Title
Birds and airports

Journal
Proceedings of the Vertebrate Pest Conference, 3(3)

ISSN
0507-6773

Author
Pearson, Erwin W.

Publication Date
1967

BIRDS AND AIRPORTS

ERWIN W. PEARSON, Bureau of Sport Fisheries and Wildlife, Wildlife Research Center, Denver, Colorado

INTRODUCTION

For all practical purposes, research in this country on the problem of bird hazards to aircraft began in 1960 with the crash of an Electra turboprop that carried 62 people to their deaths and was attributed to ingestion of starlings into the engines. In this paper I intend to review the problem and present some of the answers found by investigators in this country and, to lesser extent, abroad. The discussion will be roughly divided into two parts: 1) what causes the problem, when, and where; and 2) what has been and is being done at airfields to reduce it. Dr. Seubert of the Patuxent Wildlife Research Center described the problem in Europe at this conference 3 years ago, so I will try to bring you up to date on the problem here.

We at the Denver Wildlife Research Center have been actively engaged in few specific studies at airfields. Although we mailed a questionnaire to airport managers at 190 installations in the 22 mainland states west of the Mississippi River in 1961 and made follow-up personal visits to 25 commercial and military airfields at seasons of the year when most problems had reportedly occurred, it appeared that none would last long enough for us to undertake studies. Since then we have attempted primarily to solve crop depredation, feed lot, and roost problems with the idea that knowledge obtained from them could be adapted and applied to bird hazard problems as they arose at airfields.

THE PROBLEM

To begin with, there have been at least four airplane crashes resulting in human deaths that authorities blame on birds, plus a few others involving total losses of aircraft: 1) On October 4, 1960, the crash I mentioned previously, when 62 people were killed in an Electra turboprop, occurred at Logan Airport in Boston. It was attributed directly to three of the four engines continually ingesting starlings for several seconds during the critical power requirement period just after the loaded plane had left the ground on takeoff (Anonymous, 1962 a). 2) On November 23, 1962, a Viscount turboprop crashed 10 miles southwest of Baltimore, killing all 17 persons aboard after a whistling swan (perhaps two) hit the left horizontal stabilizer at an altitude of about 6,000 feet (Anonymous, 1962 b). 3) In March 1963, the pilot and single passenger of a private single-engine plane were killed in California when a common loon struck the tail assembly at an unknown altitude, the airframe failed, and the plane crashed (Seubert, 1965). 4) On October 31, 1964, an astronaut in a jet trainer was killed in Texas when a snow goose apparently collided with the cockpit canopy at low altitude, causing the pilot to lose control and crash (Anonymous, 1962).

These four cases are the extreme part of the problem--losses of human lives. Much less publicized, naturally, but much more common--and extremely expensive--is the cost of repairing engines, wings, windshields, nose section, radomes, tail assemblies, landing gear, etc., as well as the cost of ferrying expensive aircraft to repair bases and the loss of revenue while they are out of service. These amount to several million dollars a year to commercial airlines and the military. An idea of the extent comes from Air Force bird-plane strike reports for 1965. For that year only, all strikes were reported, regardless of the amount of damage. The total number was 839, or nearly six times the number reported the previous year. These and other records indicate that Air Force bird-plane strikes are increasing and that damages may total "perhaps $10 million a year" (Anonymous, 1966). (They also indicate that a large number of strikes are not normally reported because the damage happens to be slight.)

As an example of the kind of expenses involved, a report from an airfield in the western United States estimated that damage of $75,000 resulted when an owl was ingested into a large jet engine. The engine was severely damaged, as were three tires and wheels during the deceleration process, because the takeoff was aborted and the pilot braked to a stop near the end of the runway. The original cost of such a jet engine was over $220,000 in 1961 (Neff, et al, 1962), and is probably more now. Another report estimated $6,000 in damage to the covering and inner wing structures of a twin-engine piston aircraft that hit a flock of geese. Reports by aircraft maintenance personnel on wing damage from bird strikes have listed $500 plus 15 hours out of service for a DC-8, $1,250 and 57 hours out of service for a DC-6B, and $2,000 for a Constellation (no out-of-service time given) (Pearson and Neff, 1963).

