

TWENTY-THREE YEARS OF BIRDSTRIKE DAMAGE IN THE ISRAEL AIR FORCE 1972-1994

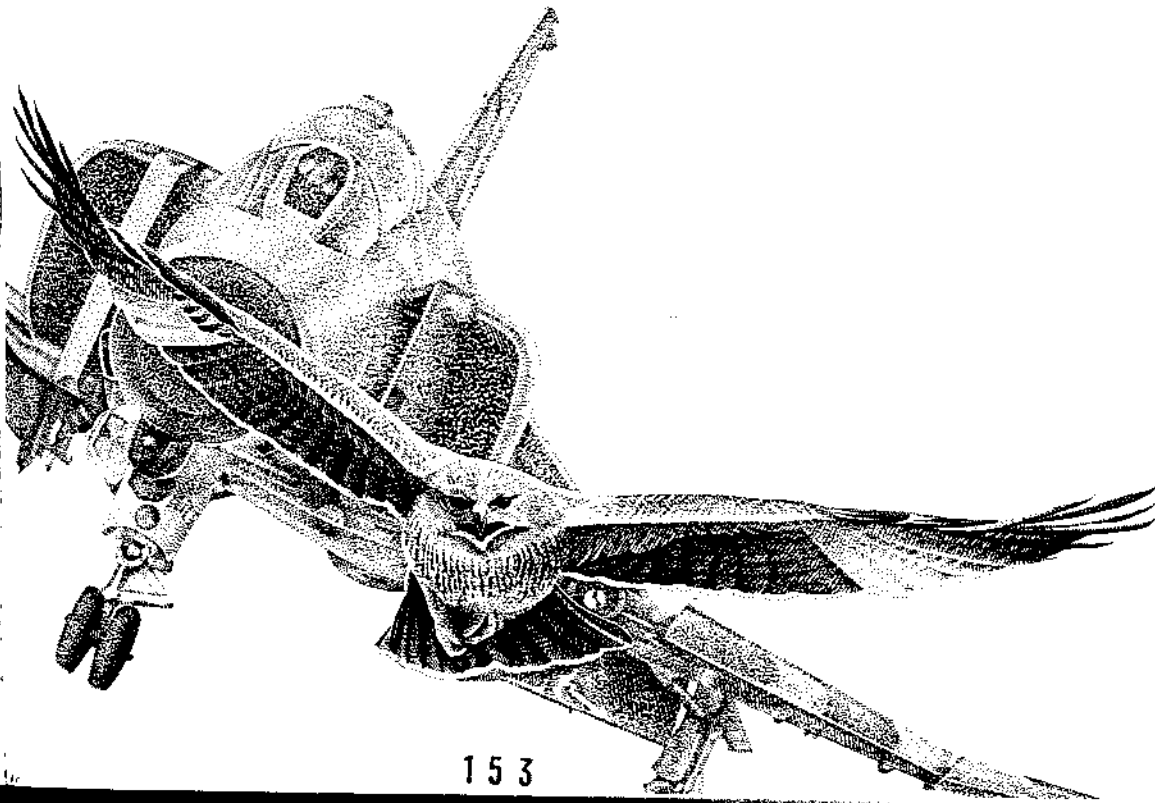
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ABSTRACT

As a result of security regulations, the Israel Air Force (IAF), did not permit publication of birdstrike damage before 1994. Now that permission has been obtained, a summary of the number of bird-aircraft collisions in the IAF can be published for the first time. Data for 1972-1983, before the joint SPNI-IAF research project started, is compared to data for 1984-1994, while research was going on. This paper will present the data on birdstrikes in relation to month of the year, with emphasis on the heavy migration seasons characteristic to Israel, as well as in relation to altitude and will compare diurnal birdstrike data to nocturnal data.

Data gathered during the last two decades on birdstrike and migration observations at high altitudes (15,000-50,000 feet) will be presented. Birdstrike data from flight areas will be compared to data from Aerodromes, and that of fighter aircraft compared to that from helicopters, carriers and light aircraft.

