SOME EFFECTS OF WEATHER ON PURPLE MARTIN ACTIVITY

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THE Purple Martin (*Progne subis*) feeds almost exclusively on aerial invertebrates (Allen and Nice 1952) that they gather while flying from a few inches to several hundred feet above ground (Johnston 1967). In view of the known influence of weather upon the numbers of insects present in the atmosphere (cf. Hardy and Milne 1938, Glick 1939, Glick and Noble 1961, Williams 1961), it is not surprising that prolonged severe weather can affect a martin population drastically. Forbush (1904) attributed a severe reduction of martins from New England to several days of rain following a drought during the breeding season. Other authors have reported that many days of cold and rain resulted in losses of martins, presumably from starvation (Allen and Nice 1952). This study was designed to determine the influence of weather conditions on the activity of Purple Martins breeding near Edmonton, Alberta.

METHODS

Because Purple Martins pass in and out of nest boxes frequently, I decided to use this behavior as an indicator of the effect of weather conditions on total activity. Enterings and departures from the nest box (henceforth referred to as ED activity) were recorded by a photoelectric device. Light sources were mounted in a small box attached to the nest entrance. A bird passing through the light beam made an impulse on the recorder. To test the accuracy of the equipment I watched ED activity during three different observation periods of 3 h each spaced 1 week apart during the most active period—the nestling stage. Of 1259 ED's I counted, only 12 (1%) were not recorded mechanically, and I assume this low percentage of mechanical failure was typical of the entire period. ED activity was measured mechanically from 28 May through 17 August 1965 in a colony of eight nesting pairs in east Edmonton, Alberta. To be certain the lengths of time the experimental birds spent in each of the breeding stages were normal, I used 13 occupied but unequipped martin nest boxes located from 30 feet to 7.5 miles from the experimental boxes as controls. In 1966 activity was measured from 23 May through 30 August at 18 nests near park headquarters at Elk Island National Park, 25 miles east of Edmonton; 14 unequipped boxes at the park and 4 more 22 miles southwest were controls the second season.

Because of interference on the light sensitive resistors by afternoon sunlight in west-facing nest boxes, only that ED activity recorded from the beginning of morning civil twilight until 1230 was usable. Previous observations showed that birds tended to be more active around the nest boxes in the morning, and to be away and presumably feeding in the afternoon. Activity data recorded all day at boxes not affected by direct sunlight indicated that the omission of the afternoon data was not significant. The data were summarized by obtaining the mean morning activity for each nest, expressed as average numbers of entrances and departures per hour over the entire morning.

Most meteorological data were obtained in 1965 from the Department of Transport Weather Station 3.75 miles northwest of the experimental site. In 1966 temperature, relative humidity, barometric pressure, and hours of rainfall were recorded 30 inches above ground at the experimental site with standard meteorological instruments. Data on wind velocity and sky opacity were obtained from the Edmonton International Airport Weather Station, 41 miles southwest of the site. Mean morning weather values were calculated from civil twilight to 1200 for each meteorological factor except rainfall. Rainfall was recorded as the total number of hours in which precipitation occurred during this time period.

Sky opacity values recorded at meteorological stations were used as an approximation of the available light. Sky opacity is the amount of the celestial dome covered by cloud through which blue sky is not visible. A high numerical value for sky opacity means an overcast sky, whereas a low value indicates a clear day. Cloud cover is often mentioned in animal studies but, usually the amount of actual sunlight penetrating through clouds, particularly cirrus clouds is rarely considered. I recorded sky opacity values periodically at Elk Island National Park in 1966 and compared them with values reported from the meteorological station at the international airport west of the Park. Conditions were almost identical between the two locations except when a weather front was passing. Then the cloud cover changed about an hour earlier at the airport because weather systems generally move from west to east here. Similar comparisons and results were obtained for wind velocity.