These examples will give you some background information to refer to as you look at Tables 1-5 and Figure 1. In looking at these tables and figure, you will notice that the data are not new; more recent figures by other workers support these data so closely that I used our own figures as examples. These show strike data for the period May 1962 to mid-October 1963 as reported by pilots and maintenance personnel of commercial airlines (Pearson and Neff, 1963; Pearson, 1964). For this period, compilations were made at Denver, but all subsequent reports were diverted to Patuxent for analysis, and these most recent data are not included in this paper.

Most of the tables are self-explanatory, but data obtained from strike reports have some limitations. For example, Table 1 shows that at least nine engines, all on large, four-engine jets, had to be changed before the aircraft could fly again; yet of these nine, only one, the $75,000 estimate previously mentioned, was included in a report, and even there the time out of service was not given. Thus even though about one-third of the reports gave cost estimates, these included no more than one-ninth of the most expensive damage item--jet engine changes and repairs--and none included engine changes or repairs in the time-out-of-service category. Another item not included was the expense required to ferry damaged aircraft to their "home bases" for repair, although there were six of these occurrences during the 2 years we compiled data at Denver. Therefore, it is obvious that the data in Table 4 cannot be called a proper sample and projected to give total cost or out-of-service estimates.

Figure 1 shows that, while we did not receive strike data for a full year, most strikes occurred in the spring and fall migration periods, and especially in the fall when bird populations, flocking tendencies, and migrational movements are at their peaks. Of the 11 known strikes by waterfowl from May 1962 to early March 1963, all but one--when a mallard duck was hit on July 9 at an altitude of 21,000 feet over Nevada (Manville, 1962)--occurred during the fall migration period between the middle of September and early December.

Strike data also indicate that a large proportion of strikes (43%) occur on or near the ground (Table 2), and most of these are near airfields where controls are possible. Bird strikes above 500 feet are probably unavoidable and would be unaffected by any presently available form of control. Solving bird hazard problems to prevent ingestion or other damage at these higher altitudes will depend upon changes in aircraft configurations and engine designs, and information from my few contacts with people qualified to know indicates that satisfactory changes will be difficult, perhaps impossible to develop.

Geographical areas where most bird strikes occur are roughly indicated by the 46 strikes at coastal and 94 strikes at inland cities (Pearson, 1964). Although difficult to weight properly, Seubert's data (1963) have categorized numbers of strikes according to numbers of air carrier operations at airports where they occurred. This appears to offer the best data available, and indicates that, in general, more strikes per 10,000 aircraft operations occur at coastal cities than inland; it also pinpoints certain airfields where the greatest bird hazards seem to exist inland.

The species of birds most often involved in strikes further clarify problem areas. Our data (Table 3) identify 26 kinds of birds struck from May 1962 to mid-October 1963, and Seubert (1963, 1965) listed 49 species from April 1, 1962, to June 30, 1964, many of them identified from bird fragments sent to the National Museum in Washington. Our 1962-63 data (Table 3) show that gulls, waterfowl, and pheasants made up 58% of the 103 reports that listed the species involved. Seubert (1965) shows these three types of birds continued to lead the list in the same order during 1964.

Bird-plane strike data, for the most part, compare closely with information from questionnaires completed by airport managers in 1961 (Neff and Pearson, 1962). Of the 73 managers reporting known or potential bird hazards at some time during the year, 34 (47%) listed gulls as a problem species; 11 of these were from inland airports far from a seacoast, but within reasonable distances of rivers, lakes, or impoundments. Waterfowl were a problem at 18 locations (25%), starlings at 11, and "blackbirds" at 9 others. Four of the starling and blackbird problems were reportedly caused by the birds' activities at nearby roosts and four by daytime feeding.

In December 1966, I mailed questionnaires to 215 managers of airports in the western United States, including the 190 canvassed in 1961 plus 25 more that we had missed or that could recently have begun operations by turboprop or jet aircraft. The questionnaires returned so far may indicate that bird hazards are increasing. In 1961, questionnaires returned in the first 54 days after mailing showed known or potential hazards at 62 (53%) of the 118 airfields reporting; in 1966, returns from 119 airfields in the first 54 days showed known or potential hazards at 73 (61%). Gulls were again at the top of the problem list being reported at 43, or 59%, of the 73 airports; next came starlings at 28 (38%), waterfowl at 15 (21%), and blackbirds at 13 (18%). These are similar to the 1961 data, except that the positions of waterfowl and starlings are reversed. In reports by pilots and maintenance personnel of actual bird-plane strikes, pheasants were the third most numerous species hit, but they were listed in fifth place by airport managers in the 1966 questionnaires.