Finally, birdstrike data before and after the research project began will be compared. This comparison shows that during the past decade damage has been reduced by 88% and the IAF has saved an average of 30 million dollars per year.



INTRODUCTION

Despite its small size, Israel is strategically located at the junction of three continents. As a result, Israel is a "bottleneck", into which all or a large part of the world populations of certain soaring species converge, during spring and autumn.

Quantitative radar studies on bird migration done by Bruderer in two sites in the southern part of Israel (Bruderer, 1992) brought him to the conclusion that not only diurnal soaring birds are funneled through the area of Israel, but also nocturnal migrants occur in higher densities than elsewhere. Calculating migration traffic rates and extrapolating them to the whole width of the area between the Mediterranean coast and the Jordan mountains showed that about one billion birds may cross the area in autumn.

Naturally, Israel's special location generated a strong conflict between migrating birds and military aircraft which were forced to share such limited airspace with this unusual migratory mass of birds. Until recently, the IAF would not release birdstrike data for security reasons. Now partial publishing of the data is allowed, therefore, this paper will deal with partial analysis of the data collected during 23 years of collisions with birds.

During the Six Day War, in June 1967, Sinai was occupied by Israel, and in April 1982, as part of the peace agreements with Egypt, Sinai was returned to Egypt. During 1967-1982 Sinai was used as the central training area for IAF aircraft, mainly because of its large area (approximately 3 times that of the state of Israel). With the withdrawal from Sinai, and the considerable increase in the number of IAF aircraft, a serious problem of limited airspace was created, within which training had to occur, resulting in many collisions with birds, especially during migration. The IAF initiated a joint research program with the SPNI which started in 1984, whose goal was to significantly decrease the risk of birdstrikes during migration.

METHODS

Until 1983 data on military aircraft collisions was collected manually and from 1983 onward, data was computerized and held in a data bank in the flight safety department of the IAF. The data presented here was taken from the IAF data bank. In addition, further data was collected from personal interviews with control units, IAF pilots, and the female birdstrike prevention crew.

