregata ariel</i>	—	—	×	×	×	—
Lesser Frigatebird						
<i>Sterna sumatrana</i>	—	—	×	×	—	×
Black-naped Tern						
<i>Sterna bergii</i>	—	—	—	—	—	×
Crested Tern						
<i>Anous stolidus</i>	—	—	—	—	—	×
Brown Noddy						
<i>Anous minutus</i>	—	—	—	—	—	×
Black Noddy						
<i>Gygis candida</i>	—	—	—	—	—	×
Common Fairy-Tern						
Migrant Shorebirds						
<i>Pluvialis dominica</i>	×	—	—	—	×	×
Lesser Golden-Plover						
<i>Charadrius mongolus</i>	—	—	—	—	—	×
Mongolian Plover						
<i>Arenaria interpres</i>	×	—	—	×	×	—
Ruddy Turnstone						
<i>Actitis hypoleucos</i>	—	—	—	—	×	×
Common Sandpiper						
<i>Heteroscelus incanus</i>	—	—	—	—	—	×
Wandering Tattler						
<i>Numenius phaeopus</i>	—	—	×	×	×	×
Whimbrel						
<i>Calidris ruficollis</i>	—	—	—	—	×	—
Rufous-necked Stint						
<i>Calidris minutus</i>	—	—	—	—	×	—
Little Stint						
<i>Calidris alba</i>	—	—	—	—	—	×
Sanderling						
Native Land Birds						
<i>Egretta sacra</i>	—	—	—	—	×	×
Pacific Reef-Heron						
<i>Egretta intermedia</i>	—	—	—	—	—	×
Intermediate Egret						
* <i>Nycticorax nycticorax</i>	—	—	×	×	×	—
Black-crowned Night-Heron						
* <i>Ixobrychus sinensis</i>	—	—	×	×?	—	—
Yellow Bittern						
cf. <i>Poliolimnas cinereus</i>	—	—	—	—	—	×
White-browed Crane						
* <i>Gallicolumba xanthonura</i>	—	—	×	×	—	—
White-throated Ground-Dove						
<i>Halcyon</i> cf. <i>cinnamomina</i>	—	—	—	—	—	×
Micronesian Kingfisher						
* <i>Coracina tenuirostris</i>	—	—	×	×	—	—
Cicadabird						
* <i>Monarcha godeffroyi</i>	—	—	—	×	—	—
Yap Monarch						

TABLE 2 (continued)

SPECIES	RECORDS ^a					
	A	B	C	D	E	F
* <i>Rhipidura rufifrons versicolor</i> Rufous Fantail	—	—	×	×	—	—
<i>Acrocephalus syrinx</i> Caroline Islands Reed-Warbler	—	×	—	—	—	—
<i>Aplonis opaca</i> Micronesian Starling	×	—	—	—	×	×
* <i>Zosterops hypolaïs</i> Plain White-eye	—	—	×	×	—	—
* <i>Rukia oleaginea</i> Olive White-eye	—	—	×	×	—	—
Non-native Land Birds						
<i>Gallus gallus</i> Chicken	—	—	—	—	—	×
Totals						
Seabirds (7 spp.)	0	0	2	2	1	6
Migrant shorebirds (9 spp.)	2	0	1	2	6	6
Native land birds (6–14 spp.)	1	1	7	7–8	3	5
Chicken (1 sp.)	0	0	0	0	0	1
All native species (22–30 spp.)	3	1	10	11–12	10	17

*. Record probably in error; if not, the species probably is extirpated today on Ulithi.

^aA, Hartlaub and Finsch (1872); B, Wigglesworth (1891); C, Taka-tsukasa and Kuroda (1915); D, Kuroda (1922); E, Hachisuka et al. (1932, 1942); F, Baker (1948, 1951). See text for additional details.

stantiated for Ulithi before or since; for most or all of these records, it is likely that Ulithi was incorrectly substituted for Yap. Kuroda (1922) reported 12 species from Ulithi in a list that seems to have been based mostly on Taka-tsukasa and Kuroda (1915).

The avid bird collectors of the Whitney South Seas Expedition (WSSE) of the 1920s and 1930s surveyed no islands in Yap. Within the Caroline Islands, the WSSE visited only Pohnpei, Rontiki, Harbor, Kosrae, and various islands in Belau.

Hachisuka et al. (1932) listed *Aplonis opaca* from Fais and nine species from Ulithi. Hachisuka et al. (1942) listed the same species as in 1932 with the addition of *Calidris ruficollis*.

Price (1936) described and illustrated the use of “bird lime” (sticky sap of breadfruit tree) to capture birds on Yap. Krämer (1937) reviewed the cultural and social anthropology of Fais. He listed (p. 388) these birds [followed by my interpretation]: “*badjoi* Brachvogel (so auf Mógemog der Flederhund)” [= *Numenius*, probably *N. phaeopus*]; “*gátap* (*f*) Fregat-

tvogel S.64” [= *Fregata*, probably *F. ariel*]; “*lili* Charadrius (s. kulung Lam.) [= *Charadrius* sp.]; “*liok* Seevogel” [= a seabird]; “*malug* Hahn (Henne erábot) [= *Gallus gallus*]; and “*mollêi* Star” [= *Aplonis opaca*].

