Observations on the Pauraque nightjar, *Nyctidromus albicollis* (Gmelin), on the roads at night.

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In an earlier study (Quesnel 1986) I concluded that the nightjar *Nyctidromus albicollis* frequented roads at night mainly to feed but also to use them as stations from which to call in establishing territories or attracting mates. I also showed that the behaviour varied greatly with moon phase because there were many more birds on the roads at full moon than at new moon. However, certain questions remained unanswered, chief of which were:

1. What is the sex ratio of the birds seen sitting on the roads?
2. Do the birds prefer to face the moon or away from it, or is there no preference?
3. Does moon phase affect the frequency of birds on the roads when they first come out at dusk?

To answer these questions I conducted a new series of observations beginning on 1 August 1985 and continuing for one year. In my analysis of the results I also use two shorter series of observations aimed specifically at determing the sex ratio, one from 1 December 1984 to 3 June 1985 the other covering the months September and October 1987. For convenience I refer to these later on as the 1985 series, the 1984 series and the 1987 series respectively. In examining these observations it became clear that numbers on the roads varied in a definite manner through the year and some discussion of this is also presented.

Methods

Methods were the same as in the previous study. Birds were observed from a motor car on every journey to or from Haven Hill Farm, Talparo, on the roads of the farm or on Leotaud Trace. (Leotaud trace runs roughly east-west with a short stretch north-south.) In addition, a survey on foot was carried out along the same route several times a week within one hour of sunset, usually from about half an hour after sunset. (Birds begin to alight on the roads from 20 to 25 min after sunset). The walk along Leotaud Trace to the main road took approximately 12 min. Birds were observed on both the outward and inward journey. A flashlight was used to illuminate the birds but only rarely was it possible to determine the sex of the birds under these conditions.

As far as possible the following facts were recorded for every observation and entered in a table: Date, time, location of bird on the road, side of the road (i.e. north or south on the east-west portion, east or west on the north-south protion), direction in which the bird faced, whether it faced the moon or away from it, sex. Other information was entered in a remarks column, such as whether the sky was clear or cloudy, whether the moon was visible, whether the determination of sex was made on a sitting bird or one in flight, whether a bird might have been the same as one seen earlier that had flown to a new location and so on. In noting the bird's position with respect to the moon the bird was considered to be facing the moon as long as the moon was forward of a line passing through the eyes and extending indefinitely on either side; the bird was considered to face away from the moon if the moon was backward of this same line. Journeys on which no birds were seen were also recorded. Times of sunset were obtained from the daily newspapers and the phases of the moon from a calendar.

To avoid bias, analysis of the observations was not attemted until each series was complete. However, a preliminary analysis done immediately after the completion of the 1985 series showed a marked decrease in numbers on the roads over the period so observations were continued for another two months to see if numbers would rise again.

Results and Discussion

Fluctuations in the numbers of birds on the road

In the 1985 series there were 527 observations of birds on the road. The distribution by month is shown in Table I and Fig. 1. Over that period numbers fell from a high in August 1985 of 83 (3.32 per journey) to a low in June 1986 of 11 (0.42 per journey), rebounding to 28 (1.22 per journey) in July. Continued observation for a further two months showed that numbers rose substantially, to 51 in August and 73 in September 1986 from 21 and 28 journeys respectively. These two months of extra observation were added specifically to see if the numbers in August 1986 would match those of August 1985. In fact, numbers did rise but the peak was delayed to September (Fig. 1). There were no observations from October 1986 to August 1987 but in September and October 1987 numbers were high again, 63 and 52 respectively (Table I). The results for the period August 1985 - July 1986 were analysed and found to be highly significant ($X^2 = 58.2$). The downward trend from August to June is therefore real and related to some feature of the bird's life.