RESULTS

Figure 1. T

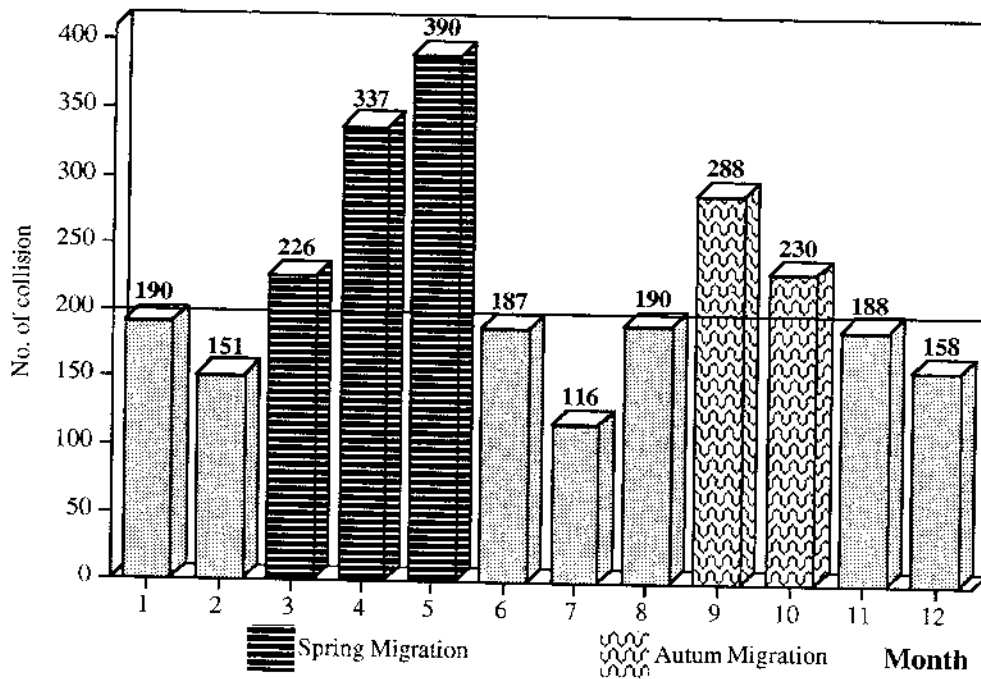


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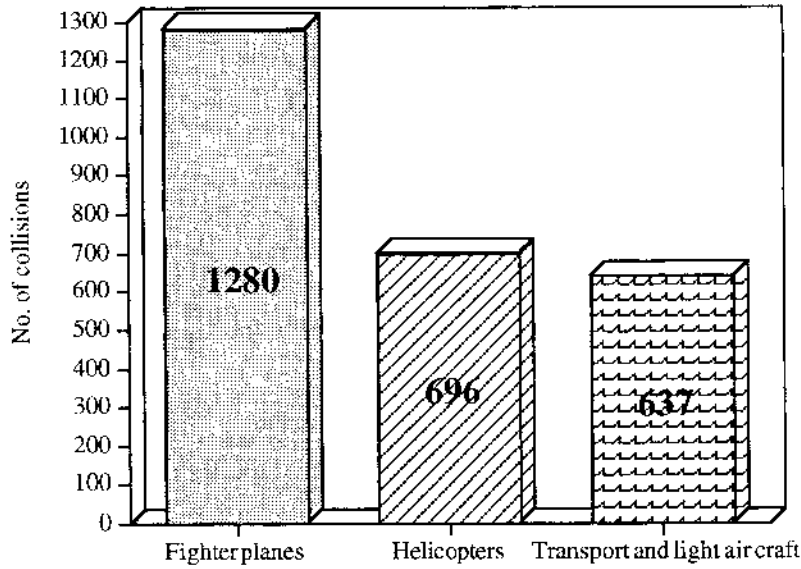
Figure 1. Total number of bird-aircraft collisions in relation to the months of the year, 1972-1994.



From the data it is apparent, when analyzing the birdstrikes during several years, the 5 months of migration, March, April, May (spring migration), September and October (autumn migration), are the months during which the most birdstrikes occur. Out of 2,639 birdstrikes, during 22.5 years, approximately 117.2 birdstrikes were recorded annually in the IAF. The multi-annual average of birdstrikes for each migratory month is 11.2% of all annual collisions, whereas during the nonmigratory months (7 months) 6.3% of the total amount of annual collisions occur each month. From this it is apparent that during the months of migration the amount of birdstrikes increases 77%.

Analysis of birdstrikes with IAF aircraft according to type of plane was divided into three main categories: fighter planes, helicopters, and transport and light aircraft. From the data in Figure 2, it is obvious that fighter planes are involved in almost twice the amount birdstrikes than the other categories (48.5% fighter planes, 26.3% helicopters, 25.2% transport and light aircraft).

Figure 2. Total number of bird-aircraft collisions in the Israel Air Force in relation to aircraft type, 1972-1994



In the IAF, the level of damage to military aircraft is divided into six categories:

LEVEL OF DAMAGE	AMOUNT IN DOLLARS
0	no damage
1	up to \$10,000
2	\$10,000-\$100,000
3	\$100,000-\$500,000
4	\$500,000-\$40,000,000
5	aircraft destroyed.

Though the IAF would not release information on damage according to the different aircraft categories, or actual numbers of collisions causing damage, from figure 3 one can learn of the proportions of the different levels of damage.

