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### MIGRATORY-BIRD STRIKES TO AIRCRAFT IN INDIA

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#### ABSTRACT

India, unlike Israel which has a high concentration of migratory birds because of its geographical location between Asia and Africa forming an isthmus between the two continents, serves merely as a destination or land route for several species of migratory birds. From bird-strike remains 13 migratory bird species were identified during the period 1966 and 1991 in India. The plant and animal food available to birds and the open, vast and tranquil aerodrome areas which provide the safety needed by the birds while feeding, resting and nesting, are irresistible attractions. By our national effort supported by the Aeronautics R & D Board of India, the Bombay Natural History Society and airport authorities the aerodrome environments are being made ecologically unattractive to birds and this is reducing aircraft strikes due to birds including migratory ones within aerodrome areas at ground level and lower altitudes.

## INTRODUCTION

The Bombay Natural History Society which has gathered over the years a wealth of information on migratory birds through bird ringing, studied the ecological aspects of bird hazards to aircraft in India with the sponsorship of Aeronautics R & Board from 1980 onwards. The data gathered on bird-strike incidents by the BNHS also includes those on migratory birds. These are documented below.

## MATERIALS AND METHODS

Between 1966 and 1991 the BNHS had received 460 identifiable bird remains along with bird-strike data. The samples were examined macroscopically comparing with bird skins from the BNHS Collections and microscopically comparing internal structure of feathers from known birds through standard techniques. Till the beginning of 1990, 67 species of birds were identified from 360 bird aircraft strike remains (Satheesan, Grubh & Pimento, IN PRESS). By the end of 1991 the number of species of birds identified rose to 70. Between 1980 and 1989 the BNHS Bird Hazard Study Team conducted field research in 22 aerodromes in India and obtained first hand knowledge of potential problem birds in and around these aerodromes.

## RESULTS AND DISCUSSIONS

Of the 70 species of birds identified from bird remains, only 13 species were found to be migratory in nature. All the strikes on aircraft by migratory birds (TABLE 1) occurred between late August and early April. Majority of these birds are winter visitors arriving the sub-continent by September/October and leaving India by March/April. The European nightjar is a summer visitor to India. The Kashmir roller migrates to peninsular India in spring and returns in autumn (Ali & Ripley 1983). Demoiselle cranes which are winter visitors, are known to have regular autumn migration over Kohar in NW Pakistan (Ali & Ripley 1983). One Demoiselle Crane which hit an aircraft in the month of August was presumably in autumn migration or an early arrival for wintering in the sub-continent.

An analysis of 16 migratory-bird strikes according to the flight phases of aircraft revealed that 43.75% occurred within the aerodrome area while the aircraft was taxiing or on its

take-off run or landing approach and 13% on taxiing. The birds involved were the Bull and sooty tern, ducks, demoiselle crane, European nightjar, and a sparrow. An hourly distribution of birds showed that during day-light there were two hits by ducks and one at night time appeared to be otherwise diverse swallows encountered during migration or in the aerodrome area near the shelter.

Migratory birds hit aircraft in India upto an altitude of 10000 ft. Of these incidents 10 of 16 incidents were occurred outside the aerodrome area.

Migratory-bird strikes on aircraft landings other than engines (five occasions), lights (four times) and the aerodrome area (once), with the heaviest migratory-bird strike on aircraft in India (TABLE 2). Some birds weighed up to 900 g) and ducks. Methods suggested to avoid hazards at Indian airports are to provide attractions to birds, such as roosting facilities, and to frequent the airports.

## ACKNOWLEDGEMENTS

This paper is presented to the BNHS Bird Hazard Study Team, Aeronautics R & Board, India, through its

take-off run or landing roll where as the rest occurred outside in approach and level flights (FIGURE 1). Bittern, harriers, gull and sooty tern struck aircraft inside the aerodrome while ducks, demoiselle crane, golden plover, gull, common swallow, european nightjar and kashmir rollers did so outside aerodrome.

An hourly distribution of 20 bird strikes involving migratory birds showed that most of these incidents (70%) had occurred during day-light hours (FIGURE 2). Of all the incidents only two hits by ducks and one by Kashmir roller which occurred at night time appear to be positively during migratory flight they are otherwise diurnal birds. Cranes, Golden plover, gulls and swallows encountered by aircraft outside aerodrome could be in migration or in foraging flights. But birds hit within aerodrome area might have visited the locality for food or shelter.

Migratory birds have been recorded to have struck aircraft in India upto an altitude of 2424 m (Satheesan, 1990). Most of these incidents (94.12%) had occurred at and below 400 m. Out of 16 incidents where the altitude of strike was known, 56.25% occurred outside the aerodrome area.