To summarize, from all sources of data presented here, it appears that gulls, waterfowl, pheasants, starlings, blackbirds, and pigeons, in that order, are the principal problem species.

PRESENT CONTROL METHODS

Data presented so far have indicated where and when bird problems occur and the principal species involved. Now let us look at methods used to reduce bird problems in airport environments.

The 1966 questionnaires were designed primarily to determine what has been done at western airports. The results are encouraging, and are summarized in Table 5. Although bird-plane strikes appear to be increasing, airport managers are increasingly aware of the problems involved, and many are doing something about it.

Habitat manipulation is a familiar term to the wildlifer, who manages habitat to increase the game yield of his lands, but to the airport manager it should have the opposite meaning. The airport environment must be changed, not to please people, but to displease birds--enough so that they will go elsewhere to nest and raise their young, feed and loaf, or stop for awhile on their migrations. Trees, shrubs, brush, and weeds must be removed because they provide cover for roosting, nesting, preening, and protection from weather and natural enemies, and because many produce seeds or berries or harbor insects that are foods for birds. Grass should be kept mowed to a height of 4 or 5 inches--any longer and it will provide cover for ground-nesting species of birds and cover for mice and rabbits, which in turn will attract hawks and owls; any shorter and it will provide excellent areas for such birds as gulls, starlings, robins, blackbirds, and others to search for seeds, worms, and insects. Ponds and ditches should be drained or otherwise eliminated, and these and other low spots should be leveled so that they will not act as catch basins for water during rainy periods. In short, airports should be managed to become biological deserts so that they will not provide a single requirement for the daily, seasonal, or annual activities of any species of bird.

This is a general description of the ideal airport environment if the goal is to displease birds, but achieving it takes time and money. Therefore, other forms of control must be used, at least temporarily, or in many areas, permanently. Many control methods are being used at airports, but not to the extent they could be. Broadcast distress calls have proved useful, and combining them with a shotgun and two-shot shellcrackers, or occasionally live ammunition, is acknowledge in this country (Seubert, 1963), Canada (Bird, 1965), and abroad (Seubert, 1964) to be one of the best control methods available. In general, the use of two or more stimuli has produced better results than one alone. Carbide exploders also have their place as a control measure, particularly where waterfowl are a problem. Fall hunting seasons are "open seasons" on migrating ducks and geese at airports, where already jumpy birds are usually easily dispersed by exploders set in open fields or on shores of ponds or ditches and ved occasionally. Revolving or moving lights also help in waterfowl problem areas.

In Canada, the possibility of using dogs to keep birds, particularly gulls, on the move, was investigated, then dropped because of numerous difficulties (Bird, 1965). Peregrine falcons were tried over a 2-year period at two airports having gull problems in Canada. However, falcons are strictly daytime operators, and because of nighttime problems as well as periods of limited visibility, high cost, difficulties of training, and susceptibility to disease and loss, plus other considerations, this project was dropped, even though it was successful in many respects (Bird, 1965).

Other aspects of the problem being investigated by the Canadians include: the possibility of using microwaves projected ahead of the aircraft that will temporarily disorient birds and cause them to drop from the flight path; decompression chamber tests to determine how high birds can fly; and development of test "birds" of the proper size, weight, and composition for impact tests to produce aircraft designs best suited to resist bird damage (Bird, 1965).

In this country considerable research is underway to find practical bird reproduction inhibitors, biological controls, and chemical agents that can be adapted to control specific bird species. Traps are already in use in Canada (Bird, 1965) and at two western airports in this country (Table 5), to reduce local bird populations. In both countries, studies have been in progress for about 3 years to detect and forecast movements of birds through the widespread use of radar (Seubert, 1966; Bird, 1965). Bird states, "It is hoped that eventually, through international cooperation, bird reports will be passed north and south from one airport to another to indicate the movements of such high hazard birds as geese and swans."