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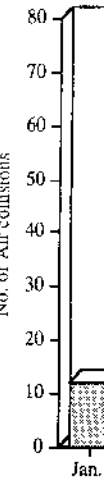
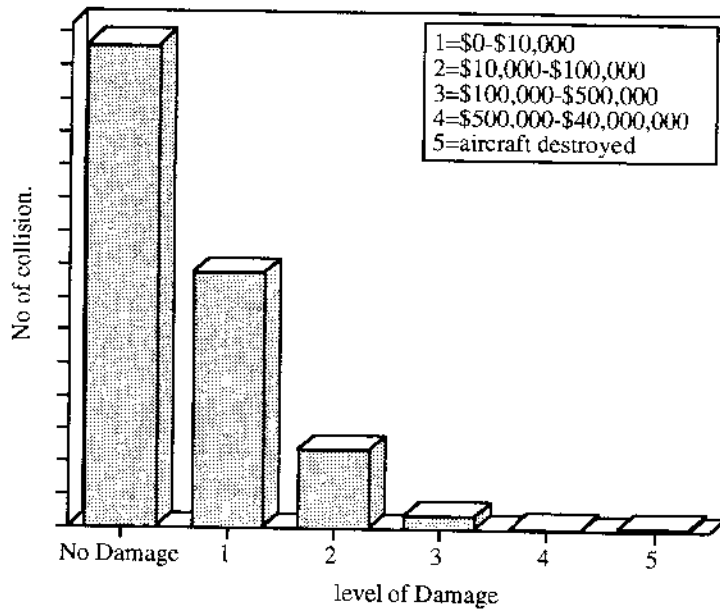


Figure 3. Total number of bird-aircraft collisions relation to the extent of damage, 1972-1994.



From the classified data which was not published it is clear that fighter planes suffered the most financial damage from birdstrikes.

A summary of the birdstrikes involving IAF fighter planes before the beginning of the joint research with the SPNI, between 1972-1982 according to months of the year, Figure 4 shows a similar picture to that seen in Figure 1.

Figure 4. Total number of bird-fighter aircraft collisions in relation to the month of the year, 1972-1982.

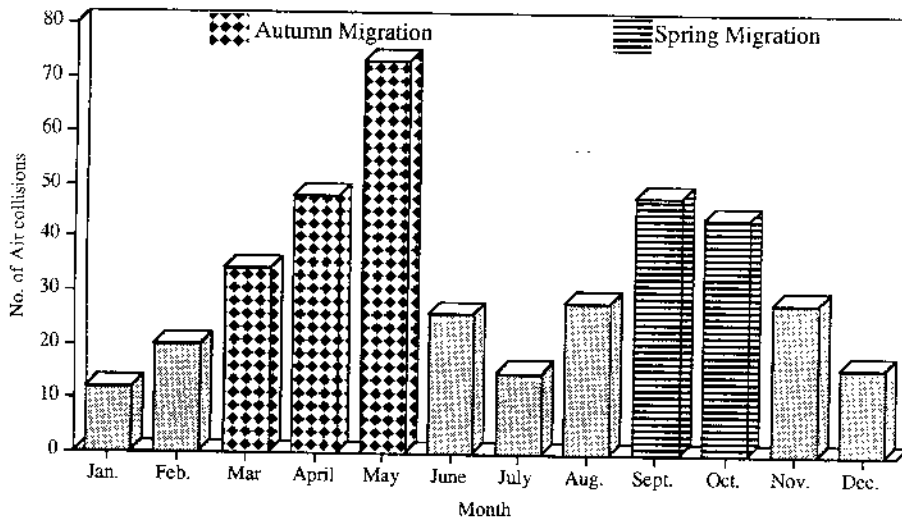


Figure 5 shows the analysis of serious damage done to fighter planes (damage levels 3-5) during 1972-1983. During this time there was an annual average of 3.18 serious birdstrikes, including the destruction of 5 fighter planes! On October 28, 1974, at the height of pelican migration, the fighter pilot Sephi Levin led a Skyhawk formation at low altitude in the Hula Valley, in northern Israel. At 12:56 a pelican collided with his plane, penetrated the aircraft's canopy and killed the pilot.

Figure 5. Total of serious collisions with fighter aircraft in the Israel Air Force, 1972-1983

Type of aircraft damage	Mirage	F-15	Phantom	Kfir	Skyhawk	Total
Level 3 (over \$100,000)	1	2	4	4	15	26
Level 4 (over \$500,000)	-	1	-	1	2	4
Level 5 (aircraft destroyed)	1	-	-	1	3	5
Total	2	3	4	6	20	35