Migratory-bird strikes have caused at least six precautionary landings other than slight to serious damage to aircraft engines (five occasions), wing (thrice), landing gear and lights (four times), nose (four times), incident probe in nose area (once), windshield (twice) and fuselage (once). The heaviest migratory bird species recorded to have struck aircraft in India was Demoiselle crane weighing about 2.5 kg. (TABLE 2). Some of the other heavier species were Bittern (c. 900 g) and ducks (300-700 g).

Methods suggested (Grubh 1989, Satheesan 1990) to reduce bird hazards at Indian aerodromes by removing all ecological attractions to birds like food and shelter, resting and roosting facility are also applicable to migratory birds which frequent the airfields.

#### ACKNOWLEDGEMENTS

This paper is prepared from the data collected as a function of the BNHS Bird Hazard Research Cell funded since 1980 by the aeronautics R & D Board, Ministry of Defence, Government of India, through its Operational Problems Panel.

TABLE 1. Migratory-birds in collision with aircraft in India between 1966 and 1991

Species	Locality	Migratory season	Date of incident	Hours of activity	Time of incident
1. Bittern	c.31.26N 75.43E	Autumn-	23-04-86	Crepuscular	2130 hrs.
<i>Botaurus stellaris</i>		Spring		& nocturnal	
2. Common teal	c.30.55N 75.54E	Winter	04-03-87	Day & night	2012-2053 hrs.
<i>Anas crecca</i>					
Common teal	c.30.55N 75.54E	-do-	22-10-90	Day & night	2023 hrs.
3. Pin tail	c.33.50N 75.00E	-do-	06-04-87	Day & night	0835-0950 hrs.
<i>Anas acuta</i>					
4. Montagu's harrier	28.35N 77.05E	Winter	21-09-87	Day	Not known
<i>Circus pygargus</i>					
Montagu's harrier	c.17.15N 78.20E	Winter	24-11-87	Day	0945 hrs.
5. Marsh harrier	12.52N 74.53E	Winter	08-11-87	Day	0710 hrs.
<i>Circus aeruginosus</i>					
6. Pale harrier	c.17.15N 78.20E	Winter	13-02-89	Day	1700 hrs.
<i>Circus macrourus</i>					
Harrier	22.28N 70.04E	Winter	15-10-90	Day	0800 hrs.
Harrier	c.26.42N 88.25E	Winter	06-11-90	Day	0900 hrs.
7. Demoiselle crane	17.54N 77.33E	Winter	29-08-84	Day	1547 hrs.
<i>Anthropoides virgo</i>					
Crane Gruidae	26.17N 73.02E	Winter	07-09-89	Day	1040 hrs.
8. Eastern Golden plover	26.38N 92.48E	Winter	28-01-86	Day & night	1535 hrs.
<i>Pluvialis dominica</i>					
9. Gull Larus sp.	15.05N 74.35E		26-02-87	Day	0820 hrs.
Gull Larus sp.	17.42N 83.18E	-do-	20-08-90	Day	1328 hrs
10. Spotted turnstone	18.32N 73.52E	Not known	24-01-88	Day	2030 hrs

TABLE 1. (Contd.)

11. Common swallow	26.38N 92.48E	Winter	27-10-88	Day	1410 hrs
<i>Hirundo rustica</i>					
Common swallow	26.38N 92.48E	Winter	15-03-89	Day	1230 hrs
12. European nightjar	23.16N 69.40E	Summer	26-09-87	Night & crepuscular	2000 hrs.
<i>Caprimulgus europaeus</i>					
13. Kashmir roller	15.05N 74.35E	Autumn	10-10-87	Day	2100 hrs.
<i>Coracias garrulus</i>					

9. Gull Larus sp.	15.05N 74.35E	26-02-87	Day	0820 hrs.
Gull Larus sp.	17.42N 83.18E	20-08-90	Day	1328 hrs
10. Sooty tern	18.32N 73.52E	Not known	24-01-83	2030 hrs
<i>Sterna fuscata</i>				

TABLE 1. (Contd.)