According to Belcher and Smooker (1936) "the peak of the breeding-time falls between February and April, but G.D.S. has found fresh eggs as late as July." I have found three incubating birds, one at Chaguaramas on 19 April 1976, one on the Aripo Savanna on 19 June 1978 and one at Haven Hill Farm on 10 April 1987, which observations fit very well with those of Belcher and Smooker. It seems logical then that numbers of birds on the road in August and September would be high as young birds accompany their parents on to the roads. My notes record three occasions on which I have seen three birds close

Table I: Numbers and sex ratio of birds observed on the roads (see text for further details)

	1984 Series		1985 Series				1987 Series			
	No. birds seen		No.	No. birds seen			No..	No. birds seen		
Month	Male	Female	Journ.	Total	Male	Female	Journ.	Total	Male	Female
Aug.			25	83	13	10				
Sept.			30	75	10	21	15	63	22	33
Oct.			26	57	4	18	18	52	15	22
Nov.			24	41	3	7				
Dec.	13	8	21	45	6	11				
Jan.	11	9	28	51	6	9				
Feb.	7	2	22	31	8	11				
Mar.	10	14	20	28	8	8				
Apr.	7	1	25	42	7	9				
May	4	4	23	35	7	5				
June	4	3	26	11	2	2				
July			23	28	4	4				
Total	56	41	293	527	78	117	33	115	37	55

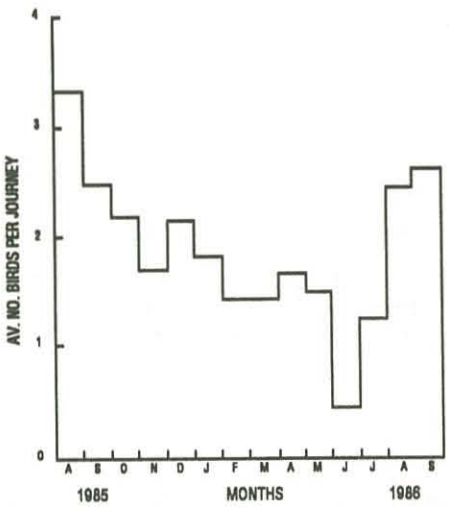

Fig. 1 Fluctuations in the numbers of Parauques seen on the roads at night. Each value is the mean number per journey for each month.

together: 3 Aug. 1985, 21 Aug. 1985 and 9 July 1987. I regard these little parties as consisting of one parent and two young. Also, in the second half of the year some birds seem not to be full-sized and to have tails that seem shorter than usual, which suggests that these are young birds. Further, at this time the sex ratio seems to tilt in favour of females (see next section) suggesting the presence of young in female plumage.

It is the tendency in most animals for immature individuals to leave the area in which they were raised and this, plus death, would account for the fall in numbers from the peak in the August - September period. The fall would be further accentuated in the period February - June by the absence from the roads of incubating or brooding birds. Thus, the observed pattern seems easily explained by reference to the breeding cycle.

The sex ratio of birds on the roads

Interest in the sex ratio lies in the fact that a ratio far from 1:1 would indicate that the availability of food is not the main attraction of the road. Table I shows the results obtained in the attempts to determine the sex of the birds seen on the roads. The first point to note is that of the 527 birds sighted in the 1985 series the sex of only 193 (36%) was determined with near certainty. In the earlier 1984 series which was undertaken specifically to determine the sex ratio of birds on the road, information was recorded for 97 birds and no record was kept either of the number of journeys or of birds that were seen but for which no determination of sex was made. In the later 1987 series the sex of 92 of the 115 birds seen was determined, i.e. 80%, and a record of all journeys was made. The main reason for the low percentage of sex determinations in the 1985 series is the high proportion of the observations made on foot when sex determination was difficult because of inadequate light. In the 1985 and 1987 series females predominate over males whereas in the 1984 series the reverse is true. Tested by χ^2, the sex ratios do not differ significantly from the expected 1:1 in the 1984 series ($\chi^2 = 2.32$) and 1987 series ($\chi^2 = 3.52$). In the 1985 series the sex ratio is significantly different from 1:1 at the 1% level (χ^2 - 7.1). However, if the 1985 series is divided into two parts, one from August to November and the other from December to June so that the first part covers the months of the 1987 series and the second part corresponds to the months of the 1984 series, then the sex ratio in the first part is significantly different from 1:1 ($\chi^2 = 7.86$) whereas that of the second is not ($\chi^2 = 0.62$). Thus, in neither the 1985 series where females predominate nor in the 1984 series where males predominate is the sex ratio significantly different from 1:1 in the period December - June. Although the sex ratio in the 1987 series is not significantly different from 1:1, it comes close to significance at the 5% level and shows a preponderance of females over males as does the first part of the 1985 series where the difference is significant. What all this seems to show is that there is a real preponderance of birds in female plumage over birds in male plumage in the period August - November. This observation would be easily explained if the young appear only in female plumage and the individual is counted as female whether in fact male or female.