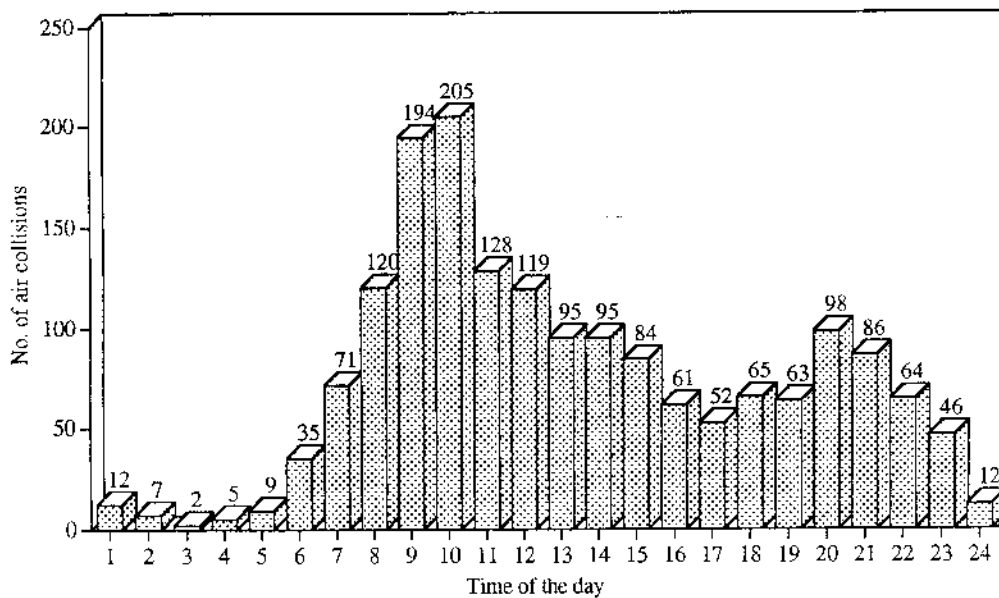
4 collisions at bases, 31 in open area (88%)

74% of the serious collisions occurred during migration

Eighty eight percent of these collisions occurred in open areas, and only 12% in bases. In addition, 74% of the serious collisions occurred during migration.

Birdstrikes during the last 23 years were analyzed according to the time of day. In Figure 6, two major peaks are seen, one between 9:00-10:00AM, and the other between 8:00-9:00PM. Since the IAF training hours are not divided equally throughout the day, it seems that the data only shows the hours that the IAF is more active, rather than any relation to the peak hours of migration.

Figure 6. Total number of bird-aircraft collisions in relation to the time of the day, 1972-1994



During 1984-1985, the IAF adopted new Technology, and the specific migration patterns of raptors, the pe...

During the study, it was found that within the migration period, throughout the year, between migration periods, as a result of a bird strike, financial savings were realized. F-16's costing \$10 million during the last 23 years, cost \$100 million dollars.

It is important to note that most of the IAF's serious damage would have been avoided simultaneously with a decrease in damage.

Figure 7. Average number of collisions before and after implementation of migration control measures.

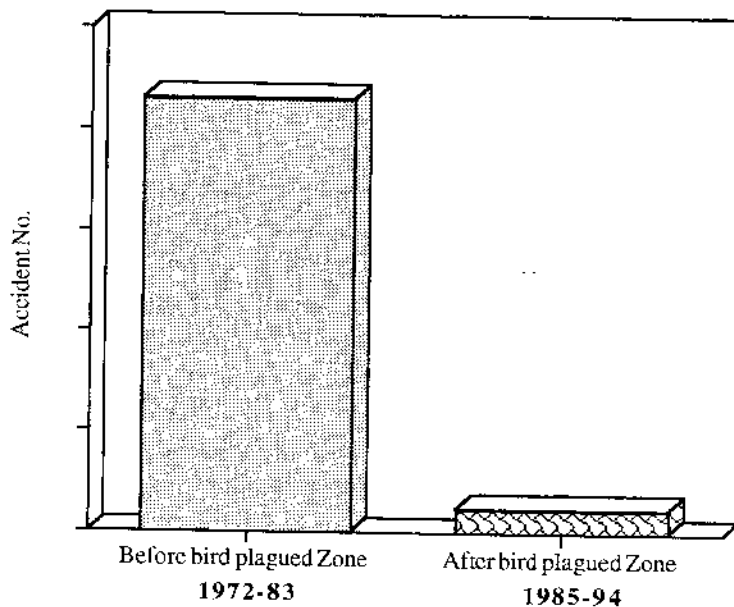
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During 1984-1989, in the joint study conducted by the SPNI, the Ministry of Science and Technology, and Tel Aviv University (Leshem 1990, 1992) the following parameters were defined: the specific migration routes of raptors, the altitude of migration, the time of arrival of migrating raptors, the peaks for each species, and how the whole system is affected by changes in climate.

