ANALYSIS OF HONEY BUZZARD FLIGHT DIRECTIONS AT BUSKETT

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Analysis of autumn sightings of Honey Buzzard *Pernis apivorus* at Buskett made during the period 1974 - 1978 suggested the existence of a leading line effect in Honey Buzzard migration through Malta. It was hypothesised that more Honey Buzzards follow the south-western coast as the day progresses. In addition, there was evidence which suggested that southerly winds increase the proportion of Honey Buzzards which follows the coast, even if the southerly winds are of a purely local nature, generated by a sea breeze system (Thake 1980b & 1983).

In this paper, angular data accumulated during the 1974-78 study period and during sporadic observations in subsequent years (1980 - 1982) are analysed. A limited amount of supporting evidence for the above hypothesis is presented.

Methods

Detailed descriptions of the methods employed may be found in earlier papers (Thake 1977, 1980a & 1980b). The flight directions of Honey Buzzard flocks flying within 200 m of the observer were determined ($\pm 10^{\circ}$) by reference to known compass points, represented by distant landmarks. A bearing compass was in use from 1978 onwards, allowing more accurate flight directions to be obtained when the birds flew directly overhead. Directional data were obtained most frequently in 1976.

Calculations were performed using ad hoc BASIC computor programs designed for use on the Casio FX 801p programmable calculator.

Results

In Fig.1, variation of the mean length of the resultant vector of flight directions is plotted against time of day. The mean length of the resultant vector is an index of the degree of scatter of the flight directions; the closer the mean length is to 1, the smaller the scatter of the flight directions. Fig. 1 clearly shows an increase in the scatter of flight directions as the day progresses. This is consistent with the interpretation that the Honey Buzzards' motivation to fly in a given compass direction decreases in the course of the day.

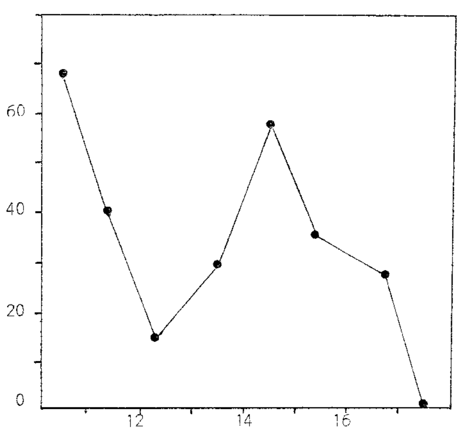

Fig.1. Variation of the length of the mean resultant vector with time of day. Angular data obtained during each hourly interval yielded the basic angular statistics. The mean length of the resultant vector (R) is plotted against time of day (C.E.T.). Correlation coefficient = -0.8980, $p > .01$.

Fig.2 depicts changes in the direction of the resultant vector with time of day. The few Honey Buzzards sighted before noon fly mostly south. The tendency to fly towards southeast increases towards mid-day, peaking between 12.00 and 13.00 C.E.T. As the afternoon progresses, the resultant vector shifts towards south until approximately 15.00, after which it returns to southeast. The following interpretation is offerred : The thermal low over the islands is best developed around mid-day. This coincides with a tendency for the Honey Buzzards to follow the coast to a greater extent, and the resultant vector

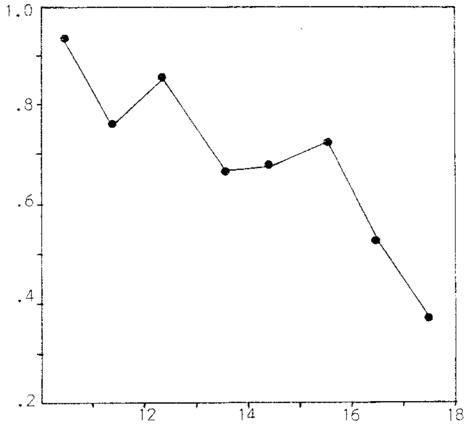

Fig.2. Variation of the direction of the resultant vector with time of day. The ordinates represent $\theta - 135^{o}$, where θ is the direction of the resultant vector in degrees. Southwest lies above the top of the diagram; southeast at the bottom. South lies at 45^{o} on the ordinates.

shifts towards the southeast. In the mid-afternoon, the weakening thermal low over Malta produces lighter winds which induce less coasting than at mid-day. Towards the late afternoon, the direction of the mean vector veers towards the southeast as the amount of coasting increases once again.

If coasting during contrary winds is an important factor in Honey Buzzard migration through Malta, one would expect an increase in the amount of coasting in moderate southerlies. Fig.3 presents appropriate data. Although there is an increase in the number of Honey Buzzard flocks flying southeast in moderate winds, the directional shift of the mean vector towards the southeast in diagram B is not significant (Watson and Williams two sample test : $F_{1,78} = 2.13$, $p > .05$). The decrease in scatter with moderate contrary winds is also consistent with the hypothesis, but again the effect is not significant (tested after Mardia 1972, p 162 : $F_{22,56} = 0.5185$, $p > .05$).

