

Phenotypic status of Red Junglefowl *Gallus gallus* populations introduced on Pacific islands

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Following many decades without conservation attention, the genetic integrity of populations of Red Junglefowl *Gallus gallus* populations worldwide has recently become an issue of concern (Brisbin 1996, Peterson & Brisbin 1998, Anon. 2001, Brisbin *et al.* 2002). In general, the concern is that extensive hybridisation with domestic or feral chicken populations is swamping 'wild type' genomes, leading to loss of original genotypes. Numerous phenotypic markers suggest domestic/feral influence, including the presence of white or other atypical colours in the wings, hackles or tail; presence of a comb in hens; absence of eclipse plumages in males; call characteristics; and elongated or exaggerated tail plumes (Peterson & Brisbin 1998, Brisbin *et al.* 2002, Cornwallis 2002), although the relationship between phenotype and genotype can be less than direct (West-Eberhard 2003). Of course, the real challenge is not establishing that particular stocks are *contaminated*, but rather that of finding pure stocks: molecular markers under development (Brisbin *et al.* 2002) and ongoing hybridisation experiments (Brisbin & Peterson in prep.) indicate that *absence* of the above traits is insufficient to indicate genetic purity, but their absence *is* a good indication that populations exhibiting them are not candidate pure populations. If indeed genetically pure Red Junglefowl are rare or even endangered, as we suspect, documentation of the distribution and characteristics of pure stocks becomes key in the conservation of the species and its genome.

As has been emphasised many times previously (e.g. Remsen 1995), natural history museum collections represent the only long-term repository of primary knowledge regarding biological diversity. In the present case, an extensive series (N=87) of birds identified as 'Red Junglefowl' in the collections of the American Museum of Natural History (AMNH), collected between the 1890s (Palmer in Hawaii) and the 1920s and 1930s (Whitney South Sea Expeditions in much of the south-west Pacific) document phenotypes (and potentially genotypes) of this species 80–100 years ago (Ball 1933). We reviewed each specimen in these series' in detail, noting phenotypic traits that differ from the 'wild type' red junglefowl that is well known (Beebe 1926, Delacour 1951, Parkes 1962, Cornwallis 2002), including the following body regions: body feathers (in genetically pure individuals should be all-black in males, mottled brown in females), tail size (should be relatively short and not exceptionally elongated), tail colour (should be all black in males or brown in females), legs (should be slender and dark and not thick and yellow), wing colour (should be all black in males or brown in females), comb (should be small and simple, and not large and elaborate), hackle colour (should be bright orange), spurs (should be relatively small and short), and collar colour

TABLE 1

Summary of phenotypes of Red Junglefowl *Gallus gallus* or feral chickens collected from Pacific islands in the 1890s–1930s, in the collection of the American Museum of Natural History (New York). Traits listed in the right-hand columns are all phenotypic dimensions in which genetic contamination has been noted. Numbers indicate numbers of individuals in the sample showing the particular phenotypic feature.

Island	Year collected	N	Body feathers wrong colour	Tail exceptionally elongated	Legs thick and yellow	White in tail	White in wings	Elaborate comb	Hackles different colour	Elongate spur	Collar wrong colour
Austral Islands, Tubuai	1921	1		1					1		
Caroline Islands, Kusaie	1931	4									
Caroline Islands, Ponape	1930	5									
Fiji Islands, Kambara	1920s	2	1		1						1
Fiji Islands, Kio	1924	4		2	2			1			
Fiji Islands, Koro	1924	3	2		1			1			
Fiji Islands, Makongai	1924	3	1	1	2	2		2			
Fiji Islands, Taviumi	1924	1	1								
Fiji Islands, Vanua Mbalava	1924	2	2			1					
Hawaiian Islands, Kauai	1891	5	5	2	4	1	1		2		
Marquesas Islands, Eiau	1922	2	2	1	2	1					
Marquesas Islands, Hivaoa	1922	4	3	2	3	1			3		
Marquesas Islands, Motane	1922	1		1	1	1					
Marquesas Islands, Nukahiva	1921, 1922	3	3		1						
Marquesas Islands, Uahuka	1922	5	5	1	1	1					4
New Guinea, NE coast, Long Island	1933	3	2		1	2					
New Hebrides, Efate Island	1926	8	4	4	4	1		1	1		
Society Islands, Moorea	1921, 1924	16	6	1	4		2	2	4		
Society Islands, Raiatea	1922	2	1								2
Society Islands, Tahiti	1921	11	1	1	2		3		4		
Tonga Islands, Ala	1925	2	1	1	1	1					

(should be black in males or brown in females). Here, we briefly present the results of our review of these series of specimens.

In general, both the Whitney and Palmer series appear to document extensive genetic contamination of junglefowl stocks on Pacific islands (Table 1). Indeed, every individual from every island showed clear evidence of domestic influence in at least one phenotypic trait examined, as had been noted in a previous review of the Whitney material (Ball 1933). The exception among the AMNH specimens, interestingly, are those collected in the early 1930s on the Caroline Islands: no individual from this series (N=9) showed indications of genetic contamination.

Given that our ongoing experiments (Brisbin *et al.* 2002) indicate that phenotypic markers are poor indicators of absolute purity (i.e. even moderate levels of genetic contamination can prove undetectable via phenotypic markers), the Caroline Island populations deserve closer examination. The specimens available are at least as pure phenotypically as those present in the native distributional areas in the same era (Peterson & Brisbin 1998, Brisbin *et al.* 2002). As no recent Caroline Island specimens have been located in our surveys of other natural history museum collections, investigation of the present-day integrity of these populations would be a priority.

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