

Raptor Migration and Conservation in Taiwan

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ABSTRACT

Among the 27 species of diurnal raptors in Taiwan, 5 are full residents, while 22 are at least partially migratory. Sixteen of the migrants pass through Taiwan regularly, 6 only occasionally. This paper reports our current knowledge on the migratory species. Only the Chinese Goshawk *Accipiter soloensis* and Grey-faced Buzzard Eagle *Butastur indicus* are common immigrants. They appear to use different migratory routes in autumn and spring. We believe most autumn birds come down to Taiwan from the Ryukyu Islands route, while most spring birds head for the south-east coast of China after they leave Taiwan. Apparently Taiwan is at the junction of these migration routes. Using 100 Grey-faced Buzzard Eagles seen on any day as a threshold, we identified 30 important migratory raptor sites where current census and conservation efforts are concentrated. Shooting and trapping of raptors has been greatly reduced since the implementation of the Wildlife Conservation Law in 1989. Habitat destruction and degradation remain serious threats to raptor conservation in Taiwan.

The last few years have seen a major increase in the number of raptor watchers and researchers in Taiwan. A raptor databank was established by the Chinese Wild Bird Federation. The Raptor Research Group of Taiwan was formed in 1994 and has an active educational and research programme.

INTRODUCTION

Taiwan is an island about 200km south-east of China, with an area of 36,000km². Its geographical location makes Taiwan an important link in the chain from Sakhalin, Japan, through the Ryukyu Islands, the Philippines, Eastern Malaysia and Indonesia. Taiwan is, therefore, right in the middle of the eastern migratory passway between the Palaearctic and tropical Orient.

Among 458 species of birds recorded on Taiwan, 27 species are diurnal raptors. Five of these are residents: Crested Serpent Eagle *Spilornis cheela*, Crested Goshawk *Accipiter trivirgatus*, Besra Sparrowhawk *Accipiter virgatus*, Mountain Hawk Eagle *Spizaetus nipalensis*, and the Indian Black Eagle *Ictinaetus malayensis*. The Black Kite *Milvus migrans* is a partial migrant. The other 21 species are either regular autumn and spring migrants, wintering birds, irregular visitors, or even vagrants (Table 1).

MATERIALS AND METHODS

Three sources of information are used for this paper: 1) published reports; 2) personal observations; and 3) observation records in the Raptors' Databank of the Chinese Wild Bird Federation. Some of the published reports employed basic sampling techniques and covered the surveyed areas systematically. Others documented the raptor numbers at specific localities without attempting general coverages. Similarly, the bulk of the data in the Raptors' Databank is

Table 1 Status and Seasonality of Nonresident Diurnal Raptors of Taiwan.

