



## Extraordinary cranial specialization in a new genus of extinct duck (Aves: Anseriformes) from Kauai, Hawaiian Islands

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### Abstract

*Talpanas lippa* is described as a new genus and species of waterfowl from Kauai, Hawaiian Islands, that is unlike any other known member of the order. It is characterized by a short, stout tarsometatarsus and a braincase that is shallow and wide relative to its length with very small orbits. In comparison with extant species, the optic foramen of *Talpanas* is remarkably small whereas the maxillo-mandibular foramen, which is the exit point of the trigeminal nerve, is grossly enlarged. Relative to skull length and foramen magnum area, the maxillo-mandibular foramen is one order of magnitude larger in cross-sectional area than that of extant Anseriformes. We conclude that *Talpanas* had reduced visual abilities, as reflected externally by its small orbits and optic foramen, and a grossly hypertrophied trigeminal foramen. Taken together, this suggests that *Talpanas* may have been more heavily reliant upon somatosensory (tactile) cues for foraging than any living species of bird. Pectoral elements are unknown, but the evident lack of keen eyesight suggests that the species was flightless, as were many other insular waterfowl.

**Key words:** Anatidae, somatosensory, trigeminal nerve, optic nerve, vision, Hawaiian Islands

### Introduction

The Hawaiian Islands have provided a wealth of information concerning the evolution and diversification of insular biotas. The fossil record has greatly enriched the known diversity of birds in the islands, with at least 39 new species having been documented from deposits throughout the archipelago (Olson & James 1982, 1991; James & Olson 1991, 2003, 2005, 2006). Most, indeed probably all, of those species apparently became extinct in the past 1500 years or so since the islands were first colonized by humans (opp. cit.). Included are songbirds, raptors, and a diverse array of flightless taxa derived from at least 6 independent colonizations that included rails (Rallidae), an ibis (Plataleidae), and waterfowl (Anatidae). Among the last and perhaps the most unusual are the moa-nalos—3 genera and 4 species of large herbivores with tiny wings, that are evolutionarily derived from dabbling ducks (Sorensen *et al.* 1999). Here, we describe another new and extraordinary species of waterfowl from the island of Kauai that is strikingly unlike any anatid previously known in Hawaii or elsewhere in the world. An exquisitely preserved neurocranium excavated in Holocene lake sediments establishes that this bird had very small eyes and hence probably poor vision. These features, combined with enhanced somatosensory abilities, indicate a dramatic adaptation for tactile foraging that appears to have been better developed than in any other known bird.