The influence of individual meteorological factors on the ED activity was analyzed for each of seven arbitrarily-selected stages in the breeding cycle: arrival, nest cavity defense, and pair bond formation; nest building; nest completion; egg-laying; incubation; nestling; and postbreeding defense of nest cavity by subadult males. A multiple regression computer program was used in the analysis. Correlations for this program together with other calculations were considered significant at the 5% level ($P < 0.05$) and highly significant at the 1% level ($P < 0.01$). The impact of several weather factors acting together upon the ED activity was studied using a graphical form designed by Hardy and Milne (1938) but expanded to include up to four weather factors—temperature, wind velocity, sky opacity, and relative humidity.

Breeding biology data were obtained from the control and experimental nests for each of the seven stages (Finlay 1971a). Several stages were compared to determine if the continuously burning low light intensity source attached to the nest boxes had any influence on breeding. No significant difference was noted between control and experimental birds in the number of days spent building and completing their nests, in commencement of egg-laying, or the age when nestlings first began begging for food at the nest entrance. I concluded that the light beam apparently had no effect on the birds during these stages and that, similarly, other stages were not affected.

ED activity recorded from two nests during the laying, incubation, and nestling stages was compared to determine whether individual Purple Martins responded similarly to the same meteorological conditions. Both nests contained the same number of eggs and/or nestlings and weather conditions were identical. The Wilcoxon two-sample test for the unpaired case (Alder and Roessler 1964) showed no significant difference in ED activity between the two nests. Therefore I assumed that ED activity during other stages was similarly comparable between them.

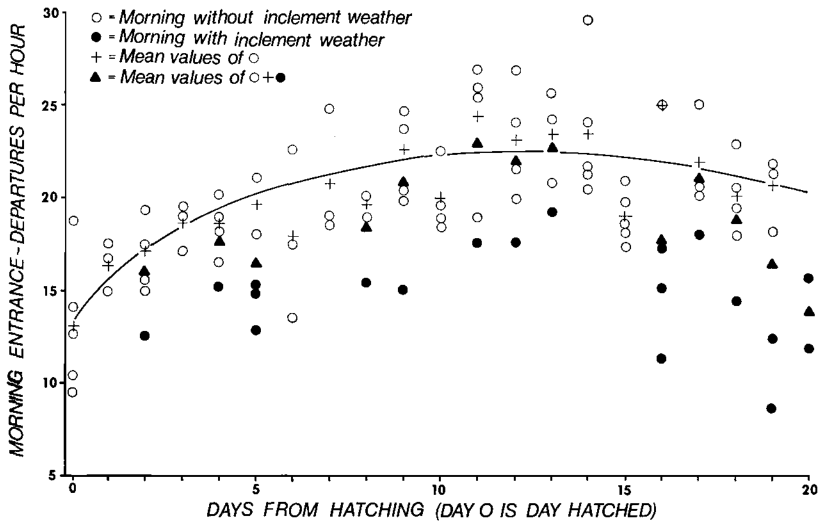

Fig. 1. Mean morning ED activity curve for Purple Martins with three young. Curve was drawn by inspection ignoring ED activity on cold, rainy, or windy days.

Average ED activity per hour was used for analysis in all but the nestling stage. For this stage, recorded activity was used for five nests with three young in each. Young in each of these nests were assumed to be the age of the oldest sibling in that nest. A standard or mean feeding curve was drawn by eye using data from these five experimental nests (Fig. 1). The numerical difference between the value on this curve and the actual recorded ED activity per hour for each of these five nests each morning was used to compare with meteorological data (i.e. departure values from that as postulated for an ideal weather situation as shown on the curve were used rather than actual ED activity).

ED activity data obtained during the day prior to the onset of laying and during the last day of the laying stage were not used. In some birds, the egg appears in the oviduct on the day before it is laid (Welty 1962: 138) and a change in activity patterns may be associated with this.

The ED activity data show that a period of rainfall lasting 3 or more hours substantially reduced the mean morning ED activity. Therefore I omitted activity measured on mornings with 3 or more hours of rainfall when comparing the influence of temperature, sky opacity, relative humidity, wind velocity, and barometric pressure on ED activity.

