

An Overview of Raptor Movements and Wintering Places in Australia and New Zealand

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New Zealand

An overview should first provide an insight into things likely to influence raptor movements and wintering places such as the location, size, topography, climate, habitats and human influences in the countries concerned. New Zealand lies in the South Pacific Ocean between latitudes 34°S & 47°S and longitudes 166°E & 179°E. It comprises two main islands which are together about 1,600 km from north to south, and several smaller islands. New Zealand covers 269,057 km² (roughly the size of Great Britain and Ireland combined) and has a human population of 3.2 million (Anon. 1984).

New Zealand is a mountainous country. More than half of the land rises above 300m and nearly a fifth above 900m. It has a high rainfall; much of the country receives 1,000-2,000mm per annum (Atkinson 1985) evenly distributed throughout the year.

When the first Polynesians settled New Zealand about 1,000 years ago, most of the land below 1,500m was temperate rainforest (Atkinson 1985). By the time Europeans arrived, Polynesian fires had helped to replace about one quarter of the forest with tussock, fernland and shrubs. After two centuries of European settlement, about 22% of the original forest cover remains (Moon 1981).

New Zealand has, or had, two endemic species of raptor. These are the New Zealand Falcon *Falco noveseelandiae* which is sedentary, but whose young disperse widely (Fox 1977), and the Laughing Owl *Sceloglaux albifacies* which is now extinct (Harrison 1985). The New Zealand Falcon has a population of between 2,000 and 4,500 breeding pairs (Fox 1978). Although totally protected, about 200 New Zealand Falcons, mostly dispersing juvenile females, are shot each year, mainly by ignorant poultry and pigeon keepers (Fox 1977). Only greater education and law enforcement can alleviate this problem.

There are two native species of raptor in New Zealand which also occur in other parts of Australasia: the Swamp Harrier *Circus approximans* and an owl, the Southern Boobook *Ninox novaeseelandiae*. The Little Owl *Athene noctua* of Europe was introduced to New Zealand's South Island between 1906-10. It has not colonized the North Island and appears to be sedentary.

Of the two native species, the Southern Boobook is generally sedentary, though some birds may move in winter, even to islands where they are not normally seen (Imboden 1985). Both the Southern Boobook and the Swamp Harrier are common and widespread birds that have adapted well to the deforestation of New Zealand.

During autumn and winter, juvenile Swamp Harriers disperse both north and south, with several band recoveries and sightings of individually marked birds that have travelled between the

two main islands. Small numbers may arrive on distant islands, even as far as the Kermadecs 900 km north-west, and then depart in spring (Oliver 1955). Birds in their second and third years that have not held a territory and bred successfully may also disperse during autumn (Baker-Gabb 1978, 1981). On the other hand, breeding adults may undertake local movements, but generally remain within 10 km of their breeding territory (Watson 1954; Robertson 1978).

Traditional communal roost sites in swampland regularly contain between 20 and 200 Swamp Harriers during autumn and winter (Gurr 1968). Small numbers of non-breeding birds may occupy these areas in spring and summer (Baker-Gabb 1978). Most overwintering Harriers hunt within 4 km of the roost, occasionally travelling up to 12 km. In parts of both main islands where agriculture is intensive and particularly on the drier east coast of the South Island, drainage or reclamation of communal roost sites is of local importance, especially as these areas double as important hunting areas and breeding locations. However, it should be borne in mind that in New Zealand the Swamp Harrier is a very common and widespread bird (Baker-Gabb 1986); this is despite the decline in population numbers that has occurred since the 1950s. This decline was brought about by effective control of Rabbit *Oryctolagus cuniculus* numbers and continuing reduction in wetland availability.

Positive signs for the future include: one major communal roost site that was targeted for development being turned into a reserve after action by local ornithologists, and the recent placing of the Swamp Harrier on the partially protected species list in New Zealand.

Australia.

Australia's extremities lie between latitudes 10°41'S and 43°39'S and longitudes 113°09'E and 153°39'E. This continental island of some 7.7 million km² is about equal in area to the U.S.A., excluding Alaska. It is some 4,000 km from east to west and 3,700 km from Cape York in the north to the south of Tasmania.