I could find no publication that mentioned the plmage patterns of immature birds and sought information on this from Dr. David Snow of the British Museum (Nat. Hist.). His reply follows: "I have looked at our specimens of *N. albicollis*. I found only one specimen labelled ♂, which had wings and tail of ♀ type plumage. It was a juvenile (not full grown). Presumably it was an immature male; the body plumage was also sandier brown, not so grey in general tone as the adults. It was from Guatemala. Of course one has to be aware that occasional museum specimens are mis-sexed, but there is no reason to think so in this case. In support of this, the only published work that goes into this kind of thing in real detail, and completely reliably, Ridgway's Birds of North and middle America, also says that the wing and tail of the juvenile male are as in the adult female, and that the body plumage is browner." Thus, the matter seems to be settled. Both sexes appear on the road in equal numbers but the young, which are in female plumage, appear to distort the sex ratio in favour of females.

Position on the road with respect to the moon

Of the 527 observations in the 1985 series 336 were made when the moon was visible to me though in a very few of these instances the moon may not have been visible to the bird at its site on the road. The bird was facing the moon 194 times and away from it 142 times. Tested by χ^2 this is significantly different from the random 1:1 ratio at the 1% level ($\chi^2 = 8.04$).

If the birds come on to the roads mainly to feed it would seem, *a priori*, that a position with the moon behind the bird would be favoured because in this position the bird would see its prey illuminated by the moonlight. However, the reverse is observed, viz the birds prefer to sit facing the moon. This result may be taken to mean either that the position of the moon in relation to the bird's prey is unimportant, and the bird's position on the road is determined by other factors, or that, despite presumptions, the prey is more easily seen when the bird faces the moon.

My notes contain some observations that bear on the first possibility. On at least two occasions when a bird on my driveway flew to a section illuminated by a security light it changed the direction it faced several times in quick succession as though confused by the extra light. This leads me to believe that the position of the moon is important and related to the ease with which the bird sees prey.

It may be noted that the Pauraque feeds principally on beetles about 1 cm long and on small moths (Edwards 1983). Perhaps, to the bird with the moon behind it, light relecting from the small prey makes it relatively inconspicuous against the bright sky of a moonlit night whereas with the moon behind