Results and Discussion

Rainfall

When it rained martins remained on trees and wires near the colony. ED activity during the nest building, nest completion, incubation, and nestling stages was reduced by one-half or more during rain (Table 1).

TABLE 1

Comparison of Total Mean ED Activity with ED Activity during Rainfall in Each Stage of the Martin Breeding Cycle

Breeding cycle stage	Mean ED activity	During rainfall	Sample size during rainfall
Arrival, nest cavity defense, pair bond formation	13.6	11.1 ± 1.6	29
Nest building	19.5	9.7 ± 1.4	40
Nest completion	14.9	7.8 ± 1.5	7
Laying	10.9	14.2 ± 0.9	2
Incubation	9.3	4.6 ± 1.0	10
Nestling	—[1]	—[1]	10
Postbreeding nest cavity defense	11.2	7.8 ± 1.9	12

[1] During rainfall, average ED activity in the nestling stage decreased 6.8 ED's from the expected values obtained from the standard feeding curve on 10 diffrent occasions measured.

Rainfall also reduced ED activity somewhat during the arrival and post-breeding stages. The ED activity in the laying stage seemed to increase during rain (Table 1), but insufficient data—from only one pair on two separate rainy days—precludes a more definite conclusion.

Purple Martins return to nest boxes for shelter during prolonged rainy periods, even after all young have fledged. On 11 August 1966 rain fell for 8 h during the day. That evening color-banded martins that had not been seen for 3 days reappeared, entered the nest cavities and remained there for the night. The rain had stopped by the following morning, and no martins were seen at the nest boxes again that season.

As aerial insect abundance decreases during rainfall (McClure 1938, Lewis 1950), I concluded that during rainy periods Purple Martins would spend more time either away from the nest searching for food, or sitting inside the nest boxes waiting for clear weather. In either case a decrease in ED activity would result. Rainfall often coincides with a drop in temperature. Younger nestlings that have not yet attained homoiothermy may then have a reduced need for food and/or a greater need for brooding by adults.

Widman (Allen and Nice 1952) noted that the rate at which 16 pairs of martins fed nestlings dropped from an hourly average of 14.9 per pair in clear weather to between 7.4 and 8.2 per pair during light rain. Trips increased to a mean of 28.7 per pair during the hour after the rain ceased. Reduction of avian activity during rainy periods was also reported for other aerial insect feeders by several authors (Moreau 1939, Purchon 1948, Koskimies 1950, Lack and Lack 1951).

TABLE 2

INFLUENCE OF TEMPERATURE UPON ED ACTIVITY

Temperature °F	Arrival, pair bond stage: Mean ED activity	Arrival, pair bond stage: Sample size	Postbreeding stage: Mean ED activity	Postbreeding stage: Sample size
35–39	7.8	7		
40–45	14.4	26		
46–50	17.1	25	12.5	11
51–55	14.1	37	14.7	8
56–60	11.4	19	13.8	26
61–65	11.8	8	9.3	27
66–70	16.4	9	8.3	17
71–75			4.8	3
Mean throughout stage	13.6		11.2	

TEMPERATURE

The influence of air temperature near the ground upon the abundance of aerial arthropods, which form the major food of Purple Martins (Spice 1972), is well documented in the literature (e.g. Hardy and Milne 1938, Glick 1957). A comparison of ED activity and mean temperature during the arrival and pair bond formation stages showed no significant correlation (sample size 22), but on the one day with a very low temperature of 37°F the mean ED activity was 7.8, well below the overall mean of 13.8 for this stage (Table 2).

Significant correlations were demonstrated between the mean temperature and ED activity during the nest completion and egg-laying stages (Table 3). These correlations indicate that when insects are abundant during warm weather, martins were able to gather sufficient food rapidly, allowing more time for other activities such as defending the nest. During cooler weather, birds spent more time gathering food, resulting in decreased ED activity.

