Short Communications

Do Cormorants Eat Freshwater Mussels? If Not What Does?

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Boehm (1959) drew attention to a report by Eylmann (1914) that suggested cormorants break open and eat freshwater mussels (Hyriidae, *cf.* Smith 1992; Walker 1981). This was based on Eylmann finding fresh mussel shells on and near dried-up flood areas of the Murray River near Waikerie, South Australia (34°11′S, 140°00′E).

Early this century, Erhard Eylmann, a German doctor of medicine and zoology, travelled by train, horse and foot from Adelaide to Darwin and back (Eylmann 1908, 1911). Later, he returned to south-eastern South Australia (Eylmann 1914). These are his only known publications; his notes, diaries and other papers were lost during the chaos in Germany after World War I. Written in German, his work is little known and difficult to obtain in Australia. He was, however, a trained and observant witness to the interactions between Aborigines, settlers, flora, fauna and environment, including the impact of introduced plants and animals in South Australia and the Northern Territory.

Eylmann distinguished clearly between his observations and hearsay, and was aware of large Aboriginal shell middens along the river and that Aborigines had not been seen in the area for several decades. The shells he found were not in locations suitable for camping and he concluded that they were not the leftover snacks of wandering Aborigines. Eylmann was told that freshwater mussels were eaten by Brolga *Grus rubicundus*, 'White-backed Magpie' *Gymnorhina tibicen* and 'White-eyed Crow' adult *Corvus* but I have failed to find any published confirmation of this.

Two local farmers saw Eylmann examining the shells and told him that cormorants ate the mussels (Little Black *Phalacrocorax sulcirostris* and Little Pied Cormorants *P. melanoleucos* were numerous in the vicinity). When asked how this was done, they admitted that they did not know and Eylmann assumed that the cormorants somehow smashed them open. This unlikely explanation has puzzled me for many years because the heads of these cormorants are smaller than the mussels, their gapes are too narrow to swallow them and their beaks are the wrong shape and too fragile to hammer them open.

The only shelled molluscs known to be taken by any Pelecaniformes including the Phalacrocoracidae are less than 2 cm long. They are ingested whole by subantarctic shags in the genus or sub-genus *Nannopterum* which feed on a wide variety of marine invertebrates and vertebrates including bivalves, snails and hermit crabs (Marchant & Higgins 1990). So if cormorants did not eat the mussels, what did?

Eylmann (1914) recognised three distinct patterns of opened mussel shells. In the first pattern, about 30 to 50 mainly broken shells formed a small mound around an apple- or fist-sized stone. This may be explained by observations of Australian White Ibis *Threskiornis moluccа* holding a mussel with a foot on a wooden or stone 'anvil' and hammering it open with its bill (Vestjens 1973).

The second pattern was formed by less clustered intact shells, mainly with both halves still stuck together. This pattern was also noted by Troughton (1954) along rivers draining into the Gulf of Carpentaria and was explained by F. Ashton (in Troughton 1954) and Barrow (1962) who had seen water-rats *Hydromys chrysogaster* place mussels in the hot sun to open them. This method is analogous to that used by Aborigines who place mussels on hot coals to open them (Walker 1990). P. Olsen (pers. comm.) found undamaged open mussel shells among food remains under nests of Brown Falcon *Falco berigora*, which had used either the hot sun method or, more likely, had stolen them from water-rats.

Eylmann's third pattern consisted of scattered shells broken by being dropped from a height onto hard chalky ground at the base of a cliff near a river or a lagoon. For this there is as yet no full explanation. Probably a large bird, soaring on the updraught of wind striking the cliff, took the mussels up (in bill or claws) and dropped them to break them open. I and many others have seen gulls *Larus* and crows *Corvus* use this technique with marine molluscs (e.g. Teichert & Serventy 1947; Zach 1978).