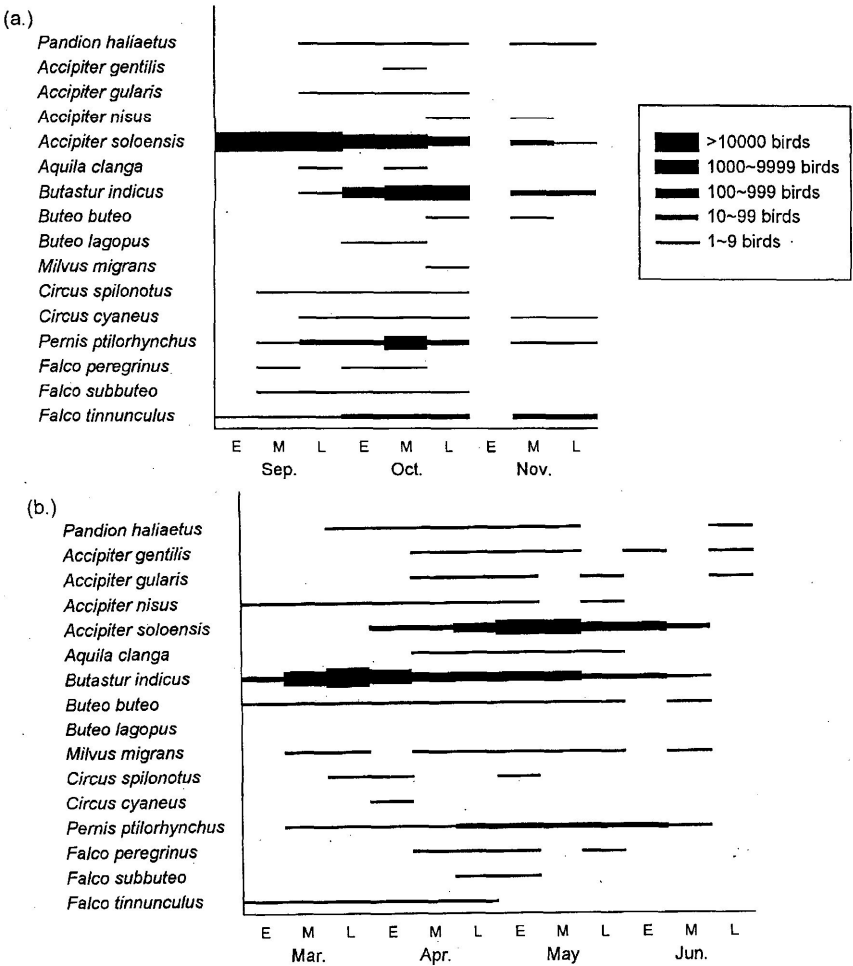
Family	English Name	Scientific Name	Autumn	Spring	Vagrant
PANDIONIDAE					
	Osprey	<i>Pandion haliaetus</i>	2	2	
ACCIPITRIDAE					
	Northern Goshawk	<i>Accipiter gentilis</i>	-	1	
	Japanese Sparrow Hawk	<i>Accipiter gularis</i>	1	1	
	Northern Sparrow Hawk	<i>Accipiter nisus</i>	1	1	
	Chinese Goshawk	<i>Accipiter soloensis</i>	5	5	
	Cinereous Vulture	<i>Aegypius monachus</i>	-	-	V
	Greater Spotted Eagle	<i>Aquila clanga</i>	1	1	
	Imperial Eagle	<i>Aquila heliaca</i>	-	-	V
	Grey-faced Buzzard Eagle	<i>Butastur indicus</i>	4	5	
	Eurasian Buzzard	<i>Buteo buteo</i>	1	2	
	Rough-legged Buzzard	<i>Buteo lagopus</i>	1	-	
	Black Kite	<i>Milvus migrans</i>	-	1	
	Eastern Marsh Harrier	<i>Circus spilonotus</i>	2	2	
	Hen Harrier	<i>Circus cyaneus</i>	1	1	
	Pied Harrier	<i>Circus melanoleucus</i>	-	-	V
	White-tailed Sea Eagle	<i>Haliaeetus albicilla</i>	-	-	V
	White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	-	-	V
	Oriental Honey Buzzard	<i>Pernis ptilorhynchus</i>	3	3	
FALCONIDAE					
	Merlin	<i>Falco columbarius</i>	-	-	V
	Peregrine Falcon	<i>Falco peregrinus</i>	1	1	
	European Hobby	<i>Falco subbuteo</i>	2	-	
	Common Kestrel	<i>Falco tinnunculus</i>	1	3	

Note: Autumn = Autumn Migrant, Spring = Spring Migrant. Numbers indicate the number of birds usually seen for that species. 4 = thousands, 3 = hundreds, 2 = tens, 1 = less than 10 birds.

based on chance observations by bird watchers instead of systematic surveys. However, the paucity of data makes it essential that we combine all the information available.

Only recently have people begun watching and studying raptors on Taiwan. Little historical information exists to permit comparisons. Currently, raptor study is limited to resident species and the most numerous migrants, while raptor watching is primarily carried out by bird watchers opportunistically. An organized annual census, with varying length of history, takes place only in four key locations: Kenting, Pakuasham, Kuanyinsham and Keelung. Thus migratory routes reported in this paper are determined on

Figure 1: The time and population size of migrating raptors passing through Taiwan. (a) Autumn (b) Spring. The thickness of the horizontal bars represents the relative abundance of the different species at different time blocks.



the basis of known information without equal coverage of the entire island. Nevertheless we believe most major raptor sites have been discovered by bird watchers by now, and our understanding should not err too far from the current situation.

Autumn Migration

A. Patterns and Routes

In general, autumn raptor migration lasts from 25 August to the end of October. The peak migration time and the population size of the 16 regular migrants differ among species (Figure 1) but all seem to use similar migrating routes while passing through Taiwan. These routes form a broad front covering several parallel north-south mountain ranges, instead of travelling over lowland plains or following the coastline. Apparently some birds enter Taiwan on the northern or north-western coast, regions closest to mainland China. However, the population counts made by birdwatchers showed a dramatic increase from the north to the south of Taiwan, a trend especially obvious on the east coast. This suggests that a large number of birds coming from the Ryukyus enter Taiwan not at the northern tip but at some unknown localities along the east coast.

