BIRD STRIKE COMMITTEE EUROPE

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HEIGHT DISTRIBUTION OF BIRD MOVEMENTS IN SOUTHERN SWEDEN MEASURED BY RADAR SEPT-OCT 1976

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Complete Paper

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HEIGHT DISTRIBUTION OF BIRD MOVEMENTS IN SOUTHERN SWEDEN MEASURED BY RADAR

by B. Larsson, Meteorologist, Swedish Air Force

Within the frame of a project of developing methods to reduce bird hazards to aircraft, surveillance radars have been used for several years in order to detect and define areas of especially high concentrations of migrating birds over southern Sweden. But a problem with the "SRE" is that you cannot determine the height of the bird echoes. During the period 25 Sep to 10 Oct 1975 another type of radar was employed in order to find out the height distribution of the migrating birds.

The radar used was a Selenia Meteor 200 (X-band, peak-power 200 kW and beamwidth 1.65 degrees, normally used as a weather and wind-finding radar) located at Ljungbyhed in the southern-most part of Sweden. With the wind-finding equipment it is possible to measure the height of a bird echo with an accuracy of $\pm$50 m within a distance of 15 km. Beyond 15 km the radar can only detect flocks consisting of many or/and big birds; mostly due to the low peak power and the fact that a flock will not "fill the beam" at a longer distance. Measuring the height of each echo randomly encountered was found to give an erroneous picture of the height distribution.

However, the PPI was also photographed with Polaroid film every hour from 06 to 14 hrs LMT (Monday to Friday, if there was not too much precipitation). Photos were taken at the elevations of 1.5, 3.75, 6.0 and 9.0 degrees (sometimes also 15 degrees and a RHI photo). The exposing time was 1 to 3 minutes. About 200 pictures were taken and the result can be seen in appendix 3 and 4. The evaluation of the pictures was carried out as follows. Within a "window" with a ground area of 25 km^2 located over a suitable area of the picture all echoes were counted. From the 1.5 degree photo the concentration of echoes in the layer 100 to 200 m was obtained, from the 3.75 degree photo that between 200 and 500 m, and so on. No measurement below 100 m was possible due to many disturbing ground echoes.

In the beginning of the period the weather was rather cloudy and rainy with low clod bases and mostly southerly winds. Therefore little migration took place. Some days, however, birds were flying between or over clouds even if the lowest cloudlayer was complete. On 5 Oct a rather deep low passed southern Sweden, and behind it a strong northerly wind brought down dry and cold air (see appendix 2). On the following days the most intense migration of Wood-Pigeons for the whole autumn was recorded. As seen in appendix 1 the maximum height repeatedly exceeded 1500 m. On 8 Oct there were so many echoes on the screen in the morning that it was almost impossible to count them on the photo. Therefore no photoes were taken at lower elevations between 0630 and 0840 hrs LMT, which, in retrospect was a mistake.

During the period 29 March to 9 April 1976 a new series of measurement using the same technique has been collected. This time also Ronneby and Kalmar were involved (see appendix 5). Visual bird observations made by

military pilots flying at Angelholm, Ljungbyhed, Ronneby and Kalmar were also collected Monday to Friday during these two weeks. The results from this period are not yet available.

Conclusion

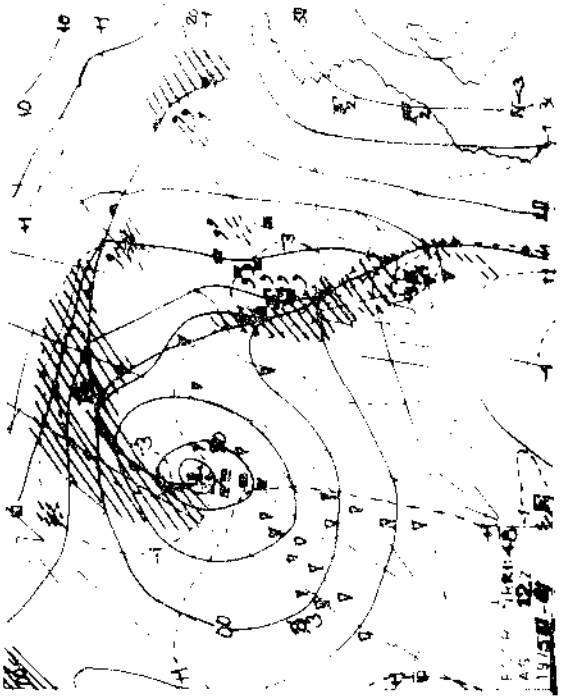
The Meteor 200 is very useful to determine the height distribution of bird migration within a distance of 15 km. If special equipment for the purpose is unavailable, it is possible to take Polaroid photos and to evaluate the echo concentration by hand. At present it is impossible to determine the different species. Radar work therefore should be coupled with field observations of the migrating birds carried out by competent ornithologists. To get a complete picture of the migration pattern over a larger area it is necessary to use the X-band radar in combination with a surveillance (L-band) radar.