R. H. Baker, C. O. Davison, L. P. McElroy, and J. N. Strong collected and observed birds on Ulithi from 11 to 23 August 1945 (Baker 1948, 1951). They reported 17 native species, including a “small rail” seen a few years previously but that “was apparently eliminated as a result of the naval activities.” I have listed this rail provisionally as *Poliolimnas cinereus* (Table 2). These records, the most recent and reliable from Ulithi, are discussed as needed in the text.

H. I. Fisher observed and collected birds on Yap from 28 July to 24 August 1946. His report (Fisher 1950) was the primary work on Yapese birds for nearly three decades, but did not include Ulithi or Fais.

Baker (1951) summarized the distribution and systematics of birds throughout Micronesia. This important monograph remains the standard reference for external morphology

TABLE 3
BIRDS RECORDED IN THE TWENTIETH CENTURY FROM
FAIS, YAP, FSM

SPECIES	RECORDS ^a	
	A	B
Seabirds		
<i>Fregata cf. ariel</i>	—	×
Lesser Frigatebird "Seabird"	—	×
Migrant Shorebirds		
<i>Charadrius</i> sp.	—	×
Plover		
<i>Numenius cf. phaeopus</i>	—	×
Whimbrel		
Native Land Birds		
<i>Aplonis opaca</i>	×	×
Micronesian Starling		
Non-native Land Birds		
<i>Gallus gallus</i>	—	×
Chicken		
Totals		
Seabirds (2 spp.)		
Migrant shorebirds (2 spp.)		
Native land birds (1 sp.)		
Chicken (1 sp.)		
All native species (5 spp.)		

^aA, Hachisuka et al. (1932); B, Krämer (1937).

and subspecies-level systematics of many taxa of Micronesian birds. Unfortunately, Baker himself visited only Ulithi (see above), not Yap or Fais. Furthermore, he was unable to examine Fisher's or anyone else's specimens from Yap.

Anthropologist W. A. Lessa visited Ulithi in 1947–1949, 1960, and 1961. Mainly from a perspective of human subsistence, he said this about the avifauna of Ulithi (1966:5, 12): "Permanent birds are few in species; transient birds are much more numerous in numbers and species. The economic value of the avifauna is trivial," and "Fowling is inconsequential."

As discussed earlier, Fosberg and Evans (1969) visited Fais on 30 July 1965. They described the habitats, collected botanical specimens, and recorded 120 species of native and non-native plants from the island. They did not report on the birds, if any, that they saw.

H. D. Pratt, P. L. Bruner, and D. G. Berrett

visited Yap (including Gagil-Tamil and Maap) from 14 to 25 June and 16 to 18 August 1976, collecting specimens and making a variety of behavioral, ecological, and systematic observations (Pratt et al. 1977).

Ralph and Sakai (1979) briefly surveyed birds and bats on Yap, one of seven islands (Saipan, Rota, Guam, Yap, Belau, Chuuk, and Pohnpei) they visited between 31 August and 16 September 1977. In 4.5 hr (4.8 km) of surveys primarily on the eastern half of Yap, they recorded at least one individual of 11 of the 14 species of land birds known to occur on Yap.

Engbring and Pratt (1985) briefly summarized the conservation status of land birds from Yap. The checklist of Micronesian birds by Pyle and Engbring (1985) is extremely useful for Yap, but lists no species from Ulithi or Fais. Last, the birds of Yap were illustrated and described in field guide format by Pratt et al. (1987), again without specific records for Ulithi or Fais.

The bird bones from all four archaeological sites on Fais are listed in Table 4, and Tables 5–8 summarize the stratigraphic distribution of taxa within individual sites. Identifications are based upon comparison with modern skeletons in the collections of the New York State Museum, U.S. National Museum of Natural History (Smithsonian Institution), and the University of Washington Burke Museum. The prehistoric bones will be housed in the archaeological collections of Hokkaido Tokai University.

SYSTEMATIC ACCOUNTS

Order PROCELLARIIFORMES Family PROCELLARIIDAE

Pterodroma sp. Unknown Petrel

MATERIAL: Carpometacarpus.