No correlation existed between mean temperature and activity in the nestling stage (N = 14), but ED activity was below the expected value on the 4 days when the temperature fell below 55°F. On 21 July 1966, when the mean temperature was 50°F, ED activity was 9.6 points below the calculated mean for activity of adults with nestlings. A correlation between ED activity and temperature could be demonstrated if additional activity data were collected at these lower temperatures.

Data for the postbreeding stage activity showed a significant negative correlation with temperature (Table 3). Direct observations of the birds during this period confirmed these results. Table 2 illustrates the reduction of ED activity in the postbreeding stage as the mean tempera-

TABLE 3

CORRELATION COEFFICIENTS OF ED ACTIVITIES WITH VARIOUS FACTORS

Stage of breeding cycle	Factor	Sample size	Correlation coefficient	Confidence limtis	
				95%	99%
Nest completion	Temperature	16	0.71[1]	±0.54	±0.71
Egg-laying	Temperature	19	0.57[1]	±0.49	±0.64
Postbreeding	Temperature	20	—0.71[2]	±0.48	±0.63
Incubation	Sky opacity	39	—0.52[2]	±0.33	±0.43
Nestling	Sky opacity	19	—0.48[1]	±0.49	±0.64
Nest completion	Wind velocity	12	—0.59[1]	±0.65	±0.88
Nestling	Wind velocity	12	—0.63[1]	±0.65	±0.88
Nestling	Relative humidity	12	—0.60[1]	±0.65	±0.88
Egg-laying	Falling barometric pressure	7	—0.87[2]	±0.98	—[3]
Nestling	Rising barometric pressure	5	—0.99[2]	—[3]	—[3]

[1] Significant at 5% level.
[2] Significant at 1% level.
[3] Sample size too small for calculation.

ture rose above 60°F, and particularly above 70°F. When food is abundant during the nestling stage, adults easily meet the broods food requirements. When food is scarce, the frequency of trips to and from the nest decrease as adults remain away seeking food.

Martins appeared to defend the nest cavity during the postbreeding stage more often on cooler days than on warm days. I suggest that these birds are then hyperphagic in association with physiological preparations for migration and they feed actively during warm weather because numerous insects are flying; when the temperatures are lower and few flying insects are available, the birds spend more time at nest boxes and show territorial behavior in response to fall recrudescence of the gonads (Finlay 1971b).

Several authors have reported reduced activity by birds on cold days. Jacobs (1903) stated several martins will crowd into one nest during cold weather, presumably to conserve heat. Koskimies (1950) found that temperature controlled the time of departure of Common Swifts (*Apus apus*) from their nest in the morning. Similarly, cold days inhibited Tree Swallows (*Iridoprocne bicolor*) from building nests (Paynter 1954).

Because temperature apparently has some influence on ED activity, I tested for a correlation between mean monthly temperatures and different stages in the breeding cycle at the northern limits of the breeding range. Table 4 illustrates the temperature means for the Edmonton area. The May temperatures are below the 55°F threshold value at which the aerial abundance of insects is significantly decreased (Glick 1939) and near the lower end of a zone of transition between 50° and 58°F, below

TABLE 4

MEAN TEMPERATURES FROM 1881–1965 AT EDMONTON AND FROM 1956–66 IN THE RURAL SURROUNDINGS FOR MAY TO AUGUST INCLUSIVE[1]

Month	Temperature (°F)	
	Edmonton	Rural
May	52.1	50.9
June	57.8	56.4
July	63.1	61.6
August	60	58.6

[1] Data from federal meteorological records.

which insect activity decreased (Wellington 1945). When martins arrive in early to mid-May, temperatures will allow some insects to be active and hence provide them food. In June temperatures are above the 55°F threshold and within the upper limits of the zone of transition. Enough food is probably then available to allow martins to participate in nest building, egg-laying, and incubation. Later, during July, the mean temperatures are at high enough levels to assure that aerial insects will be plentiful. Martins in the Edmonton area hatch in July (Finlay 1971a) and adults presumably encounter the greatest number of aerial insects at this time. Therefore insect abundance probably does not limit this bird at the northern edge of its breeding range during June or July.

