

ories in the 12 km² study area averaged 31 ha, nest sites averaged 910 m apart, pairs' overlapping home ranges averaged 9 km², and favourite hunting areas 3 km². A high population density of one bird per 50 ha was calculated. A low fledging success rate of 1.8 young per successful pair and 1.1 young per nest site and two cases of polygyny were recorded during two breeding seasons. Territorial and courtship behaviour, nest parameters, and the parental division of labour are described. Seasonal movements and the dispersion of age and sex classes from the study area at the end of the breeding season are described. Most (66.7%) individually marked adults returned after the autumn dispersal phase and established winter home ranges averaging 9 km². The home range of an adult female in open farmland was calculated to be 14 km² using radiotelemetry techniques. A nonbreeding season population density of one bird per 80 ha was calculated. Communal roosting, which occurred throughout the year, is discussed. Four hundred and seventy food items were identified in the diet from pellets, prey remains, stomach contents, and field observations. In descending order of numerical importance in the diet were mammals (46.4%), introduced passerines (29.0%), insects (7.6%), game birds (6.7%), birds' eggs (4.8%), and aquatic prey (4.6%). Australasian Harriers ate significantly greater numbers of live prey than carrion annually. Adults took significantly greater numbers of agile food items than juveniles. Females ate significantly more large (>200 g) and fewer agile food items than did males. Seven search techniques and five attack techniques, including some buteonine techniques, are identified and described in the Australasian Harriers' wide range of hunting techniques. Ninety-five attacks on prey are recorded, and 15.8% of them were successful. Adults were significantly more successful hunters than juveniles. Cooperative hunting, hunting in the daily cycle, feeding behaviour at carrion, interspecific competition for carrion, interspecific disruption of hunting, and prey escape tactics are described. From a computer analysis of hunting behaviour data it is concluded that adult males are more maneuverable and less conspicuous than adult females and juveniles because they flew significantly lower and faster. Adult males also hunted, to a significantly greater degree, those habitats where there were greater numbers of agile prey. The hunting inexperience of juveniles was quantified. The Australasian Harrier is moderately sexually dimorphic. Current hypotheses proposed to explain the degree of sexual dimorphism in raptors and why the females of most raptor species are larger than males are critically reviewed.

Baker-Gabb, David J. 1978. Aspects of the biology of the Australasian Harrier (*Circus aeruginosus approximans* Peale 1848). M.Sc. thesis, Massey University, Palmerston North, New Zealand. 221 pp.

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BEHAVIORAL AND PREDATORY DYNAMICS OF AMERICAN KESTRELS WINTERING IN THE ARCATA BOTTOMS

A field study of American Kestrels (*Falco sparverius*) was conducted in the Arcata Bottoms, Humboldt County, California, during the winters of 1972-73 and 1973-74,

to evaluate the influence of season, chronological hour, and environmental conditions on time and activity budgets, predatory efficiency, and prey capture.

Data were collected on the behavior of individual Kestrels observed from dawn to dusk. All behavioral acts were recorded with respect to time of day and elapsed time. Special attention was given to their predatory behavior (e.g., mode of hunting, predatory success, prey species captured, and food consumption).

In addition to intensive observation of the behavior of Kestrels, monthly road censuses were conducted in the Arcata Bottoms to obtain density indices of wintering raptor populations. During each field season, densities of small mammal prey species were estimated by periodic trapping in areas Kestrels commonly hunted.

Kestrels were 45.4 percent successful at capturing prey on 635 attempts in 1972-73; of the prey captured, 32 (11.1 percent) were vertebrates and 257 (88.9 percent) were invertebrates. In 1973-74, Kestrels were 60.7 percent successful on 1,198 attempts; of the prey captured, 46 (3.8 percent) were vertebrates and 1,167 (96.2 percent) were invertebrates. The decrease in the percentage of vertebrates captured in 1973-74 compared to 1972-73 corresponded with a drastic reduction in abundance of small mammals. The increase in predatory efficiency during 1973-74, reflected the greater efficiency of Kestrels in capturing invertebrates over that of capturing vertebrates.

The modes of hunting used by Kestrels were perch-hunting, hover-hunting, and flight-hunting. In both years, perch-hunting was most efficient, 51.8 percent and 66.9 percent, respectively; followed by flight-hunting, 23.3 percent and 48.8 percent, respectively; and hover-hunting, 23.8 percent and 26.9 percent, respectively. The predatory efficiency of each mode of hunting was inversely related to the proportion of vertebrate prey captured.

Caching behavior by American Kestrels is described. In 1972-73, 20 acts of prey caching behavior were observed; of these, 11 involved food storage and 9 involved food retrieval. Unsuccessful attempts to retrieve prey were observed 6 times in 1972-73. In 1973-74, 59 acts of prey caching behavior were observed; of these, 36 involved food storage and 23 involved food retrieval. Six unsuccessful attempts to retrieve prey were witnessed in 1973-74. The relative proportion of prey species involved in caching behavior corresponded directly to the relative proportions captured. In 1972-73, 16 (88.9 percent) of the prey items cached were small mammals, and 1973-74, 28 (63.6 percent) were frogs.

The relevance of this study to the functional and numerical components of predation; a comparative analysis of the interrelationships among predatory efficiency, hunting strategies, and taxons of prey; the relevance of time and activity budgets, body size, and foraging strategies to energy economy are discussed.

Collopy, M. W. 1975. Behavioral and predatory dynamics of American Kestrels wintering in the Arcata Bottoms. M.S. thesis. Humboldt State University, Arcata, California. xiv + 211 pp.

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