REMARKS: This fragmentary specimen resembles in size (and other features) the carpometacarpus of *P. alba*. No species of *Pterodroma* have been recorded from anywhere in Yap (or Belau). All records of *Pterodroma* (*rostrata*, *neglecta*, *hypoleuca*, *nigripennis*, *longirostris*) from elsewhere in Micronesia are of

TABLE 4

SUMMARY OF BIRD BONES FROM ARCHAEOLOGICAL SITES ON FAIS, YAP, FSM

SPECIES	NO. OF SPECIMENS FROM FAIS SITES				TOTAL
	FSFA-1	FSFA-2	FSPO-1	FSPO-2	
Seabirds					
* <i>Pterodroma</i> sp. Petrel	—	1	—	—	1
* <i>Bulweria bulwerii</i> Bulwer's Petrel	—	—	1	—	1
<i>Phaethon lepturus</i> White-tailed Tropicbird	1	—	—	—	1
* <i>Sula dactylatra</i> Masked Booby	1	—	—	—	1
* <i>Sula sula</i> Red-footed Booby	—	2	—	—	2
[* <i>Sula sula</i> or <i>S. leucogaster</i>] Red-footed Booby or Brown Booby	2	—	—	—	2
<i>Fregata minor</i> Great Frigatebird	1	—	1	2	4
<i>Fregata ariel</i> Lesser Frigatebird	1	1	—	—	2
[<i>Fregata</i> sp.] [Frigatebird]	—	—	1	—	1
* <i>Sterna sumatrana</i> Black-naped Tern	1	1	—	—	2
* <i>Sterna lunata</i> Gray-backed Tern	4	1	1	2	8
* <i>Sterna fuscata</i> Sooty Tern	4	2	—	—	6
[<i>Sterna</i> sp.] [Tern]	1	—	—	—	1
<i>Anous stolidus</i> Brown Noddy	13	1	2	2	18
* <i>Anous minutus</i> Black Noddy	2	1	—	—	3
* <i>Procelsterna cerulea</i> Blue-gray Noddy	1	1	1	—	3
<i>Gygis candida</i> Common Fairy-Tern	5	3	—	—	8
[Sterninae sp.] [Tern]	6	5	—	—	11
Migrant Shorebirds					
<i>Pluvialis dominica</i> Lesser Golden-Plover	1	1	—	—	2
<i>Charadrius leschenaultii</i> Greater Sand-Plover	—	1	—	—	1
<i>Tringa erythropus</i> Spotted Redshank	1	1	—	—	2
<i>Heteroscelus</i> sp. Tattler	1	—	—	—	1
<i>Numenius phaeopus</i> Whimbrel	3	1	—	1	5
[Scolopacidae sp.] [Sandpiper]	—	2	—	—	2
Native Land Birds					
* <i>Poliolimnas cinereus</i> White-browed Crake	—	1	—	—	1

TABLE 4 (continued)

SPECIES	NO. OF SPECIMENS FROM FAIS SITES				TOTAL
	FSFA-1	FSFA-2	FSPO-1	FSPO-2	
* <i>Gallicolumba</i> cf. <i>xanthonura</i> White-throated Ground-Dove	1	1	—	—	2
* <i>Ducula oceanica</i> Micronesian Pigeon	1	—	—	—	1
<i>Aplonis opaca</i> Micronesian Starling	—	3	—	—	3
Non-native Land Birds					
<i>Gallus gallus</i> Chicken	56	26	7	13	102
Totals (NISP/% of total)					
Seabirds (14 spp.)	43/41	19/34	7/50	6/30	75/38
Migrant shorebirds (5 spp.)	6/6	6/11	0/0	1/5	13/7
Native land birds (4 spp.)	2/2	5/9	0/0	0/0	7/4
Chicken (1 sp.)	56/52	26/46	7/50	13/65	102/51
All species (24 spp.)	107/100	56/100	14/100	20/100	197/100
Total native species	18	17	5	4	23
Total (*) native species	9	9	3	1	12

NOTE: Numbers in Tables 4–10 are NISP (number of identified specimens). Taxa in brackets [] are unlikely to represent a species other than those listed.

*, Likely to be extirpated on Fais.

nonbreeding birds. As the prehistoric record of Micronesian birds improves, it is likely to reveal that several species of *Pterodroma* once nested in this region. Thus far, the only other prehistoric record of *Pterodroma* from Micronesia is that of *P.* cf. *becki* (a small *rostrata*-like species) from Pohnpei (Steadman, Ayres, and Kataoka, unpublished data).

Bulweria bulwerii (Jardine & Selby). Bulwer's Petrel

MATERIAL: Ulna.

REMARKS: Unrecorded anywhere in Yap State, *B. bulwerii* breeds in Micronesia only in the Marshall Islands, with possible sight records from Chuuk and Pohnpei.

Order PELECANIFORMES
Family PHAETHONTIDAE

Phaethon lepturus Daudin. White-tailed Tropicbird

MATERIAL: Humerus.

REMARKS: This species breeds virtually

throughout Micronesia. It has been recorded from Yap and Ulithi.

Family SULIDAE

Sula dactylatra Lesson. Masked Booby

MATERIAL: Tarsometatarsus.

REMARKS: Unrecorded anywhere in Yap, *S. dactylatra* breeds in Micronesia in the Northern Marianas, Marshall Islands, and Wake.

Sula sula (Linnaeus). Red-footed Booby

MATERIAL: Two pedal phalanges.

REMARKS: Unrecorded anywhere in Yap, *S. sula* breeds in Micronesia on Belau, the Northern Marianas, Chuuk, the Marshall Islands, and Wake.