It must be obvious by this time that a great deal of information has been gathered by many people concerning the bird hazard problem, and that controls are available and studies are searching for others. It seems that the next major steps to be taken are to coordinate efforts and to develop methods to implement findings in specific airport problem areas.

The most ambitious, and by far the most practical, solution to the problem of starting a permanent program to reduce hazards was evolved by the Canadians. Alarms over the bird problem had been sounded by several groups for about 2 years when the Department of Transport asked the National Research Council to look into the matter in the autumn of 1962. A National Research Council Associate Committee on Bird Hazards to Aircraft was formed with M. S. Kuhring as Chairman. In the words of Mr. Kuhring, "The members of the Associate Committee were chosen so that the various agencies involved with birds would be represented and the individuals were selected on the basis of what they could contribute to the work." This very effective group includes four representatives from the Canadian Wildlife Service, three from the National Research Council, and one each from the Royal Canadian Air Force, Department of Transport, Air Canada (a major airline), Canadian Pacific Air Lines Limited, Rolls-Royce of Canada Limited (representing the aircraft industry), and the Canadian Aeronautics and Space Institute--13 members in all (Kuhring, 1965). Since the Canadian Department of Transport operates most of the airports, their member on the committee makes possible direct and effective communications to the field (Bird, 1965).

An international symposium on the bird-airport problem was held in Nice, France, in November 1963 and attended by about 70 persons from 10 countries. One of the most important recommendations made was that national committees be formed by all countries so that cooperation could be arranged on an international basis. Shortly after the symposium, national committees were formed in Germany and New Zealand. The Netherlands had already set up an informal but close-working group including a biologist and representatives from the civil airline and the military (Kuhring, 1965). In this country an interagency committee held its first meeting in September 1966, and included representatives from the Departments of Interior and Health, Education, and Welfare, as well as the Federal Aviation Agency, Civil Aeronautics Board, National Aeronautics and Space Administration, Air Force, Army, and Navy (Seubert, personal communication, January 1967). The FAA was the agency primarily responsible for formation of this committee and is acting as coordinator for the group. Members are presently forming research priorities for submission to the FAA in the areas of ecological research, airport bird management, and radar surveillance of migratory birds. The FAA has indicated that the programs to be initiated will be given high priority for action (Seubert, personal communication, February 1967).

To repeat in summary, it appears that the problem and some of the solutions have been sufficiently documented for work to begin at any problem airfield in this country. Studies have been underway for several years at some of our eastern airfields, but we should now attempt to alleviate problems on a coordinated, nation-wide basis.

LITERATURE CITED

ANONYMOUS 1962 a. Tacoma News Tribune, July 31. (Associated Press release from Washington, D.C.)
ANONYMOUS 1962 b. A soft cannonball. Newsweek, December 10.
ANONYMOUS 1964. Goose proved jet crash cause. Denver Post, November 8.
ANONYMOUS 1966. Bird/Aircraft Collisions. Air Force Office of Scientific Research