Since Eylmann's day, a fourth pattern, produced by White-winged Chough *Corcorax melanorhamphos* using a valve or an intact mussel in its bill to pick or chisel open another intact mussel, has also been reported (Hobbs 1971; McDonald 1970).

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References

Barrow, G.J. 1962. *Hydromys chrysogaster* – some observations. Queensland Naturalist 17, 43-44.

Boehm, E.F. 1959. Cormorants and mussels. Emu 59, 63.

Eylmann, E. 1908. Die Eingeborenen der Kolonie Südaustralien. Dietrich Reimer, Berlin.

Eylmann, E. 1911. Die Vogelwelt der Kolonie Südaustralien. Journal für Ornithologie 59, 93-299.

Eylmann, E. 1914. Die Vogelwelt des südostlichen Teiles vom Staate Südaustralien. Journal für Ornithologie 62, 1-35 and 226-251.

Hobbs, J.N. 1971. Use of tools by the White-winged Chough. Emu 71, 84-85.

Marchant, S. & Higgins, P.J. (Eds) 1990. Handbook of Australian, New Zealand and Antarctic Birds, Vol. 1. Oxford University Press, Melbourne.

McDonald, N.H.E. 1970. Cases of high intelligence of White-winged Chough. Sunraysia Naturalists' Research Trust 7th Report, 61-63.

Smith, B.J. 1992. Non-marine Mollusca. Vol. 8 in Zoological Catalogue of Australia. Ed. W.W.K. Houston. AGPS. Canberra.

Teichert, C. & Serventy, D.L. 1947. Deposits of shells transported by birds. American Journal of Science 245, 322-328.

Troughton, E. 1954. Furred Animals of Australia. Angus & Robertson, Sydney.

Vestjens, W.J.M. 1973. Feeding of White Ibis on freshwater mussels. Emu 73, 71-72.

Walker, K.F. 1981. The distribution of freshwater mussels (Mollusca: Pelecypoda) in Australian zoogeographical region. Ecological Biologicae 41, 1231-1249.

Walker, K.F. 1990. Mussels. Pp. 309-314 in The Murray. Eds N. Mackay & D. Eastburn. Murray Darling Comission, Canberra.

Zach, R. 1978. Selection and dropping of whelks by Northwestern Crows. Behaviour 67, 134-148.

Poison in *Pitohui* Birds: Against Predators or Ectoparasites?

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Dumbacher *et al.* (1992) reported three New Guinea passerine birds in the genus *Pitohui* to be poisonous. They contained varied concentrations of the steroidal alkaloid homobatrachotoxin, a substance hitherto found only in neotropical poison-dart frogs of the genus *Phyllobates* (Dendrobatidae). They found the concentrations of homobatrachotoxin to be highest in the skin and feathers. Dumbacher *et al.* (1992) suggested the substance might be a chemical defense against natural predators such as snakes, raptors, and possibly some arboreal marsupials.

From the concentrations of homobatrachotoxin presented in their paper, I calculated that the most poisonous frog *Phyllobates terribilis* contained 200-500 μg toxin per 0.1 g of skin. The most poisonous bird Hooded Pitohui *Pitohui dichrous* contained only 0.3-0.5 μg toxin per 0.1 g of skin, i.e. three orders of magnitude less. Potential predators of warning-coloured poison-dart frogs range from similar size spiders through small reptiles to birds, but they normally avoid the frogs (Crump 1983; Fritz *et al.* 1981; Szelistowski 1985). It may thus require considerably higher concentrations of toxin to affect seriously predators of even much smaller size than the pitohui predators suggested by Dumbacher *et al.* (1992).

The possible evolution of homobatrachotoxin in pitohuis raises certain difficulties in considering the proposed bird predators. A raptor such as an *Accipiter* will catch and kill the pitohui in its talons before the poison gets in contact with its mucous membranes. In this context it is difficult to imagine how a few, slightly toxic mutant individuals in an ancestral unpoisonous