[*Sula sula* or *S. leucogaster*. Red-footed or Brown Booby]

MATERIAL: Two ulnae.

REMARKS: These specimens, too fragmentary for species-level identification, resemble

TABLE 5
BIRD BONES FROM SITE FSFA-1, FAIS, YAP, FSM

SPECIES	LAYER				TOTAL
	1	2	3	4	
Seabirds					
<i>Phaethon lepturus</i>	—	—	—	1	1
<i>Sula dactylatra</i>	—	—	1	—	1
<i>Sula sula/S. leucogaster</i>	—	—	2	—	2
<i>Fregata minor</i>	—	—	1	—	1
<i>Fregata ariel</i>	—	—	1	—	1
<i>Sterna sumatrana</i>	—	—	1	—	1
<i>Sterna lunata</i>	2	2	—	—	4
<i>Sterna fuscata</i>	—	3	—	1	4
[<i>Sterna</i> sp.]	—	1	—	—	1
<i>Anous stolidus</i>	1	6	6	—	13
<i>Anous minutus</i>	—	2	—	—	2
<i>Procelsterna cerulea</i>	—	1	—	—	1
<i>Gygis candida</i>	—	4	1	—	5
[Sterninae sp.]	—	5	1	—	6
Migrant Shorebirds					
<i>Pluvialis dominica</i>	—	1	—	—	1
<i>Tringa erythropus</i>	—	1	—	—	1
<i>Heteroscelus</i> sp.	—	—	1	—	1
<i>Numenius phaeopus</i>	—	3	—	—	3
Native Land Birds					
<i>Gallicolumba</i> cf. <i>xanthonura</i>	—	—	1	—	1
<i>Ducula oceanica</i>	—	—	—	1	1
Non-native Land Birds					
<i>Gallus gallus</i>	5	34	15	2	56
Totals					
Seabirds (12 spp.)	3	24	14	2	43
Migrant shorebirds (4 spp.)	0	5	1	0	6
Native land birds (2 spp.)	0	0	1	1	2
Chicken (1 sp.)	5	34	15	2	56
All species (18 spp.)	8	63	31	5	107

in size the ulna of *S. sula* or *S. leucogaster* rather than that of the larger *S. dactylatra*. Like the other two species, *S. leucogaster* probably does not reside on Fais today.

Family FREGATIDAE

Fregata minor (Gmelin). Great Frigatebird

MATERIAL: Humerus, ulna, radius, carpo-metacarpus.

REMARKS: *Fregata minor* has been recorded from Yap and many other places in Micronesia, although breeding is known only on

Belau, Chuuk, Pohnpei, the Marshall Islands, and Wake. This widespread species probably still visits Fais today.

Fregata ariel (Gray). Lesser Frigatebird

MATERIAL: Ulna, carpometacarpus.

REMARKS: The only probable breeding record in Micronesia for *Fregata ariel* is from Yap, although this species visits many other Micronesian islands. Fais probably is visited as well.

[*Fregata* sp. Frigatebird]

MATERIAL: Ulna.

TABLE 6
BIRD BONES FROM SITE FSFA-2, FAIS, YAP, FSM

SPECIES	LAYER						TOTAL
	1	2	3	4	5	6	
Seabirds							
<i>Pterodroma</i> sp.	—	—	1	—	—	—	1
<i>Sula sula</i>	—	—	—	—	—	2	2
<i>Fregata ariel</i>	—	—	—	1	—	—	1
<i>Sterna sumatrana</i>	—	1	—	—	—	—	1
<i>Sterna lunata</i>	—	—	—	—	1	—	1
<i>Sterna fuscata</i>	—	—	2	—	—	—	2
<i>Anous stolidus</i>	—	1	—	—	—	—	1
<i>Anous minutus</i>	—	—	1	—	—	—	1
<i>Procelsterna cerulea</i>	—	—	—	1	—	—	1
<i>Gygis candida</i>	—	1	2	—	—	—	3
[Sterninae sp.]	—	—	4	1	—	—	5
Migrant Shorebirds							
<i>Pluvialis dominica</i>	—	—	1	—	—	—	1
<i>Charadrius leschenaultii</i>	—	—	—	—	1	—	1
<i>Tringa erythropus</i>	—	1	—	—	—	—	1
<i>Numenius phaeopus</i>	—	1	—	—	—	—	1
[Scolopacidae sp.]	—	—	1	—	—	1	2
Native Land Birds							
<i>Poliomnas cinereus</i>	—	—	1	—	—	—	1
<i>Gallicolumba</i> cf. <i>xanthonura</i>	1	—	—	—	—	—	1
<i>Aplonis opaca</i>	1	—	1	—	—	1	3
Non-native Land Birds							
<i>Gallus gallus</i>	2	8	13	2	1	—	26
Totals							
Seabirds (10 spp.)	0	3	10	3	1	2	19
Migrant shorebirds (4 spp.)	0	2	2	0	1	1	6
Native land birds (3 spp.)	2	0	2	0	0	1	5
Chicken (1 sp.)	2	8	13	2	1	0	26
All species (18 spp.)	4	13	27	5	3	4	56