Australia's nearest neighbour is the island of New Guinea which is part of the same continental land mass and lies 139 km across Torres Strait from Cape York. New Zealand is about 2,300 km away and it is about 2,900 km to the nearest part of the Asian mainland (Anon. 1977).

Man has occupied Australia for more than 40,000 years. Aboriginal man has very likely played a prominent role in shaping the natural vegetation through the use of fire (Nix 1981). However, there can be no doubt that the start of marked disturbance and destruction of the environment coincided with the arrival and occupation of Australia by Europeans 200 years ago. Greatest disturbance in the form of urban development, dryland cash cropping and deforestation has occurred in the south and east, where most of the present human population of 15 million is concentrated.

This human distribution is readily explained by the fact that Australia is the driest continent, excluding Antarctica. Desert and semi-arid areas occupy 70% of Australia (Williams & Lazarides 1985), mainly in the centre and west of the continent (Fig. 1). The covering of perennial shrubs and grasses belies the truly desert nature of 55% of Australia which on average receives less than 250mm of rain annually (Williams & Calaby 1985). The Australian landscape is subdued, with low mountain ranges in the centre, north-west and one extending for 2,500 km in the east. Forest and woodland occur only in the coastal and subcoastal north, east and south-west. The climate is also predictable in these regions, but is very irregular throughout most of Australia. Prolonged droughts lasting 3-10 years may be broken by flooding rains. For this reason many bird species have had to adapt to an environment that is vastly different from year to year. Consequently many are resilient to present man-made changes, whilst those species whose survival is tightly linked with a few historically stable resources have not fared so well.

Unfortunately, preoccupation with the often extreme variability of climate in continental Australia has inhibited recognition of underlying patterns. Too often, bird movements have been labelled nomadic because this provides a ready-made answer to otherwise puzzling and cryptic observations.

To investigate some of these problems, Nix (1972) developed a model of bird migration in Australia based on the premise that the *relative* degree of change in the environment, whatever the cause, should provide the best index of the need for seasonal movement. Seasonal variation in plant growth index values (whether light, temperature or water regime induced), as measured by the coefficient of variation, provides an index of the relative degree of seasonal change at any given location. Thus we are looking at *within* year and not year-to-year variation.

Because temperature regimes show much greater year-to-year stability than water regimes in Australia, we should expect much more regular seasonal movements of bird populations in those areas with temperature controlled seasonal changes.

Analysis of seasonal growth indices suggests that movements of bird populations in the Australian region should occur very largely within four discrete sets (Nix 1972; Fig. 2).

1. Eastern Australia, including Tasmania and extending to New Guinea and associated islands for some species. The important seasonal change here is the low winter temperatures in the south-east.

2. North-western Australia, extending to New Guinea and eastern Indonesia for some species. The extreme seasonality of the water regime is important in this region.

3. South-western Australia, in which movements are largely internalised. Both lower winter temperatures and extreme seasonality of the water regime contribute to the relatively high degree of seasonal change in this sector.

4. Arid inland Australia, in which movements are the result of episodic rather than annual seasonal events. Even so, given the major climatic controls operative over Australia, the apparently random movements may have an underlying north-south pattern.

It should be noted that New Guinea shows a remarkable lack of seasonality in growth index values, which is in marked contrast to the seasonality of northern Australia (Nix 1972).

So how do the seasonal movements of raptors reported in the literature accord with the predicted patterns? Australia's 8 species of owl and 24 of diurnal raptor can be divided into four groups according to their seasonal movements. Widely separated populations of the same species may exhibit a range of movements, and so the category that they are placed in below represents the known movements of the bulk of the Australian population.

1. Sedentary species (14 species; 44%).
2. Rodent specialists which irrupt occasionally (4 species; 12%).
3. Arid and semi-arid zone species which generally remain in these zones, but migrate south-north seasonally (4 species; 12%).
4. Widespread and temperate zone species, some populations of which migrate south-north over long distances, and other populations which move much shorter distances in different directions (10 species; 32%).