The southern tip of Taiwan is a narrow peninsula, ending with a cape only 6km wide. This is the location of Kenting National Park. Census data show that raptor counts at Kenting are consistently much higher than those made in other locations. The current explanation is that a "funnel effect" exists there. Because of its geographical peculiarity and the local wind pattern of the season, probably most of the southward moving raptors pass through Kenting. Of course this needs verification, but without question Kenting is the most important site to study autumn raptor migration in Taiwan.

B. Species and Numbers

In most years 16 species of migrating raptors are recorded in autumn. Only two pass through Taiwan in large numbers while the others are rare (Table 1). Chinese Goshawk *Accipiter soloensis* is the most numerous and has the longest migratory period. Around 25 August only a few individuals show up. After 1 September, the daily total increases rapidly and soon reaches above 1,000. Peak time is around 20 September, when the daily total may exceed 20,000 birds. After 15 October the number decreases until the season is over at the end of October. The total autumn count of Chinese Goshawk varies between 60,000 and 100,000 birds.

The second most numerous species is the Grey-faced Buzzard Eagle *Butastur indicus*. Its migrating duration through Taiwan is shorter than that of the Chinese Goshawk but the timing is very stable from year to year, always

between 5 and 25 October with a peak around 10 October. The maximum day count is 2,641 birds and the total autumn count is about 10,000.

Pernis ptilorhynchus is the third most numerous species. Its numbers have varied greatly over the years (between 19 and 470 birds) while its migration duration is very long. All the other species are uncommon, numbering less than 50 birds each autumn.

C. Important Sites

Among all the locations known, Kenting is the best observation site for autumn raptor migration. Nevertheless, many other sites also have noticeable numbers of raptors passing through. Because the Grey-faced Buzzard Eagle is easier to spot and count than the Chinese Goshawk, we use the maximum daily count of the Grey-faced Buzzard Eagle as an index to determine the importance of each site. Any site where 1,000 or more Grey-faced Buzzard Eagles were recorded in any one day in any year is designated a "thousand-level" site. Sites where hundreds of Grey-faced Buzzard Eagles were recorded in one day are designated "hundred-level" sites. These important Grey-faced Buzzard Eagle sites are presented on a map of Taiwan divided by a grid system into 261 (each one-eighth degree longitude by one-eighth degree latitude) to show their locations and distribution on the island (Figure 2).

Spring Migration

A. Patterns and Routes

The species that pass through Taiwan during spring migration are roughly the same as those in autumn, but their numbers are quite different (Table 2). Spring migration lasts longer and the birds are not as concentrated as in autumn. Birdwatchers tend to focus on two well-known sites, Pakuashan and Guanyinshan. The more scattered and protracted nature of the spring migration no doubt causes it to be overlooked by birdwatchers in many places even now.

Spring migration usually begins from about 25 February to late June, lasting almost four months. At Pakuashan, more than 10,000 Grey-faced Buzzard Eagles can be counted around 25 March, while none is seen after 10 April. At Kuanyinshan, although many of them can be seen in late March, the numbers are much less than those in Pakuashan, while many come through from mid-April through late May. Apparently Grey-faced Buzzard Eagles pass through Taiwan in two waves in the spring, each following a somewhat different route. This suggests that they come from different wintering grounds. Whether this is the case with other species of raptors is unknown.

Table 2. Seasonal Totals of Migrating Raptors Passing Through Taiwan

<i>Species</i>	<i>Autumn</i>	<i>Spring</i>
<i>Pandion haliaetus</i>	<20	40 - 50
<i>Accipiter gentilis</i>	<3<	10
<i>Accipiter gularis</i>	<50<	20
<i>Accipiter nisus</i>	<10	35
<i>Accipiter soloensis</i>	60,000 - 100,000	2,700 - 6,000
<i>Aquila clanga</i>	1	<10
<i>Butastur indicus</i>	7,400 - 10,600	20,000
<i>Buteo buteo</i>	<3	20
<i>Buteo lagopus</i>	<5	none
<i>Milvus migrans</i>	<3	<24
<i>Circus spilonotus</i>	<50	<6
<i>Circus cyaneus</i>	<3	<3
<i>Pernis ptilorhynchus</i>	<500	60 - 300
<i>Falco peregrinus</i>	<5	<15
<i>Falco subbuteo</i>	<20	<3
<i>Falco tinnunculus</i>	<50	<25