TABLE 7
BIRD BONES FROM SITE FSPO-1, FAIS, YAP, FSM

SPECIES	LAYER			TOTAL
	2	3	4	
Seabirds				
<i>Bulweria bulwerii</i>	—	—	1	1
<i>Fregata minor</i>	—	1	—	1
[<i>Fregata</i> sp.]	—	1	—	1
<i>Sterna lunata</i>	—	1	—	1
<i>Anous stolidus</i>	—	2	—	2
<i>Procelsterna cerulea</i>	1	—	—	1
Non-native Land Birds				
<i>Gallus gallus</i>	4	2	1	7
Totals				
Seabirds (5 spp.)	1	5	1	7
Chicken (1 sp.)	4	2	1	7
All species (6 spp.)	5	7	2	14

TABLE 8
BIRD BONES FROM SITE FSPO-2, FAIS, YAP, FSM

SPECIES	LAYER			TOTAL
	1	6	9	
Seabirds				
<i>Fregata minor</i>	—	1	1	2
<i>Sterna lunata</i>	—	2	—	2
<i>Anous stolidus</i>	—	2	—	2
Migrant Shorebirds				
<i>Numenius phaeopus</i>	—	1	—	1
Non-native Land Birds				
<i>Gallus gallus</i>	2	9	2	13
Totals				
Seabirds (3 spp.)	0	5	1	6
Migrant shorebirds (1 sp.)	0	1	0	1
Chicken (1 sp.)	2	9	2	13
All species (5 spp.)	2	15	3	20

Order CHARADRIIFORMES
Family LARIDAE

Sterna sumatrana Raffles. Black-naped Tern

MATERIAL: Two ulnae.

REMARKS: This small tern breeds on Yap and "in small numbers" (Baker 1948:55) on Ulithi, as well as on Belau, Chuuk, Pohnpei, and the Marshall Islands.

Sterna lunata Peale. Gray-backed Tern

MATERIAL: Two humeri, five ulnae, radius.

REMARKS: Within Micronesia, *S. lunata* breeds only in the Northern Marianas and on Wake Island (Clapp and Hatch 1986). Nonbreeding birds have been recorded from Belau, Yap, and the Marshall Islands, but not on Chuuk or Ulithi.

Sterna fuscata Linnaeus. Sooty Tern

MATERIAL: Coracoid, three ulnae, radius, carpometacarpus.

REMARKS: Common and widespread but local in Micronesia, *S. fuscata* has been recorded on Yap, where, unlike in Belau, Chuuk, the Northern Marianas, Pohnpei, the Marshall Islands, and Wake, breeding is unknown. It has not been recorded from Ulithi.

[*Sterna* sp. Tern]

MATERIAL: Ulna.

Anous stolidus (Linnaeus). Brown Noddy

MATERIAL: Quadrate, sternum, furcula, two coracoids, scapula, two humeri, five ulnae, five radii.

REMARKS: This tern is a common resident virtually throughout Micronesia, including Yap, Ulithi ("large nesting colony" [Baker 1948:56]), and presumably Fais. Like *Gygis candida*, *Anous stolidus* often nests in trees, making it less vulnerable than most other terns to predation from mammals.

Anous minutus Boie. Black Noddy

MATERIAL: Coracoid, humerus, ulna.

REMARKS: *Anous minutus* also resides through much of Micronesia, including Yap and Ulithi. Because it nests on the ground, however, this species is unlikely to survive on Fais.

Procelsterna cerulea (Bennett). Blue-gray Noddy

MATERIAL: Furcula, humerus, ulna.

REMARKS: In Micronesia today, this tiny tern occurs only in the Marshall Islands. Bones of *P. cerulea*, including those of nestlings, were recovered from Payapai Cave, Rota (Northern Mariana Islands [Steadman 1992a]). The specimens from Rota and Fais indicate a much larger former distribution.

Gygis candida (Gmelin). Common Fairy-Tern

MATERIAL: Ulna, two radii, five carpometacarpi.

REMARKS: *Gygis candida* is a common and widespread resident in Micronesia, including Yap ("abundant" [Baker 1948:58]), Ulithi, and presumably Fais.

[Sterninae sp. Tern]

MATERIAL: Coracoid, four humeri, two ulnae, two carpometacarpi, manus phalanx, tibiotarsus.

Family CHARADRIIDAE

Pluvialis dominica (Muller). Lesser Golden-Plover

MATERIAL: Two coracoids.

REMARKS: This common migrant shorebird occurs throughout Micronesia, including Yap and Ulithi. Like the other four taxa of migratory shorebirds that follow, *Pluvialis dominica* almost certainly still visits Fais today.

Charadrius leschenaultii Lesson. Greater Sand-Plover

MATERIAL: Tarsometatarsus.

REMARKS: This fairly common migrant shorebird has been recorded in much of Micronesia, including Yap.