1. Among sedentary species, the adults of most populations are present in or near their breeding areas year-round, whilst their young disperse widely. Characteristically, these are species of historically stable environments such as coastal and subcoastal forests and woodlands, and marine areas (5 owls and 6 diurnal raptors). Alternatively, they may be K-selected species occurring in a wide range of environments from coastal to inland regions (3 diurnal raptors). Among these sedentary species from forests and woodlands are the Rufous Owl *Ninox rufa*, Powerful Owl *N. strenua*, Barking Owl *N. connivens*, Masked Owl *Tyto novaehollandiae*, Sooty Owl *T. tenebricosa*, Grey Goshawk *Accipiter novaehollandiae* (Blakers *et al.* 1984), Red Goshawk *Erythrotriorchis radiatus* and Pacific Baza *Aviceda subcristata*. Very little is known about Australia's rarest raptor, the Red Goshawk, and its inclusion in this group is based on its tropical forest and woodland distribution, and not on any detailed study. The Pacific Baza is also doubtfully included in this group because it exhibits some altitudinal and other migrations in the south-east of its range during winter (Kaveney 1977; Czechura 1985), and moves out of the north-west during the dry winter there (Crawford 1972). However, it appears to be sedentary elsewhere (Blakers *et al.* 1984).

The sedentary marine species include the Osprey *Pandion haliaetus*, Brahminy Kite *Haliastur indus* and White-bellied Sea-Eagle *Haliaeetus leucogaster*. Ospreys occasionally leave their coastal haunts to travel along inland rivers during autumn (Blakers *et al.* 1984) and Brahminy Kites occasionally arrive in Torres Strait in winter (Draffon *et al.* 1983), but these are likely to be mainly dispersing juveniles. Whilst most coastal adult Sea-Eagles are sedentary, the comparatively few breeding birds on southern inland rivers disperse to areas unknown during autumn and winter (Blakers *et al.* 1984).

The widespread sedentary species include the Wedge-tailed Eagle *Aquila audax*, Peregrine Falcon *Falco peregrinus* and Brown Falcon *F. berigora*. Adults of these species may disperse irregularly during climatic extremes such as prolonged inland droughts, or exhibit minor movements at the extreme ends of their range (Blakers *et al.* 1984).

2. The four rodent specialists are the Letter-winged Kite *Elanus scriptus*, Black-shouldered Kite *E. notatus*, Barn Owl *Tyto alba* and Eastern Grass Owl *T. longimembris*. The Letter-winged Kite's core breeding area is the arid inland, whilst the other three species are more widespread. When numbers of the Long-haired Rat *Rattus villosissimus* and other rodents are low, inland populations of the Letter-winged Kite, Grass Owl and Barn Owl are sedentary along water courses and near bores. When substantial rains fall and rodent numbers reach plague proportions, these three species breed continuously and other raptors such as the Black Kite *Milvus migrans* breed up too. When the plague crashes, the raptors disperse, often towards the coast, where many of them die.

In coastal and subcoastal regions the Black-shouldered Kite and owls go through similar marked population increases, followed by nomadic movements and declines which mirror the population changes of rodents such as the introduced House Mouse *Mus musculus*. When rodent numbers are low, the movements of the more coastal populations of these three species seem to be more like those of the migratory species which are described below.

3. The arid and semi-arid zone species include the Grey Falcon *Falco hypoleucus*, Black Falcon *F. subniger*, Black-breasted Buzzard *Hamirostra melanosternon* and the Spotted Harrier *Circus assimilis*. All of these species have been previously described as either sedentary or nomadic (Hobbs 1961; Cupper & Cupper 1981; Morris *et al.* 1981; Hollands 1984). Whilst some pairs may be sedentary, R.A.O.U. Atlas data clearly show that all of these species are to be found further south in summer and north in winter. These regular movements in numerous areas have only been recognised in recent years (Baker-Gabb 1984a; Blakers *et al.* 1984; Olsen & Olsen 1985).