Note: Autumn numbers based on data from Kenting

Spring numbers based on data from Guanyinshan and Pakuashan

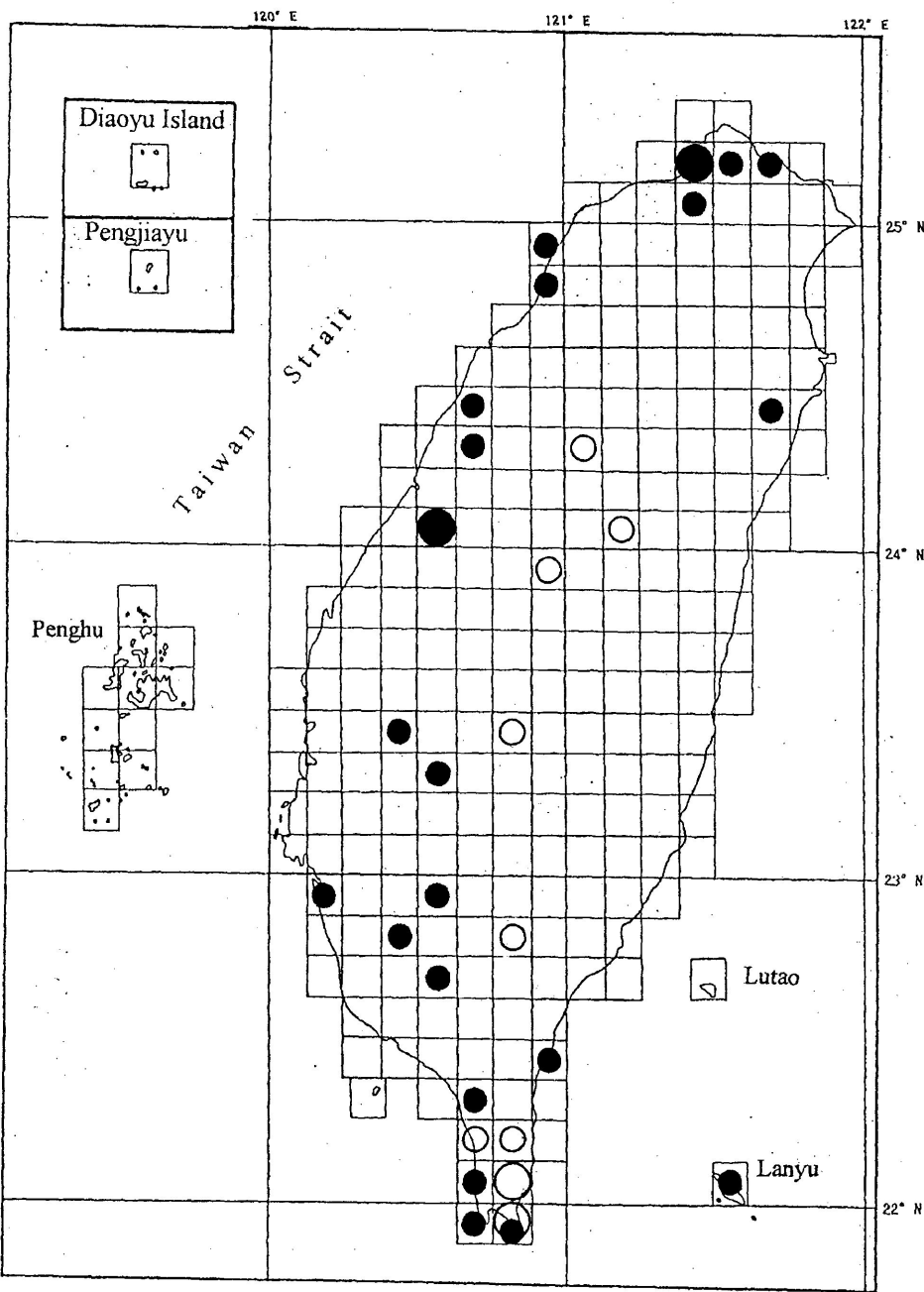
Spring migration routes either follow the western coastline or cross over low foothills instead of following high mountain ranges. These north-bound birds are most likely returning to their breeding grounds through the south-east coast of China instead of the Ryukyu Islands.

B. Species and Numbers

The Chinese Goshawk and Grey-faced Buzzard Eagle are the most important spring migrants also. Total spring counts for the former number 20,000 making it the most numerous species. This number is twice that of the autumn counts, suggesting that part of the population either pass by Taiwan on their way south, or were flying so high that they were missed in ground counts. The spring migration of the Grey-faced Buzzard Eagle peaks on about 25 March.