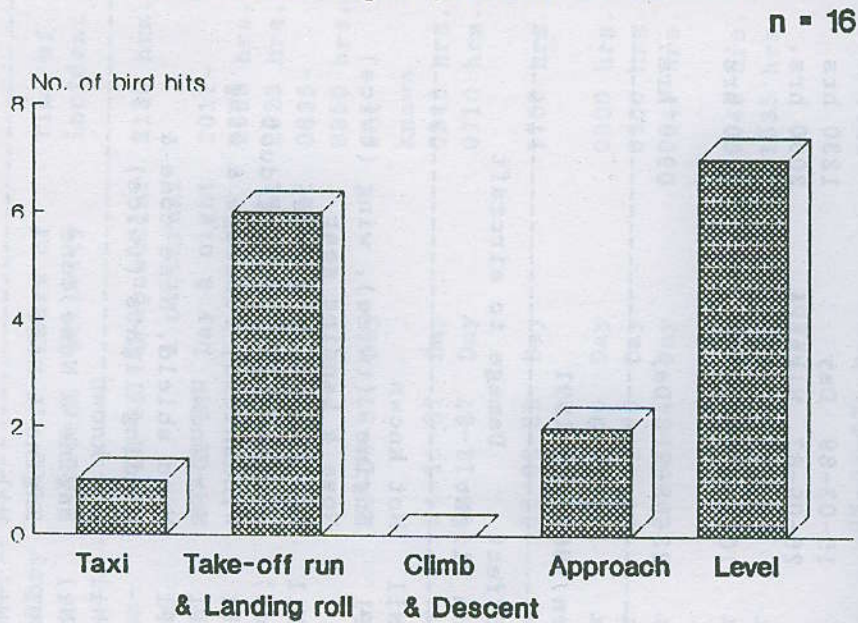
		27-10-88	Day	1410 hrs
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12. European nightjar				
<i>Caprimulgus europaeus</i>	15.05N 74.35E	Autumn	Day	2100 hrs.
13. Kashmir roller				
<i>Coracias garrulus</i>	26.45N 83.24E	Autumn	Day	0900 hrs.
Kashmir roller				

TABLE 2. Migratory-bird strikes in India between 1966 and 1991

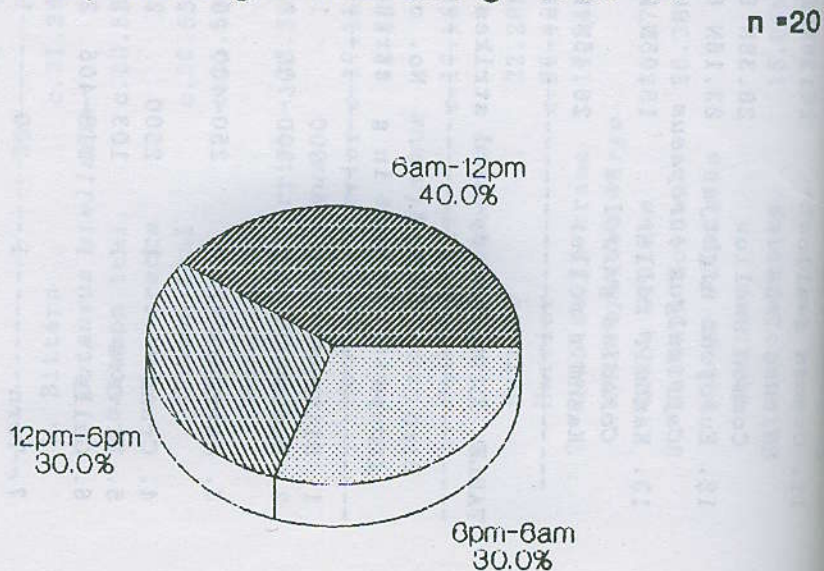
Bird groups	No. of species	wt. in g	No. of strikes	Local-ity	Effect on flight	Damage to aircraft
1. Bittern	1	900	1	NW	Nil	Not known
2. Ducks	2	300-700	3	NW	Pl	Engine (twice), wing (twice) Nose & Landing gear
3. Harriers	3	250-400	6	N, NE, W S & SE (twice)	Nil	Landing gear, Engine, Ventral fin, Cooling duct Windshield, Fuselage & wing
4. Crane	1	2500	2	NW & S	Pl	Not known
5. Plovers	1	103	1	SE	Pl	Wind shield, Nose cone & Landing lights (twice)
6. Gulls	1	116-405	2	SW & E	Pl	Not known
7. Tern	1	200	1	W	Nil	Not known
8. Nightjar	1	75-100	1	W	Nil	Engine & Nose cone
9. Roller	1	170	1	SW & N	Pl	Engine & Nose
10. Swallows	1	18	2	NE (twice)	Nil	Nil

Pl - Precautionary landing Ab. T/O - Aborted Take-Off

**FIGURE 1. Migratory-bird hits in India at various flight phases of aircraft**



**FIGURE 2. Migratory-bird hits in India at day and night time during 1966-91**



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