SKY OPACITY

Insects are stimulated to greater activity as light intensity increases up to a certain level (Barr et al. 1960, Minar 1962). Because rain and/or low temperatures also occurred on very dull days, correlations of ED activity with sky opacity are probably coincidental. Sky opacity was found significantly correlated with ED activity only during the incubation ($r = -0.52$) and nestling ($r = -0.48$) stages (Table 3). During the nestling stage, ED activity increased on clear or partly cloudy days that coincided with warm summer temperatures. On these days more insects are flying, the birds can feed more efficiently and return to the nest box relatively quickly, and more activity in and out of the nest boxes occurs. On dull days, which are usually cooler, less food is available and ED activity is lower. Also females may spend more time incubating eggs or brooding young, thus further reducing ED activity.

The automatically recorded ED data together with my direct observations confirmed that martins left the nest in the morning during the period of civil twilight. On clear days they departed earlier than they did on dull days. This agrees with reports of other workers who found the start of morning bird activity positively related to light intensity (e.g. Scheer 1952, Leopold and Eyon 1961, Davis 1963, Schoennagel 1963).

WIND VELOCITY

Wind velocities greatly influence aerial insect abundance. The greatest number of insects appear to be aloft at wind velocities between 5 and 6 mph (Glick 1939, Freeman 1945). Aerial insect numbers are reduced when wind velocity exceeds 6 mph, and particularly above 10 mph (Lewis 1950, Glick 1957, Williams 1961).

Significant negative correlations were shown between wind velocity and ED activity in the nestling ($r = -0.63$) and nest completion ($r = -0.60$) stages (Table 3). I plotted wind velocity data against ED activity in the nestling stage and noted that wind velocities below 6 mph do not appear to influence ED activity directly then, but ED activity rapidly declined as wind velocities increased to 10 mph and the one day with a 16 mph wind had a substantially reduced ED activity. I saw no martins this day and presumed they were either resting or foraging.

ED activity during the incubation stage was not significantly influenced by wind, except that it decreased noticeably on the few days when wind velocities exceeded 13 mph, which suggests a possible negative correlation between ED activity and high wind velocities.

The decrease in ED activity as wind velocities increased indicates that the birds were having difficulty obtaining food. During the nest completion stage, the amount of time available for nest defense would be reduced when food was hard to get, in turn reducing ED activity. Lack and Lack (1951) reported similar decreases in activity at the nest with high wind velocity.

RELATIVE HUMIDITY

In the present study the only significant correlation of ED activity with relative humidity ($r = -0.60$) occurred in the nestling stage (Table 3). Mean relative humidity during this stage ranged from 55% to 73%. My data suggest that incubation was the only other stage with any possible direct relationship between activity and relative humidity. ED activity in this stage tended to decrease above 65% relative humidity, but no relationship was apparent below this level.

Lewis (1950) summarized the limited literature on the influence of humidity upon the activity of aerial insects. Glick (1939, 1955) found no relationship between the number of insects in the upper air and relative humidity, whereas Hardy and Milne (1938) reported aerial insect numbers decreased as the relative humidity rose from 37% to 73%. Freeman (1945) found a similar reduction in insect numbers between 65% and 73%. A few workers have noted a slight positive or negative correlation between humidity and bird activity (Elliot 1932, Prince et al. 1965, Verner 1965), but in general ornithological literature makes little mention of relative humidity. The reduction in martin activity with increased humidity could be caused by a reduced insect supply. The mornings with high relative humidity usually coincided with cool temperatures, overcast sky, and some rain, and consequently the influence of relative humidity upon martins may be coincidental rather than casual, or else a second order effect.

