The Evolution of Tree-nesting and the Origin of the Spotted Harrier

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It is suggested that the origin of harriers *Circus* spp. was in the southern hemisphere and not in the north as has been previously proposed. Data are presented to show that Spotted Harriers *Circus assimilis* were probably once ground-nesters like other harriers and that they have subsequently become more aboreal.

Origin

There are as few as nine (Vaurie 1965) or as many as 13 (Mayr and Cottrell 1979) species of harrier. Either way, there are more species in the southern hemisphere, but Europe with four sympatric species is the continent with the greatest diversity of breeding species. However, there are six species in Africa and another one in nearby Malagasay. Those in Africa include two endemic residents, two widespread Palearctic breeding species that also breed in North Africa and migrate south in winter, and two purely Palearctic winter migrants. Australia, Asia and South America each have two species and North America only one.

Whilst recognising that diversity may not only indicate a long history of a group in an area, but may also result from the size and diversity of the environment inhabitated and the amount of competition by other organisms during that history, Rich (1975) proposed that harriers arrived in Australia by southward movement via the Indomalaysian route. I question this proposal for the Spotted Harrier *Circus assimilis*.

Brown and Amadon (1968) and Nieboer (1973) classified the Spotted Harrier as the most ancestral of the recent harriers on the basis of its plumage details. The observation that Spotted Harriers are monogynous and defend large non-overlapping territories (Baker-Gabb 1982), whereas sexually dichromatic species of harrier are often polygynous (Cramp and Simmons 1980; Baker-Gabb 1981), supports this classification (Lack 1968).

In his detailed morphological study of harriers, Nieboer (1973) stated that sexual dichromatism was an advanced character in the development of plumages, and he recognised a progressive sequence of three stages: no sexual dichromatism, conspicuous sexual dichromatism and immature plumage retardation. On this basis the Spotted Harrier was considered to be the most "ancestral" of the recent harriers and the European Marsh Harrier *C. aeruginosus aeruginosus* the most "advanced". Using a different approach, Baker-Gabb (1982) analysed data for six well-studied species of harrier on mating systems, nesting habitat, breeding season dispersion, territory maintenance and displays. This resulted in the moderately dichromatic members of the Marsh Harrier complex being placed between those monochromatic species such as the Spotted Harrier and those with conspicuous dichromatism such as Montagu's Harrier *C. pygargus*.

The net result of both approaches was that all of the species considered by Nieboer (1973) to have ancestral plumage types and by Baker-Gabb (1982) to have ancestral mating systems and behaviour patterns are found in the southern hemisphere. They include representatives of Nieboer's three harrier groups: those with no demonstrable relationships (*C. assimilis* and *C. buffoni* the Long-winged Harrier), the small harriers (*C. maurus* the Black Harrier and *C. cinereus* the Cinereous Harrier) and the marsh harriers (*C. ranivorus* the African Marsh Harrier and *C. aeruginosus approximans* the Marsh Harrier of Australasia).

Further support for a southern origin of harriers comes from a study of the distribution of their nearest relatives. Brown and Amadon (1968) stated that the harriers' supposed closest relatives are the harrier-hawks *Polyboroides* of Africa south of the Sahara and crane-hawks *Geranospiza* of South America There is also similarity in skeletons of *Circus* and snake-eagles *Spilornis* which range from India to the Phillipines and Sulawesi (Celebes), and the plumage of *C. assimilis* bears considerable resemblance to that of *Spilornis*.

Therefore, the thesis that harriers might have colonised the northern hemisphere by dispersal from the south is at least as likely as Rich's (1975) alternative proposal. Although I favour a southern origin of the harriers, it seems likely that there has been considerable movement between the continents of the Old World by members of the Marsh Harrier complex in particular and, unlike *C. assimilis*, it is possible that Marsh Harriers have an African origin (*C. ranivorus*) and that *C. a. approximans* is a later coloniser of Australasia from the north.