To illustrate: in southern Australia Spotted Harriers return to their mainly semi-arid breeding areas in late winter or early spring (North 1913; Brandon 1948; Hobbs 1961; Storr 1973; Baker-Gabb 1984a). The numbers arriving to breed at a given location may vary markedly from year to year. In arid regions the birds arrive to breed only after sufficient rain has fallen which is one year in two or three (Brooker *et al.* 1979; Klau 1983). After the breeding season, most adults and juveniles depart for the northern semi-arid zone where they overwinter with the resident birds (Fig. 3). There are no known discrete overwintering areas of special significance for the arid and semi-arid migrants.

4. The widespread and temperate zone species which migrate south-north over long distances include the Square-tailed Kite *Lophoictinia isura*, Whistling Kite *Haliastur sphenurus*, Brown Goshawk *Accipiter fasciatus*, Collared Sparrowhawk *A. cirrocephalus*, Little Eagle *Hieraetus morphnoides*, Black Kite, Australian Hobby *Falco longipennis*, Australian Kestrel *F. cenchroides*, Swamp Harrier and, probably, the Southern Boobook.

The Swamp Harrier is Australia's best-known migratory raptor, mainly because it breeds solely in the south of the continent and Tasmania, and vacates Tasmania entirely for the winter. This migration was first documented as recently as 29 years ago (Sharland 1958; Hobbs 1959). Some Harriers reach the mainland and travel west, but most fly up the east coast with large numbers overwintering in northern Australia and others crossing Torres Strait to southern New Guinea (Blakers *et al.* 1984; Beehler *et al.* 1985; Fig. 4). On their return in spring, many first year birds oversummer in the south of the continent, rather than crossing Bass Strait to Tasmania with the breeding birds. In south-western Australia, Swamp Harriers are not known to be migratory.

Some Australian Hobbies and Australian Kestrels also migrate to southern New Guinea, while many more overwinter on the Australian mainland. The seven other migratory species travel north, some as far as northern Australia, but they are not known to leave the continent in any numbers. However, the southern Australian subspecies of the Brown Goshawk has been collected on the east Indonesian island of Timor (Wattel 1973) and it has been speculated that Black Kites may travel to Indonesia also (Hollands 1984).

In conclusion, the seasonal movements of raptors in Australia appear to reflect well the patterns predicted by Nix (1972). There has been only one major study of an important overwintering area and its raptors (Baker-Gabb 1984b), and this was in south-eastern Australia. That area is

an 11,000 ha wildlife sanctuary where up to 300 raptors of a dozen species overwinter. No management problems are likely to occur there.

It is much more significant that predicted wintering areas for both south-western and south-eastern bird populations have, in the last two decades, suffered massive disturbance from agricultural development. Apart from vague references to "northern Australia", important overwintering areas are still not defined. Clearly, more work such as banding at selected sites and regular counting is needed, especially in northern Australia.

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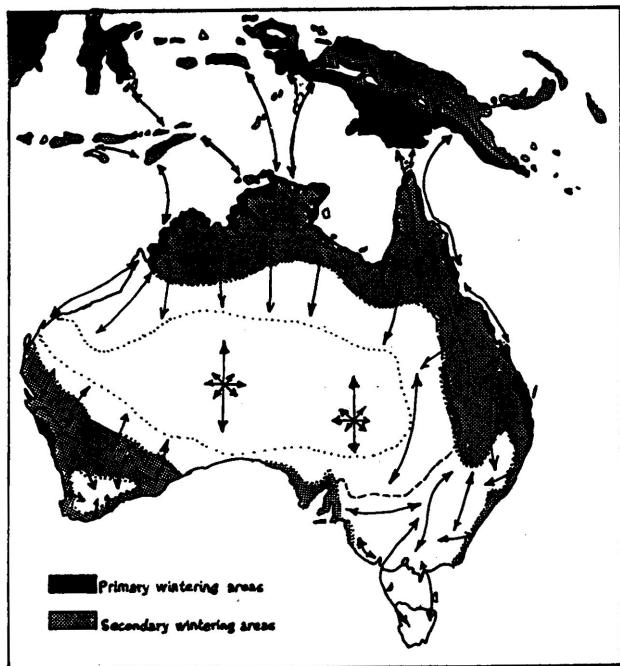


Figure 1. The distribution of Australia's arid and semi-arid regions.