Family SCOLOPACIDAE

Tringa erythropus (Pallas). Spotted Redshank

MATERIAL: Radius, tibiotarsus.

REMARKS: This uncommon migrant shore-

bird has been recorded from Micronesia only from Chuuk and Guam. Of the five shorebirds recorded archaeologically from Fais, this one is probably the least frequent visitor today.

Heteroscelus sp. Tattler

MATERIAL: Scapula.

REMARKS: This specimen cannot be distinguished from the scapula of the Gray-tailed Tattler, *H. brevipes* (Vieillot), or that of the Wandering Tattler, *H. incanus* (Gmelin). Both species are common and widespread migrant shorebirds in Micronesia and have been recorded from Yap. *H. incanus* has been recorded as well from Ulithi.

Numenius phaeopus (Linnaeus). Whimbrel

MATERIAL: Scapula, humerus, ulna, radius, carpometacarpus.

REMARKS: This common migrant shorebird has been recorded nearly throughout Micronesia, including Yap, Ulithi, and Fais.

[Scolopacidae sp. Sandpiper]

MATERIAL: Furcula, pedal phalanx.

REMARKS: These specimens resemble in size the bones of *Heteroscelus* sp. or *Tringa erythropus*, but are otherwise undiagnostic.

Order GALLIFORMES
Family PHASIANIDAE

Gallus gallus (Linnaeus). Chicken

MATERIAL: One hundred and two specimens, representing most skeletal elements.

REMARKS: The chicken, a non-native species of Southeast Asian origin, is by far the most common species of bird in all four sites on Fais. Feral chickens have been reported from Yap, Ulithi, and Fais. Chickens were transported prehistorically as a domesticated nearly throughout Oceania.

Chicken bones were present throughout the stratigraphic sequences at FSFA-1, FSPO-1, and FSPO-2. At FSFA-2, chicken bones were not recorded from the deepest stratum (Layer 6) and made up only three of 12 bird bones from Layers 4–6 of FSFA-2, compared with

23 of 44 bones in Layers 1–3. This might suggest an early relative scarcity of chickens compared with native birds, as reported from the Tangatautu Rockshelter on Mangaia, Cook Islands (Steadman and Kirch 1990) and elsewhere in Polynesia (Dye and Steadman 1990).

Order GRUIFORMES
Family RALLIDAE

Poliolimnas cinereus (Vieillot). White-browed
Crake

MATERIAL: Tibiotarsus.

REMARKS: Within Micronesia, this rail inhabits wetlands on Belau, Yap (common), Chuuk, and Pohnpei. Formerly it lived on Guam and Rota (Steadman 1992a). It probably inhabited Ulithi until the 1940s (Baker 1948:48). The current lack of wetlands on Fais makes it unlikely that *P. cinereus* survives there. Fais may have had small wetlands on the central plateau (before phosphate mining) or at the base of the limestone cliffs until they were infilled by soils eroded from upslope, as evidenced at site FSPO-2.

Order COLUMBIFORMES
Family COLUMBIDAE

Gallicolumba cf. *xanthonura* (Temminck).
White-throated Ground-Dove

MATERIAL: Two ulnae.

REMARKS: These two specimens are referred to *Gallicolumba* following characters in Steadman (1992b). Their sizes match the ulnae in a male (larger) and female of *G. xanthonura*, based upon comparisons with specimens of two Polynesian species of similar size (*G. stairi* and *G. erythroptera*). A resident of the Marianas and Yap (common in 1976 [Pratt et al. 1977]), *G. xanthonura* is replaced by the similar *G. kubaryi* in Chuuk and Pohnpei. Although perhaps recorded earlier this century (but not in 1945) from Ulithi, it seems unlikely that this species of the forest understory could survive today on Fais.

Ducula oceanica (Lesson & Garnot). Micronesian Pigeon

MATERIAL: Pedal phalanx.

REMARKS: *Ducula oceanica* resides in natural and disturbed forests of Belau, Yap, Chuuk, Pohnpei, Kosrae, and the Marshall Islands. Formerly it lived on Rota and presumably elsewhere in the Marianas (Steadman 1992a). *Ducula oceanica* inhabits both atolls and high islands. There are no records for Ulithi, and it seems improbable that *D. oceanica* still exists on Fais. On Namoluk Atoll (Chuuk), *D. oceanica* died out around the turn of the century (Marshall 1977). The chronology of its loss on Fais is unknown.

Order PASSERIFORMES
Family STURNIDAE

Aplonis opaca (Kittlitz). Micronesian Starling

MATERIAL: Two ulnae, femur.

REMARKS: This starling occurs virtually throughout Micronesia except the Marshall Islands and Wake. It lives both on high islands such as Yap (*A. o. kurodai*) and on atolls like Ulithi (*A. o. angus*). Baker (1948:71) found it abundant on Ulithi in 1945, in spite of it being considered "a choice food item" by local people. *Aplonis opaca angus* is the only species of native land bird known to occur in modern times on Fais (Krämer 1937:388, Baker 1951:290). A generalized diet and broad habitat preference have contributed to the relative success of *A. opaca* compared with other Micronesian land birds.