Office of Aerospace Research, USAF, Arlington, Va. December. 15 p.
BIRD, W. H. 1965. Bird strike hazards can be reduced, paper prepared for presentation at Fifth Annual National Conference on Environmental Effects on Aircraft and Propulsion Systems, Princeton, N. J., September 20-22, 1965 (unnumbered report, Air Canada, Montreal. 19 p. mimeo). Also in A summary of the Flight Safety Foundation 18th International Air Safety Seminar, Williamsburg, Va., 7-10 November 1965, p. 99-115.
KUHRING, M. S. 1965. The bird hazard problem--general and specific observations. Canadian National Research Council Associate Committee on Bird Hazards to Aircraft, Rept. No. CM4-S.17-2, October. 10 p. (mimeo). Also in A summary of the Flight Safety Foundation 18th International Air Safety Seminar, Williamsburg, Va., 7-10 November 1965, p. 25-37.
MANVILLE, R. H. 1962. Altitude record for Mallard. Wilson Bull. 75(1):92.
NEFF, J. A. and E. W. PEARSON 1962. Annual Progress Report of Work Unit: Location and extent of bird hazards to aircraft in the Western United States, Denver Wildlife Research Center. March 22. 6 p. (Unpublished, mimeo).
____, ____, T. J. DeCINO, R. I. STARR, J. W. DeGRAZIO and J. L. GUARINO 1962. Annual Progress Report of Work Unit: Appraisal of known and experimental biological, physical, and chemical techniques for minimizing hazards to jet aircraft at selected problem airfields in the Western United States, Denver Wildlife Research Center, Calendar Year 1961. March 26. 7 p. (Unpublished, mimeo).
PEARSON, E. W. and J. A. NEFF 1963. Annual Progress Report of Work Unit: Location and extent of bird hazards to aircraft in the Western United States, January 1962 - March 31, 1963, Denver Wildlife Research Center. May 7. 7 p. (Unpublished, mimeo).
______ 1964. Annual Progress Report of Work Unit: Location and extent of bird hazards to aircraft in the Western United States, April 1, 1963 - March 31, 1964, Denver Wildlife Research Center. July 24. 6 p. (Unpublished, mimeo).
SEUBERT, J. L. 1963. Progress Report, Biological studies of the problem of bird hazard to aircraft, April 1, 1962 - June 30, 1963. Prepared for the Federal Aviation Agency under Project Agreement FAA/BRD A-90. 41 p. plus 21 figures.
__________ 1965. Final Report, Biological studies of the problem of bird hazard to aircraft, July 1, 1963 - June 30, 1964. Prepared for the Federal Aviation Agency under Project Agreement FAA/BRD A-90. June. 22 p. plus 3 figures.
__________ Interim Report, Biological control of birds in airport environments. Prepared for the Federal Aviation Agency, Project Agreement FA6SWA1-77, Project No. 430-011-01E. January. 41 p.
__________ 1964. Highlights of bird control research in England, France, Holland, and Germany. In: Proceedings of Second Vertebrate Pest Control Conference, March 4 and 5. p. 150-159.

TABLE 1. BIRD-PLANE STRIKE DATA COMPILED AT DENVER WRC, MAY 1962 TO MID-OCTOBER 1963

Plane Type	No. of Strikes	Ingestions	Engine Changes
Conventional	134	--	--
Turbojets	129	28	9
Turboprops	92	8	--
Helicopter	1	--	--
Unknown	11	--	--
Totals	367	36	9

TABLE 2. ALTITUDES OF BIRD STRIKES

Altitude (feet)	Number	Per cent
0-500	52	43.3
501-1,000	9	7.5
Above 1,000	59	49.2
Total	120	100.0

TABLE 3. SPECIES OF BIRDS INVOLVED IN STRIKES, 1962-1963

Species	Number	Per cent known species
Gull	36	35.0
Ducks and geese	14	13.6
Pheasant	10	9.7
Pigeon	6	5.8
Starling	5	4.9
Sparrow	5	4.9
Hawk	4	3.9
Dove	2	1.9
Robin	2	1.9
Ricebird (Hawaii)	2	1.9
"Buzzard"	2	1.9
1 each of 15 known species	15	14.6
Subtotal	103	100.0
Unknown or not reported	264	
Total strikes	367	

TABLE 4. ESTIMATES OF COST AND TIME OUT OF SERVICE FROM 367 BIRD-PLANE STRIKES, AS REPORTED BY AIRLINES PERSONNEL, 1962-1963

Number indicating tangible damage	146
Number listing cost estimates	51
Total estimated damage	$93,201
Number listing time out of service	34
Total hours estimated out of service	354-3/4

TABLE 5. BIRD CONTROLS USED AT AIRPORTS IN THE WESTERN UNITED STATES

Control method	No. airports
A. Habitat manipulations to reduce attraction to birds	
1. Filled or drained ponds (55.5 acres)	9
2. Cut trees, bushes, hedgerows, weeds (6,153 acres)	36
3. Cut grass to 3-5 inches (25,001 acres)	51
4. Dumps: moved	11
covered immediately	10
burned immediately	3
still problems (on adjacent property)	3
5. Other: cattails cut and roost dispersed	1
pheasants hunted	1
soil "sterilized" (to reduce insects)	1
B. Controls used	
1. Tower radio warning of birds in area	32
"Air advisory" (written)	1
2. Patrols: year around	8
spring and/or fall migrations	12
during bad weather, as needed (mostly for gulls)	7
3. Shotguns	24
4. Shellcrackers	10
5. Exploding devices (exploders and firecrackers)	5
6. Distress calls	5
7. Sirens or horns	3
8. Trapping (starlings and pigeons)	2
9. "Poisons" or chemical treatments	8