Increased coasting in moderate southerlies would be expected to cause more flocking, giving rise to a higher mean flock size. This was found to be the case (see Table 1).

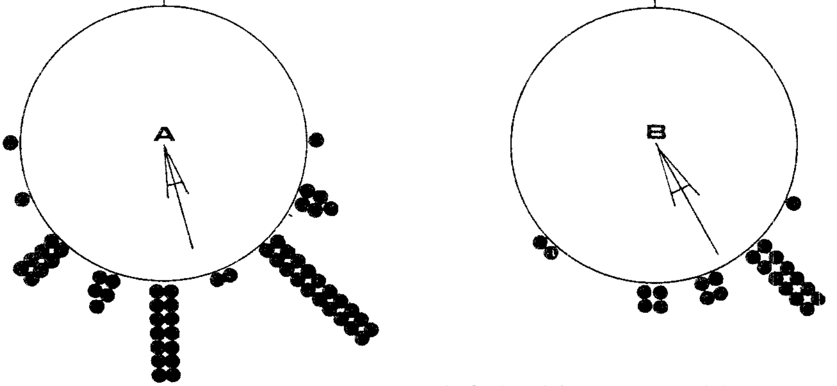

Fig.3. Scatter diagrams of flight directions of flocks sighted in light (A) and moderate (B) southerly winds. Southerlies (from east-southeast to west-southwest) were grouped according to wind strength as indicated in the table below.

Category	includes winds	R	θ
Light (A)	3 to 7 knots	.7714	165.47^{o}
Moderate (B)	8 to 17 knots	.8846	152.08^{o}

The direction, length and 95% confidence limits of the mean resultant vector are shown on each diagram. The direction of geographical north is marked at the top of each diagram. Both scatter diagrams differ significantly from a uniform distribution (Rayleigh test : $p < .001$).

TABLE 1 : Variation of mean flock size with wind strength

southerly wind strength category	mean flock size	sample standard deviation
Light	2.23	2.12
Moderate	4.70	5.68

Anova (Single classification) : $F_{1,77} = 7.6736$; $p > .01$.

Conclusions

The results presented in this paper provide limited further support for the hypothesis of a leading line effect in Honey Buzzard migration through Malta. The tests described above should be repeated when a more extensive set of angular data becomes available.

References

MARDIA,K.V. 1972. Statistics of directional data. Academic Press : London & New York.

THAKE,M.A. 1977. Synoptic scale weather and Honey Buzzard migration across the central Mediterranean. *Il-Merill* 18:19-25.

THAKE,M.A. 1980a. Gregarious behaviour among migrating Honey Buzzards. *Ibis* 122:500-505.

THAKE,M.A. 1980b. Autumn migration of the Honey Buzzard through Malta in relation to weather. *Il-Merill* 21:13-17.

THAKE,M.A. 1983. Evidence for the existence of a leading line effect in Honey Buzzard migration through Malta. *Il-Merill* 22:8-9.

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MIGRATION OF THE SANDWICH TERN IN EAST SICILY

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The Sandwich Tern *Sterna sandvicensis* is a scarce autumn migrant to Malta (Sultana & Gauci 1982), with no autumn records in some years (Cachia Zammit & Attard Montalto 1980).

On the other hand, along the nearby south-east Sicilian coast it is a very common autumn visitor with a definite, and sometimes huge, southward movement. A good counting station along the east Sicilian coast is Capo Murro di Porco (135 km. north-west of Malta) near Syracuse, where large numbers of Sandwich Terns moving to the south are recorded every year from early August to late November, with peaks in the last ten days of October. In 1980 the author counted 348 birds during 18 observation hours from 8th October to 11th November; and in 1981, 397 from 23rd August to 22nd November during 22 observation hours. A more systematic count in 1982 totalled 1,403 during 81 observation hours from 1st September to 28th November, with peaks of 334 on 25th October during 150 observation minutes and 195 on 31st October during 140 observation minutes.

Table 1 includes all the 2,148 birds counted in the three autumns and shows the percentage of terns that passed singly or in flocks of different sizes (largest flock counted was of 63 birds).

Table 1	Flock size	1	2-10	11-20	21-30	31-63
	Percentage	2.33	51.23	24.09	10.52	11.80

No definite relation with weather was noted, but most of the largest counts were on days with clear sky, south or south-west light winds and smooth sea. Only a few wintering birds were recorded from late November.

Spring passage is not so well defined. In late February, but mostly from mid-March to early April, I recorded small flocks or single birds, most moving to the north, but some to the south (the last are probably terns that wintered in the Tyrrhenian Sea and that fly south before moving to the east, crossing the Messina strait). Spring passage is probably more marked well offshore and involves large flocks, like the one of 100+ recorded near Comino on 20 April 1969 (Sultana & Gauci 1982). Migrating Sandwich Terns generally pass very close to Capo Murro's cliff. It is unusual to record birds further offshore than 200-300 m. They fly low (below 20 m. above the sea) in loose flocks with the birds, at least one or two, calling incessantly. Sometimes, especially with strong side winds, they prefer to fly in compact line formations, very close to the surface of sea.