DISCUSSION

Taphonomy and Subsistence

The seabird bones from Fais are dominated by wing elements (Table 9), much as in archaeological sites elsewhere in Oceania (D.W.S., pers. obs.). The elemental distribution among the other three groups of birds tends to be divided more evenly, except for the absence of axial elements in the small sample of land birds. Leg elements are the most common category only for chickens. We agree with Livingston (1989:545) that "the underlying property affecting element survivorship [of archaeological bird bones] may be a morphological similarity such as bone density."

There is a high rate of bone breakage for all taxonomic and elemental categories (Table 10). A single chicken femur is the only long bone recovered in its entirety. Even this bone, however, was recovered in two pieces, having been broken in the middle of the shaft. The only axial elements found whole were a quadrate and a vertebra, neither of which is particularly elongate or fragile. All wing bones were broken except for one ulnare. Unlike most other wing elements, the ulnare is a compact, dense bone that is difficult to break. The higher proportion of unbroken leg and foot bones is due mainly to the presence of nine complete chicken toes. Like the ulnare, toes are short, stocky, and dense. The low proportion of burned bones (7 of 197) suggests that the birds generally were cooked in underground ovens, probably wrapped in leaves, rather than over open fires. Some of the birds may have been eaten raw as well.

TABLE 9

ELEMENTAL DISTRIBUTION OF ARCHAEOLOGICAL BIRD BONES FROM FAIS (NISP/% OF TOTAL)

SPECIES	AXIAL ET AL. ^a	WING	LEG AND FOOT	TOTAL
Seabirds	10/13	61/81	4/6	75/100
Migrant shorebirds	5/38	5/38	3/24	13/100
Land birds	0/0	4/57	3/43	7/100
Chicken	16/16	35/34	51/50	102/100
Total	31/16	105/53	61/31	197/100

^a Axial et al. = axial skeleton (cranial, vertebral elements) + pectoral girdle (sternum, furcula, coracoid, scapula) + pelvis. See text for further details.

TABLE 10
CONDITION OF ARCHAEOLOGICAL BIRD BONES ON FAIS

SPECIES	AXIAL ET AL.			WING			LEG AND FOOT		
	W	BR	BU	W	BR	BU	W	BR	BU
Seabirds	1	9	0	0	61	3	0	4	0
Migrant shorebirds	0	5	0	0	5	0	0	3	0
Land birds	0	0	0	0	4	0	0	3	0
Chicken	1	15	0	1	34	1	10	41	3
Total	2	29	0	1	104	4	10	51	3

NOTE: Axial et al. defined in Table 9. W, whole; BR, broken; BU, burned. See text for further details.

The overall composition of the four avian assemblages from Fais is fairly similar, as one would expect if the assemblages are in fact all from a single site complex. Seabirds account for 30 to 50% of the bones, migratory shorebirds 0 to 11%, native landbirds 0 to 9%, and chickens 46 to 65% (Table 4). In Polynesian archaeological sites, the percentage of land bird bones decreases with time (Steadman 1989, Dye and Steadman 1990, Steadman and Kirch 1990). In other words, on any individual island, extirpation of indigenous populations or species of land birds has resulted in deposition of fewer bones of land birds in younger strata than in older strata. A similar pattern may exist in Micronesian archaeological assemblages, but this has not been tested. On Fais, site FSFA-2 yielded the oldest radiocarbon age. The relatively high percentage of land birds and low percentage of chickens at FSFA-2 support the radiocarbon evidence that this assemblage is the oldest. The presence at FSFA-2 of seven of the nine presumably extirpated seabirds and two of three presumably extirpated land birds further corroborates the relatively old age for this "site." Similarly, the lack of extirpated seabirds or land birds and the high percentage of chickens, suggests that FSPO-2 is the youngest assemblage on Fais. Larger bone samples would strengthen the validity of these comparisons.

Ecology and Biogeography

As detailed above, the paucity of modern ornithological data for Fais makes it difficult

to interpret the ecological and biogeographic implications of the prehistoric assemblage of birds. One obvious requirement for some land birds is the quality and quantity of native woody vegetation. Of the trees recorded on Fais by Fosberg and Evans (1969), probably only *Ficus tinctoria*, *Guettarda speciosa*, and *Pipterus argenteus* would be important sources of food for frugivorous columbids such as *Gallicolumba xanthonura* and *Ducula oceanica*. Relatively small areas of prime habitat (native forests or woodlands) can sustain columbid populations on islands that are about an order of magnitude larger than Fais, such as Atiu (26.9 km²) or Mitiaro (22.3 km²) in the Cook Islands (Franklin and Steadman 1991). From the description in Fosberg and Evans (1969), it seems that no more than 5 to 15% of Fais's 2.8 km² is forested suitably for native columbids. Such a tiny area, however, probably could not sustain columbid populations that were hunted by humans or by other mammals.