Barometric Pressure

No significant correlation between barometric pressure *per se* and ED activity was found during any of the stages in the breeding cycle, but highly significant correlation coefficients between barometric pressure change and ED activity were found in the egg-laying and nestling stages (Table 3). Correlation between falling pressure and ED activity during the egg-laying stage may be explained by the existence of similar weather conditions on the 7 days when pressure was falling. Otherwise no correlation should be expected during this stage. A negative correlation between rising barometric pressure and ED activity during the nestling stage is explained by the fact that a rising pressure at Edmonton is generally accompanied by strong winds which, noted earlier, reduced insect aerial numbers.

Entomologists generally agree that a change in barometric pressure affects insect activity, and falling pressure particularly stimulates greater flight activity. Some authors noted a relationship between barometric pressure *per se* and insect activity (Lewis 1950, Edwards 1961), whereas others reported no such relationship (Hardy and Milne 1938).

Interaction of Weather Factors

Because meteorological factors do not act independently of each other, I considered it desirable to examine the influence of combinations of these factors, temperature, wind velocity, sky opacity, and relative humidity. When analyzed in combination with each of the other factors, barometric pressure *per se* appeared to have little or no influence upon ED activity in the nestling stage, and hence other stages were not examined. The influence of barometric pressure change was not studied in combination with other parameters because of insufficient data. Hence barometric pressure was not considered further in the multiple analysis.

Analyses of pairs of factors indicated that sky opacity had the greatest influence on ED activity and relative humidity the least. Analyses of various combinations of paired meteorological factors showed greatest influence during nest completion and postbreeding stages and least effect during arrival, laying, and incubation stages. At all stages temperature and sky opacity combined showed the greatest impact on activity.

An analysis of the three most influential factors combined—temperature, sky opacity, and wind velocity—showed that ED activity was influenced more by these factors during the nest completion stage than it was during the other stages. Influence on the other stages by these three factors in combination was about equal.

In summary these analyses indicated that days with low temperature, high sky opacity, wind velocity above 6.5 mph, and high relative humidity resulted in the least ED activity. The greatest ED activity occurred when there was low sky opacity, wind velocity below 6.5 mph, temperatures above 59°F, and relative humidity below 65%.

Meteorological factors in combination did not appear to influence ED activity substantially in the arrival, nest defense, and pair bond formation stage. The drive to locate, defend, and retain a nest cavity appeared to override the influence of weather (barring extremes). Each of four male martins collected during this stage had a thick layer of fat that could be used as a reserve energy supply. Hence they would need to spend less time feeding while they searched for, and later defended, a cavity.

Meteorological conditions in combination had their greatest influence on ED activity during the nest completion stage, a transition stage between nest building and egg-laying. Apparently the drive to carry nesting material has been satisfied, but as yet the cavity contains no eggs or young. During clear, warm, calm weather, sufficient food may be gathered rapidly, leaving more time for nest defense, courtship, and copulation activity, with a resultant increase in ED activity. During dull, cool, windy weather martins spend relatively more time hawking insects, and less defending the nest site, thus reducing ED activity.

ED activity during the incubation stage did not appear to be significantly influenced by combined weather factors. I assumed this was because of the female's establishment of a regular pattern of incubation sessions and recesses. This pattern changed only during extremely inclement weather, which forced the birds into a prolonged search for food. During 3 days of almost continuous rain and cool temperatures in 1965, some incubating females left the nest for long periods of time, presumably to hunt food. While the martins were away, House Sparrows (*Passer domesticus*) entered the nests and destroyed some clutches.

During the nestling stage, the influence of combined weather factors on ED activity was not so great as during the nestling and postbreeding stages. Parental birds are more likely to have a negative energy balance during this stage than at any other time, because they must feed both themselves and their nestlings. Nestlings are fed at a greater rate on warm, clear, calm days when aerial insects are plentiful than they are on cool, dull, windy days when fewer insects are flying.