During the study, in 1985, the IAF adopted the B.P.Z. (bird plagued zone) policy and stopped flying within the migratory paths at the altitudes and times of day and season defined in the study. Throughout the study errors were corrected and as a result, there was a decrease of 88% in collisions between migrating birds and fighter planes. This is the tenth year that no fighter aircraft was lost as a result of a birdstrike during migration, and no level 4 damage has occurred. The calculations of financial savings during this time, based on the fact that most of the IAF fighter planes are F-15's and F-16's costing up to 45 and 27 million dollars respectively, reaches 30 million dollars annually, and during the last decade since the beginning of the joint study the financial savings reached 300 million dollars.

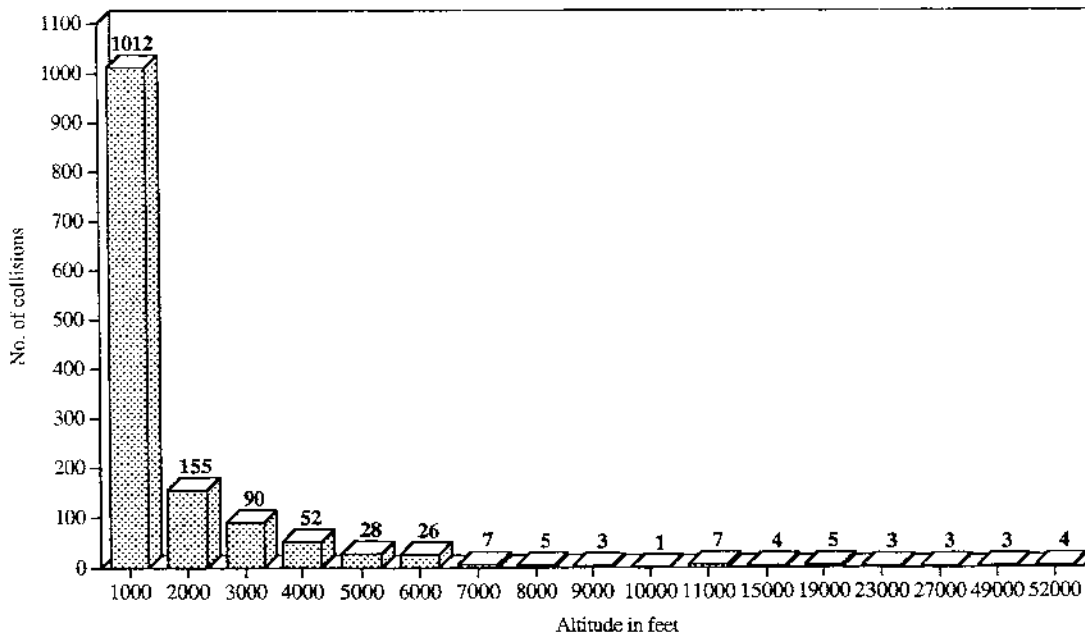
It is important to emphasize that the birdstrike data from 1972-1983 is from the period when most of the IAF training was in Sinai. There is no doubt that without the B.P.Z. the amount of damage would have increased significantly when the IAF fighter planes division increased and simultaneously had to train in limited airspace after Sinai was returned. Figure 7 shows the relative decrease in damage after the BPZ was initiated, though the exact numbers are still classified.

Figure 7. Average yearly fighter aircraft damage (level 3-5) during migration months before and after implementation of Bird Plagued Zone regulations.



Most of the IAF birdstrikes occur low altitudes between 0-4,000 feet. The data is shown in Figure 8.