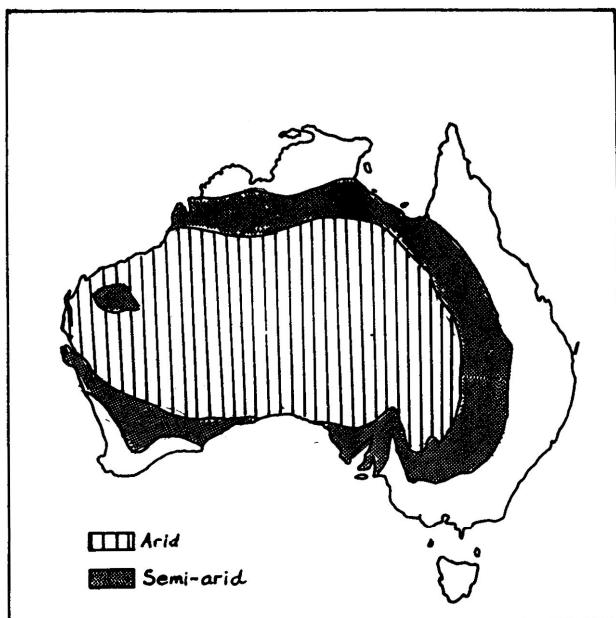


Figure 2. Movements and wintering areas of Australian birds (after Nix 1972).

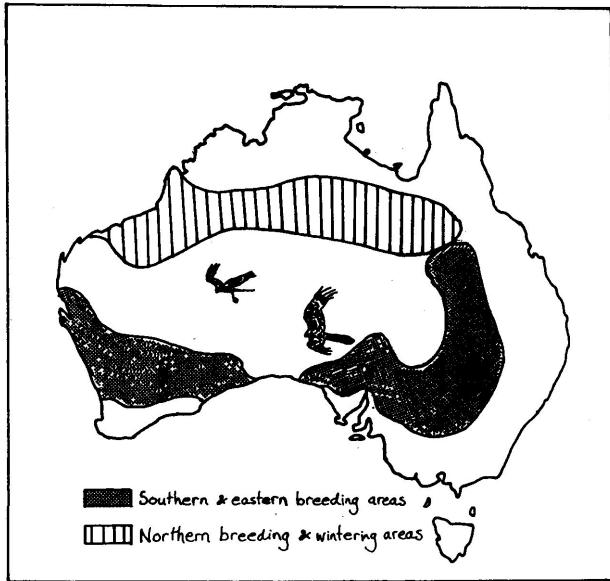


Figure 3. Breeding and wintering areas of the Spotted Harrier *Circus assimilis*.

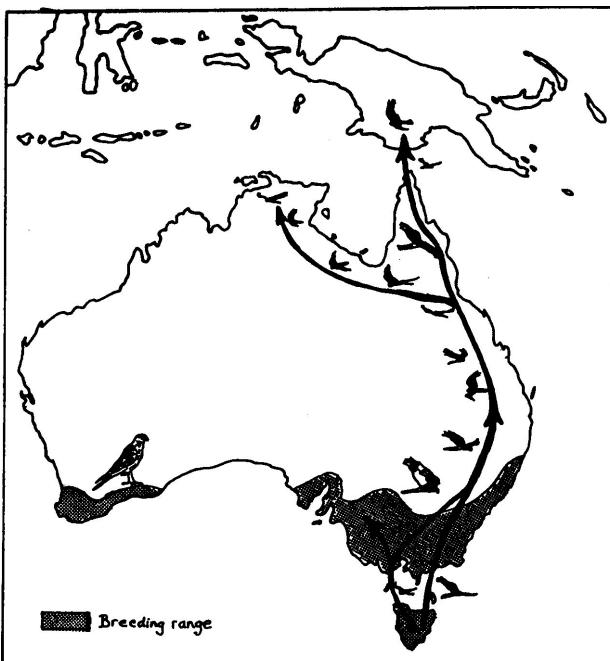


Figure 4. Breeding areas and post-breeding movements of the Swamp Harrier *Circus approximans*.