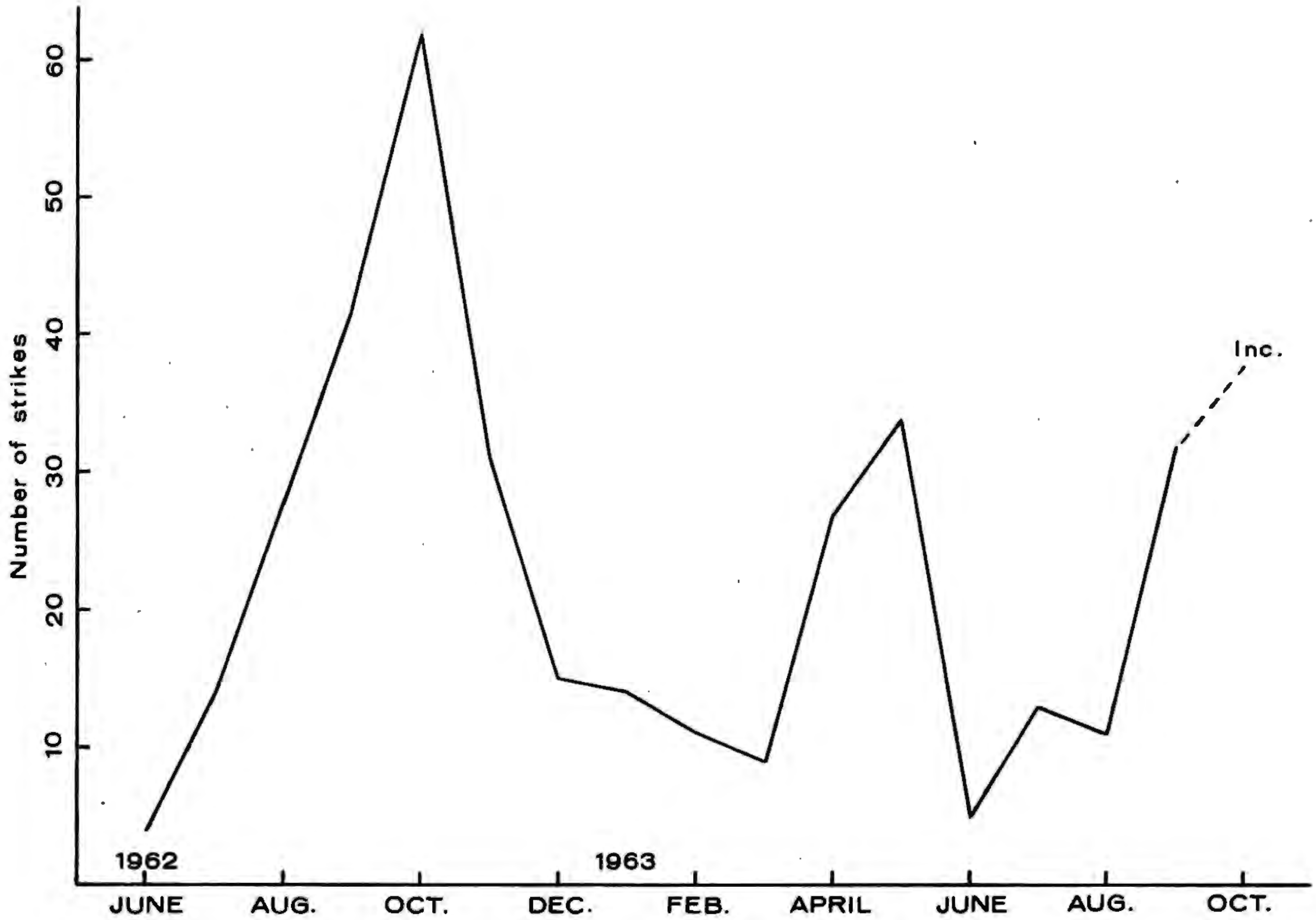

FIG. 1. Monthly bird-plane strikes in the United States, June 1962 to September 1963