Figure 8. Total number of bird-aircraft collisions in relation to altitude, 1972-1994.



In addition, for the first time, data concerning birdstrikes at high altitudes, between 15,000-52,000 feet was collected. The data collected is based on the following sources:

- Tables summarizing altitudes of birdstrikes from the IAF Flight Safety data bank.
- Interviews with air traffic officers concerning incidents at high altitudes, and observations from radars.
- Interviews with several pilots which visually, or through the aircraft's radar, spotted birds.
- Information from the feathers remains identification laboratory (J. Shamoun, pers. commun.)

In various literature (Manville 1963; Swan 1970; Stewart 1978; Elkins 1979) there are several descriptions of Anseriformes and cranes that cross the Himalayas at an altitude of 9km above sea level. A Ruppell's Griffon collided on 29.11.73, with a commercial aircraft over Abijan, Ivory Coast, at 37,000 feet (Laybourne 1974). On 9.12.67, a radar in Northern Ireland discovered a wave at 8 km above the ocean, identified by a plane as a flock of swans migrating from Iceland to Ireland at an average speed of 180 km/hr, which migrated 1,200 km in 7 hours.

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The following is several events during which the IAF discovered migrating birds at high altitudes:

- (1) On 30.4.1987, at the peak of spring migration, fighter pilot "N" , commander of an F-15 squadron, flew at 20,000 feet above sea level, near Mitzpeh Ramon in the Negev, when he saw large birds fly by him. Commander "N" identified them as raptors though the identification is not definite.
- (2) On 22.9.1988, during the peak of autumn migration, at the IAF air traffic control unit, unidentified movement was discovered at 24,000 feet ASL, south of the Dead Sea, near the Jordanian border. A fighter pilot was alerted and sent to the unidentified target, and identified a flock of approximately 200 light colored birds migrating south in a V formation. The birds were not identified.
- (3) In March 1990, during spring migration, an IAF F-16 collided with an unidentified bird above the Mediterranean Sea, along the coast, at an altitude of 28,000ft ASL!! There was no serious damage to the plane, though blood smears from a bird were found.
- (4) On 24.9.1990 during autumn migration, a Phantom pilot during training at 20,000 feet near the Jerusalem mountains, at 11:40, saw a flock of about 150 white birds "the size of a gull" 2,000 feet above him in the formation of one large and one small V. This occurred 2 years and 2 days after the event south of the Dead Sea.
- (5) On 29.1.1994, in the afternoon, the IAF air traffic controllers discovered an unidentified target which entered Israeli territory from Sinai at 15,000 feet ASL, and moving at 150 knots. F-16's were alerted to the area, and saw the target from 100 meters. From an interview with one of the pilots, it was apparent that the unidentified object was a flock of dark birds, flying in a V formation, using active flight, the pilot identified them according to their size as ducks. When the fighter aircraft was approximately 100m from the flock, they dispersed, but immediately after the plane passed, they returned to their formation. After checking with the meteorological unit of the IAF, it was discovered that at high altitudes there was a very strong air current. This current, apparently enabled the ducks to reach the incredible speed of 273 km/hr, four times their normal flight speed at low altitudes! Other flocks were seen by the control units on similar flight paths and altitudes that same night and the day after.
- (6) On 12.9.1991, at 12:00PM, and 20,000 feet, a fighter plane collided with a bird over central Israel. The remains that were collected were identified as a type of duck.
- (7) On 19.5.1986, at 3:00PM, and 20,000 feet, a Phantom was hit by a bird above Jericho in the Jordan Valley.
- (8) On 20.8. 1986, at 10:00AM, and 20,000 feet, an F-16 pilot, who is also an experienced bird watcher, identified a hawk west of the Gaza strip above the sea.

Data was collected from several radar observations, where flocks moved in the migratory paths at altitudes of 15-25,000 feet and at speeds of 80-120 knots. This new data shows that the concentration of migration at these altitudes is much higher than previously estimated. Apparently the birds able to reach these heights have the advantage of utilizing strong wind currents in order to migrate at speeds 4-5 times faster than at conventional heights.

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