The growing prehistoric record of Micronesian birds remains much less comprehensive than that of Polynesia (Steadman 1989, James and Olson 1991, Olson and James 1991). Table 11 compares the only three prehistoric avian assemblages from Micronesia that have been studied (Rota, Fais, and Pohnpei). The limited evidence from each island includes a number of major range extensions of extirpated species. Payapai Cave on Rota is the only Micronesian site with a diverse assemblage of land birds; the best data on seabirds are from Fais. The data from

TABLE 11

COMPARISON OF PREHISTORIC AVIFAUNAS FROM THREE MICRONESIAN ISLANDS

SPECIES	ROTA	FAIS	POHNPEI
Seabirds			
<i>Puffinus nativitatis</i>	—	—	e?
<i>Puffinus lherminieri</i>	e	—	x
<i>Pterodroma cf. becki</i>	—	—	e
<i>Pterodroma</i> sp.	—	e?	e
<i>Bulweria bulwerii</i>	—	e?	—
<i>Phaethon rubricauda</i>	x	—	—
<i>Phaethon lepturus</i>	x	x	—
<i>Sula dactylatra</i>	—	e?	—
<i>Sula sula</i>	—	e?	—
<i>Fregata minor</i>	—	x	x
<i>Fregata ariel</i>	—	x	—
<i>Sterna sumatrana</i>	—	e?	—
<i>Sterna lunata</i>	—	e?	—
<i>Sterna fuscata</i>	—	e?	—
<i>Anous stolidus</i>	—	x	x
<i>Anous minutus</i>	—	e?	—
<i>Procelsterna cerulea</i>	e	e?	—
<i>Gygis candida</i>	x	x	—
Migrant Shorebirds			
<i>Pluvialis dominica</i>	—	x	—
<i>Charadrius leschenaultii</i>	—	x	—
<i>Tringa erythropus</i>	—	x	—
<i>Heteroscelus</i> sp.	—	x	—
<i>Numenius phaeopus</i>	—	x	—
Native Land Birds			
<i>Egretta sacra</i>	x	—	x
Anatidae, undescribed sp.	E	—	—
<i>Megapodius laperouse</i>	e	—	e
<i>Poliolimnas cinereus</i>	e	e?	—
cf. <i>Porphyrio</i> sp.	e/E	—	—
<i>Gallinula chloropus</i>	e	—	—
<i>Gallinula xanthonura</i>	x	e?	—
<i>Gallinula</i> , undescribed sp.	E	—	—
<i>Ptilinopus roseicapilla</i>	x	—	—
<i>Ducula oceanica</i>	e	e?	—
Psittacidae, undescribed sp.	E	—	—
<i>Collocalia vanikorensis</i>	e	—	—
<i>Aplonis opaca</i>	x	x	—
<i>Zosterops conspicillatus</i>	x	—	—
<i>Erythrura</i> , undescribed sp.	E	—	—
<i>Myiagra cf. freycineti</i>	E	—	—
<i>Myzomela rubrata</i>	x	—	—
Chicken			
<i>Gallus gallus</i>	—	x	x
Total sites	5	4 (1?)	9 (<9?)
Total NISP			
All species	323	197	38
Native species only	323	95	15
Total species			
Seabirds	5	14	6
Migrant shorebirds	0	5	0
Native land birds	17	4	2
Chicken	0	1	1
All native species	22	23	8
Extinct/extirpated species	13	12?	3/4

NOTE: Data for Rota are from Steadman (1992a), for Yap from herein, and for Pohnpei from Steadman, Ayres, and Kataoka (unpublished data). E, extinct species; e, extirpated; x, archaeological record of locally extant species. NISP, number of identified specimens.

Rota show that many genera of land birds with limited or no range in Micronesia today probably were widespread before human arrival.

We suspect that, in the absence of human influence, the full assemblage of land birds on Fais might have included species in most of the following genera: *Egretta*, *Nycticorax*, *Ixobrychus*, *Anas*, *Megapodius*, *Gallirallus*, *Porzana*, *Poliolimnas*, *Gallinula*, *Ducula*, *Ptilinopus*, *Trichoglossus*, *Collocalia*, *Halcyon*, *Coracina*, *Monarcha*, *Myiagra*, *Rhipidura*, *Acrocephalus*, *Aplonis*, *Myzomela*, *Zosterops*, *Rukia*, and *Erythrura*. The archaeological assemblage from Fais does not include flightless rails or ducks, megapodes, parrots, or undescribed species. This suggests that the bone sample currently available does not represent the first centuries of human occupation of Fais. Expanding the excavations at FSFA-2 might disclose this proposed missing time interval, thereby giving an improved estimate of the birds that once inhabited this small island. This estimate would be of great biogeographic importance, for we still do not have a large (>1000 identifiable specimens) sample of bird bones from any island of <10 km² in tropical Oceania. Such samples are needed to determine the lower limits of island land area required to support diverse assemblages of native land birds.

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