Tree-nesting

During studies of Spotted Harriers in arid north-western Victoria in 1980 and 1981, I recorded several anomalies in the bird's behaviour which suggest that it was once a ground-nester like other harriers and that it subsequently became more arboreal. The first anomaly is that the flimsy nests which Spotted Harriers constructed were unusually flat for a tree-nesting raptor, a feature also remarked upon by North (1901). Ten nests which averaged 50 x 40 cm and 16 cm deep were built from thistle stems and light dry twigs 0.5 cm or less in diameter. These nests more closely resembled the nests of ground-nesting Marsh Harriers (Baker-Gabb 1981) than they resembled the nests of other tree-nesting raptors.

The siting of Spotted Harriers' nests was also unusual for an arboreal species because they were placed on horizontal branches of casuarinas where they forked to provide a supportive base ($n = 18$ nests), or in areas of dense but slender reed-like regrowth where branches of eucalypts had broken away ($n = 8$ nests). Other species of raptor wove the larger sticks of their nests around stout upright branches and these nests were on average higher (9.6 m, $n = 118$) than the nests of Spotted Harriers (7.5 m, $n = 26$).

Four (14%) of 28 Spotted Harriers nests and their contents were blown from trees compared with only one (0.8%) of 118 nests of all other raptor species, a significant difference ($\chi^2 = 36.7$, $p < 0.001$). These observations indicate that Spotted Harriers are less competant builders of nests in trees.

When the young Spotted Harriers fledged they often perched on the ground rather than in trees like the young of other arboreal raptors. This behaviour would have exposed the Spotted Harrier fledglings to greater risks from ground predators. Although adult Spotted Harriers sometimes roosted in trees at night, they also roosted on the ground in long grass like other harriers (see also Brown and Amadon 1968). This behaviour is unusual for an arboreal raptor. When on their hunting grounds, Spotted Harriers often perched on the ground or a low bush as other harriers do (Watson 1977; Cramp and Simmons 1980). However, when they were near their nest sites they were likely to perch in a tree (33 of 68 observations 49%).

These observations suggest to me that ground-nesting was the "ancestral" breeding habit of Spotted Harriers. Similarly, Cullen (1957) concluded that flat ground was the ancestral breeding habitat of cliff-nesting Kittiwakes *Rissa tridactyla*. Her conclusion was drawn from the fact that Kittiwakes' eggs retain to some extent the cryptic pattern of blotching although this can be of little value, as every nest is marked conspicuously by a flag of white droppings. Also, young Kittiwakes are able to run under suitable conditions which is an unusual feature for a species nesting on cliff ledges. Cullen stated that the advantage of nesting on cliffs by Kittiwakes was that it reduced predation and this would seem the most likely explanation for the tree-nesting habit of Spotted Harriers.

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A Report on Visits to Stanley Island and Flat Island, Western Australia

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In November 1982 visits were made to Stanley Island (35°04'S., 117°09'E.) and Flat Island (34°51'S., 116°00'E.), off the south coast of Western Australia. Stanley Island* off Point Hillier, between Denmark and Walpole, is recorded as a breeding station of the Flesh-footed Shearwater *Puffinus carneipes* (Serventy and Whittell 1967). Flat Island, off Point D'Entrecasteaux, near Windy Harbour, about 100 kilometres further west, appears to be previously unknown ornithologically.

* Formerly there was also a Stanley Island in the Archipelago of the Recherche; it has now been renamed Whickham Island.

The following details were obtained during the visits to these islands.

Stanley Island

In company with T. Allen, H. Allen and my wife, this island was visited from 07:00 hours to 14:00 hours on 7 November 1982, access being by launch from nearby Parry Beach.

The island is about 700 m long by 350 m wide and rises to some 30 m in height. The vegetation mainly comprises *Poa* tussockland, *Carpobrotus* in rockier places, *Nitraria* (?) in some parts and areas of bare rock, mostly at the northern end.