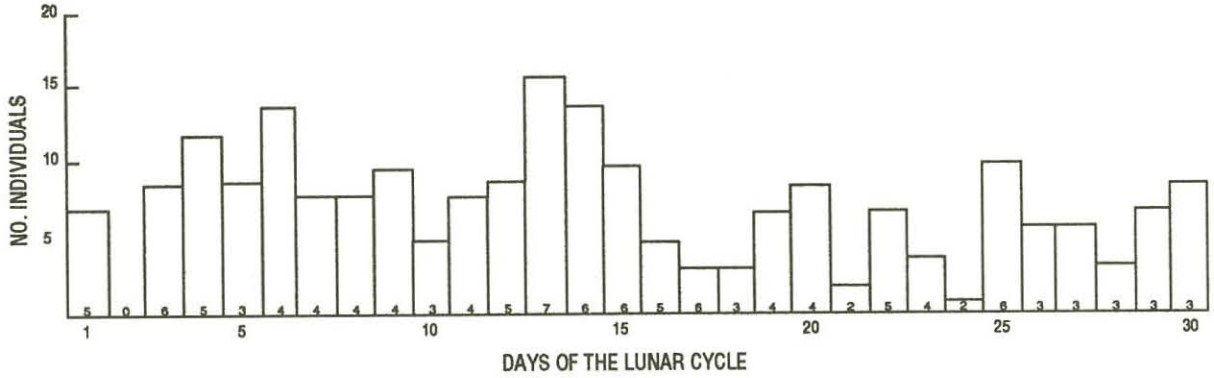

Fig. 2 The influence of moon phase on the numbers of Pauraques in the 1 hr period following sunset for the 1985 series of observations. Each value is the total nmber seen for that day of the lunar cycle. The small numbers at the base of the histogram give the number of journeys that took place on each day of the cycle. This figure should be compared with Fig. 1 of Quesnel 1986. NM = new moon FM = full moon

the insect it appears dark and more conspicuous.

To test this hypothesis I tied a dead, shiny, tan-coloured beetle of the right size to a piece of black thread and on a bright moonlit night I swung it in front of me both while I faced the moon and when I faced away from it. After several trials I decided that the beetle was more conspicuous when I faced the moon. Also, on the full moon night of 28 July 1988, I asked ten people (members of family and friends) to repeat this procedure and decide in which situation the beetle appeared more conspicuous. Each person wrote his or her opinion on a piece of paper without announcing the result to anyone. When I tallied the results afterwards there were five people who found the beetle more conspicuous against the moonlight sky, four who found it more conspicuous against the relatively dark sky opposite the moon and one who could not decide. With my own result this means a 6:4 verdict in favour of the bird's position.

Of course, this result does not prove that my hypothesis is correct. A much greater number of observations is desirable and a dead beetle at the end of a string is not the same as a flying beetle with vibrating wings, but the result is encouraging nonetheless. Perhaps a more rigorous experiment along the same lines would lead to a more conclusive result and there is opportunity here for further work.

Effect of moon phase on the numbers of birds on the road within one hour of sunset.

In the previous study there were only 31 observations in the period up to one hour after sunset and no definite conclusions could be drawn. In the 1985 series there were 221 observations distributed as shown in Fig. 2.

The mean number of birds expected per day of the lunar month would thus be 7.4 Fig. 2 shows that in the period from day 3 to day 15 of the lunar cycle when the moon is visible up to one hour after sunset the numbers seen are mostly above seven whereas in the period from day 16 to day 30 when the moon is not visible the numbers are mainly seven or below. The trend is in the direction expected if the moon is influencing behavious and, tested by χ^2, the distribution is just significantly different at the 5% level from that expected if moonlight is unimportant ($\chi^2 = 42.85$).

It may be argued that the observed trend resulted from the greater visibility to the observer of birds on the road when there is moonlight than when there is not. In other words, there would appear to be a possibility that I could have missed some birds in the darker twilight of moonless evenings. There is nothing to indicate that this was so. Because birds on the road always sat sideways to the observer walking on the road and because the eyes easily reflect the light of a flashlight it was always possible to detect the birds from a long way off, i.e. long in proportion to the distance between bird and observer when they decided to fly off. Hence there is no reason to believe that the above results have been biased by the conditions under which the observations were made.

Birds begin to fly on to the roads at 20-25 min after sunset. The present results show that even though moonlight does influence the numbers, birds always sit on the roads at this time of day regardless of moon phase. This finding confirms the impression gained in the earlier work (Quesnel 1986). It is not difficult to see that this situation is to be expected if the birds come on to the roads principally to feed. There is still some residual sunlight left at this time which should attract insects to the roads if, as postulated in the previous paper, insects are attracted to the road by a greater reflection of light from it than from vegetation. The greater numbers on the roads on days 3-15 of the lunar cycle are also to be expected because extra light from the moon would increase the attraction of the road for insects if the difference in reflection between road and vegetation increases with increasing moonlight as previously postulated.