Weather factor analyses showed that high ED activity during the postbreeding stage usually occurred on days when the temperature was low, the sky was overcast, and the wind velocity was high, as opposed to lower activity under opposite conditions. On days of fair weather, martins are stimulated to feed away from nest sites; whereas on poor days, birds defend the nest site and/or spend more time in the nest (Finlay 1971a). These same factors have the opposite effect on ED activity when they occur during the nestling stage.

Temperature and sky opacity together were the most influential weather factors. An analyses of these paired factors indicated that temperatures below 53°F substantially reduced ED activity. If the mean temperature during the critical 30-day period required for nestling development is above 55°F, martins probably will reproduce successfully. If not a colony may survive for a few years, but with low reproductivity success and no immigration, it will eventually disappear. ED activity on a day with clear to a half-overcast sky was usually greater than on a completely overcast day.

Wind velocity in combination with the other factors appeared to have less influence on ED activity than temperature and sky opacity. A wind velocity above 6.5 mph usually caused a reduction of ED activity. If wind velocities continually exceed 10 mph during the 30-day critical nestling period, the adults would have difficulty obtaining sufficient food for the young. Wind in the prairie parklands of the Edmonton area seldom blows steadily at such high velocities.

Relative humidity combined with the other weather factors was the least influential factor affecting ED activity. Humidity above 63% appeared to cause a slight reduction of ED activity, but as mentioned earlier, higher relative humidities usually occurred on overcast, cool days and after some rainfall, all conditions that reduce ED activity.

The influence of weather on the size of animal populations has been discussed at length in the literature. Birch (1957: 203) states "weather is a component of the environment of animals which effectively determines the limits to distribution and the abundance of some species.

Short term and long term changes in weather determine short term and long term changes in distribution and abundance." This view is contrary to the density dependent concept, which supposes that populations increase when densities are relatively low and stop growing or decrease when densities are high. Nicholson (1957), taking a more realistic approach, stated that the density of a population is not governed by biotic and abiotic factors *per se* but by such attributes of these elements as availability, accessibility, and intensity. Furthermore he stated that inherent in all populations is the ability to adjust to great changes in their environments. Purple Martin populations do fluctuate (Mayfield 1969). Local populations may be reduced radically by long spells of bad weather, as in New England (Forbush 1904). Adverse weather of short duration affects ED activity of Purple Martins but not overall production (Finlay 1971a). It appears that either productivity of the Edmonton birds or emigration to Edmonton from elsewhere has been sufficient to increase the size of the population from probably fewer than 10 pairs in 1946 to an estimated 2000 pairs 20 years later (pers. observ.). Short spells of bad weather, as in 1965, did not greatly affect the population.

One of the chief factors that probably limits the expansion of the population of Purple Martins at Edmonton is the availability of nest sites. Except for a major catastrophe such as extreme bad weather, aerial insects should be plentiful enough to support many more martins than now summer here.

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SUMMARY

A study of the influence of several meteorological factors, rainfall, temperature, sky opacity, wind velocity, relative humidity, and barometric pressure on nest entrance and departure activity (ED activity) of Purple Martins during seven stages of the breeding cycle was undertaken near Edmonton, Alberta in 1965 and 1966.

The various weather factors influencing martin ED activity act indirectly through their direct effects on the availability of aerial insects. Rain lasting 3 or more hours substantially reduced ED activity. Temperatures below 55°F appeared most influential on ED activity. Tempera-

tures above approximately 59°F had little influence except in the nestling stage when more food was brought to the young. During most of the breeding cycle martin activity was greater on a clear to partly cloudy day than on a dull day. When wind velocities reached 6.5 mph and above or when relative humidities were above 65%, ED activity decreased. Barometric pressure *per se* and changes in barometric pressure had little influence on ED activity. Sky opacity influenced ED activity only in the incubation and nestling stages. Clear days usually were fairly warm with low wind velocities, both conditions that bring more insect activity. Weather conditions influenced ED activity most during the nest completion stage and least during the incubation stage. Weather conditions during the breeding season do not appear to be limiting productivity of Purple Martins in the Edmonton area.

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