The Chinese Goshawk numbers only a few thousand in the spring, many fewer than in autumn. This suggests that a major portion of this species returns to its breeding area via a different route, not passing through Taiwan at all.

Figure 2. Map of important raptor migration sites. Empty circles are spring locations. Filled in circles are autumn locations. Large circles denote places where more than 1,000 Grey-faced Buzzard Eagles were seen in one day, while small circles refer to sightings of 100 to 999 Buzzard Eagles in one day.



C. Important Sites

Important sites for spring migration are selected in the same way as for important autumn sites (Figure 2). It is interesting to note that, with the exception of Kenting region, important sites for autumn and spring are totally separated geographically and topographically.

Wintering Raptors

Most species of autumn migrants have at least a small proportion of their populations wintering in Taiwan. Seven of the common and regular migratory species in the order of their winter abundance are: Common Kestrel *Falco tinnunculus*; Honey Buzzard *Pernis apivorus*; Osprey *Pandion haliaetus*; Common Buzzard *Buteo buteo*; Grey-faced Buzzard Eagle *Butastur indicus*; Peregrine *Falco peregrinus*; Marsh Harrier *Circus aeruginosus*. These are all Palearctic birds, most of them birds of open fields. Since very few resident raptors inhabit this habitat in Taiwan, these wintering birds appear to occupy this largely open niche.

Conservation Issues

Although no historical data exist for comparison, accounts by local people suggest major decreases of distributional ranges of raptors on Taiwan in the last 50 years. The absence of raptors in lowland plains and foothills most likely resulted from major habitat destruction or degradation. Although the enforcement of the Wildlife Conservation Law brought about a recent increase of the resident raptors, habitat destruction and degradation remain fundamental problems for raptor conservation in Taiwan.

The Wildlife Conservation Law mandates the completion of environmental impact assessments before major development projects are implemented. Although most developing agencies claim that they have abided by this regulation, habitat loss is still rapid. The most significant offenders are large-scale construction projects promoted by the national government, such as power plants, dams or cross-mountain super highways. Habitat conservation seems always to lose in the face of hypothetical economic gains.

The seriousness of habitat contamination for raptors is not as well known. No study of the direct impact of any existing environmental toxin on raptors has been completed. However, the negative effect of agrochemicals on the food base is beyond question, despite the lack of hard data to quantify the effect. The rapid decline of the Black Kite *Milvus migrans* in recent years is assumed to be a result of environmental contamination. The general public has become more and more concerned about the overuse of agrochemicals and the presence of other toxins in the environment. We hope major improvements in this area will occur before too long.

With the exception of people in Manchou and Pakuashan, few people

ever shot or trapped raptors in Taiwan. Manchou, near Kenting, was the most well known autumn roosting site for the Grey-faced Buzzard Eagle. Local people there used to shoot the roosting eagles at night as a traditional sport and business. A similar situation occurred in Pakuashan, where people used pole traps to snare roosting Buzzard Eagles in the spring. After many years of public education and law enforcement, shooting and trapping in these places has largely, though not completely, ceased. An increasing number of people have become interested in watching the hawk migration instead. The arrival of Grey-faced Buzzard Eagles is now usually announced on national television news. Thousands of birdwatchers and tourists crowd into Manchou and Pakuashan each season to observe migrating raptors. Many hunters of the past have turned into tour guides, directing tourists to the best hawk-watching locations. No-one could have predicted this turn of events ten years ago.

A potential new danger has emerged in recent years. Shooting with crossbows has increased in popularity as a sport. Crossbow users are usually well-off city people in search of fun. Equipped with four-wheel drive vehicles and powerful torches, they go into the mountains to shoot at any wildlife they may see, otherwise they shoot at some unfortunate trees. Roosting raptors become easy targets and arrows from crossbows can be lethal. Although the number of crossbow shooters is still small, its increasing popularity is worrisome. Conservationists must pay close attention to this development.

In addition to the long-existing nature conservation citizens' groups, such as wild bird societies, raptor enthusiasts formed the 'Raptor Research Group of Taiwan' (RRGT) in 1994. The aim of the RRGT is to organize and promote raptor research and conservation. It holds monthly meetings to discuss research methods, share information and plan group activities. The very successful First Annual Raptors' Conference organized by the RRGT attracted 200 local participants. We anticipate much heightened awareness of the status and conservation needs of raptors by the general public as a result of the RRGT's activities.

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