If further work should prove that the insects on which the Pauraque feeds are not more common over roads than over vegetation, or that moonlight does not influence their numbers although they are more numerous over roads than over vegetation, then some other explanation of the influence of moonlight on the bird's behaviour will have to be sought. In this case the explanation is not likely to be the use of roads as stations from which to call because, as already indicated, birds are most common on the roads in the months July - September and during the first two of these the birds do not call at all whereas in September a new phase of calling begins with very few calls. Observations on calling will be published at a later date.

However, it is worth noting too that the Pauraque often calls at dusk and at dawn even if it does not call during the rest of the night. If roads are being used as stations from which to call, birds would be expected to be on the roads at dusk

regardless of moon phase.

Conclusion

All the results presented above support the conclusion already reached, viz that the Pauraque comes to the roads because they are favourable places for feeding. The sex ratio of birds on the roads if far from 1:1 would indicate that roads are used for some activity favoured by one sex alone but the ratio is 1:1 for most of the year. When birds in female lumage predominate in the months August - October it is because young birds of both sexes in female plumage accompany their parents on to the roads. Also, the use of the roads at twilight, even during the week preceding New Moon when nights are dark and roads are not favoured by the birds later in the night, seems to support the postulated reason for the attractiveness of the roads, viz that their reflectivity is greater than that of vegetation and that the reflected light attracts insects. There is even preliminary evidence that humans see insects at night better when they stand facing the moon (as does the Pauraque) with the insects between them and the moon than when facing away from the moon with the insect illuminated by the moon.

There is support too for the idea that the birds use the roads as convenient stations from which to call, for at the phase of the moon when calling occurs least, it occurs at the times when the birds are one the roads, viz just after sunset.

However, a new question arises: do the young birds learn to favour the roads by accompanying their parents or is the behaviour genetically determined? It would be possible to answer this question by rearing young birds in isolation and comparing their behaviour with that of birds raised by their parents. Such a programme of experimentation, would, however, be completely beyond my resources.

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Bird Observations in Tobago December 1985 to November 1987

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The most spectacular visitor to Tobago during this period was the Jabiru Stork (*Jabiru mycteria*). The largest of South American storks, this bird stands upright at 1.3 m (nearly 4.5 ft) and has an immense wing span. One individual was seen in Tobago, mainly in Buccoo swamp, between August 1988 and April 1989, not only by myself but by many visitors. Its range covers Central America south to Peru and nothern Argentina, but it rarely reaches the West Indian islands. This is the first record for Tobago. However, during the 1950s a bird visited Grenada where it was subsequently shot (p.c. Fr. Raymund Devas). The same fate may have overtaken the Tobago bird.

A White-necked Jacobin (*Florisuga mellivora*) hummingbird was found nesting at Gilpin Trace in the Main Ridge Forest Reserve in May 1989, the first recorded nest for the subspecies *flabellifera*. The nest was attached to the upper side of a large leaf.

Some interesting records from Buccoo Swamp include a young Scarlet Ibis (*Edocimus ruber*) on 20 Aug. 1989 and Glossy Ibis (*Plegadis falcinellus*) on 26 Nov. 1989 and later; the numbers of Black-bellied Whistling-ducks (*Dendrocygna autumnalis*) and White-cheeked Pintails (*Anas bahamensis*) have recently increased. It is important that this swamp be preserved if the future of these marsh and swamp birds is to be safeguarded.

Elsewhere in Tobago I had records of a Black Vulture (*Coragyps atratus*) on 11 April 1989 and a Common Potoo (*Nyctibius griseus*) at Moriah in 1988. Both species have been rarely recorded in Tobago. Several nests of the Gray Kningbird (*Tyrannus dominicencis*) were found during May and June 1989. The nests were placed in the lower branches of saman trees in western Tobago.

Finally, an interesting case of predation was observed when a manicou crab (*Pseudothelphusa garmani*) was found eating the chicks of a Blue-crowned Motmot (*Momotus momota*) inside its nest at Gilpin Trace in early 1989. It is not clear whether the crab actually killed the nestlings or was merely feeding on the corpses.

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