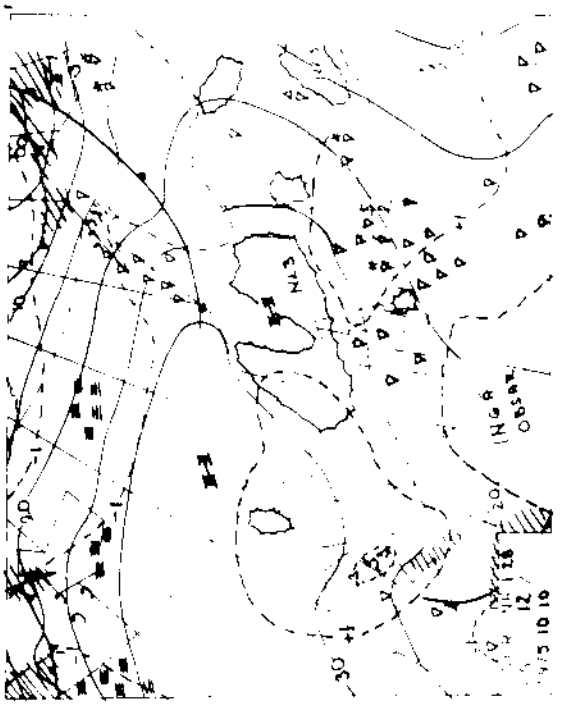
Appendix 1

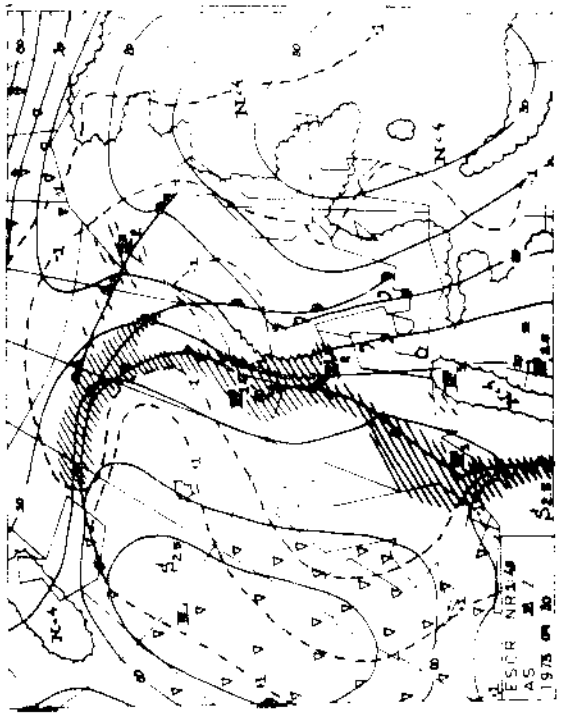
Height Distribution of Bird Echoes evaluated from Polaroid Photographs.

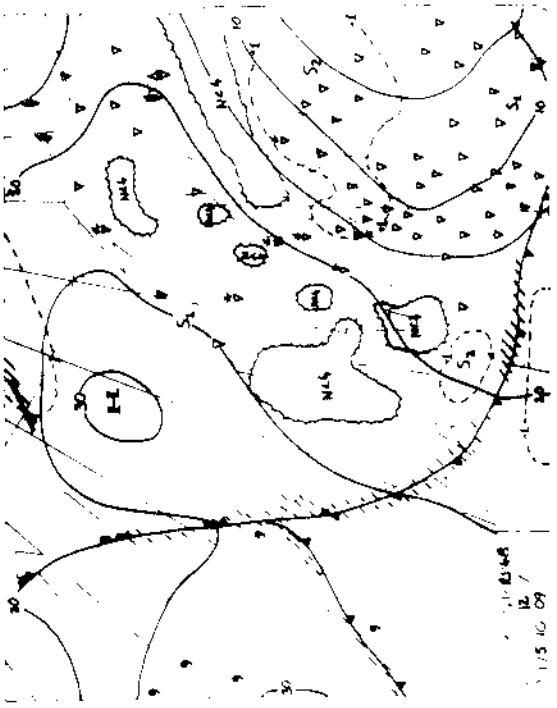
Date	Time (LMT)	Number of Echoes per 100m and 25 km^2 100-200m	200-500	500-1000	1000-2000	2000-3000	Maximum Height
25 Sep	1115	4					200
26 Sep	0920	2					200
29 Sep	0600	-	-	-	22	14	2450
	0640	7	15	7	5		1400
	0835	6	21	11	4		1750
	0945	4	7	2			850
	1100	11	5	2	6		1200
30 Sep	0630	10					200
	0740	20	11	3			1000
	0910	19	10	2	2		1350
	1010	10	6	2	1		1400
	1320	1		2			750
1 Oct	0625	2	2				500
	0650	16					200
	0750	8	4	3			650
	1330	1					200
2 Oct	0600	12	18	17	8		1250
	0700	3	4	1	1		1450
	0800	9	2				500
	0915	8	5				500
	1110	2	3	2			1000
6 Oct	0930	2	2				500
7 Oct	0820	15	4			3	3000
8 Oct	0545	24	19	17	10	9	2200
	0630	-	-	-	13	6	2700
	0650	-	-	-	5	6	2600
	0720	-	-	-	8	3	3000
	0750	-	-	-	11	4	2700
	0840	-	-	-	12	3	2700
	0930	9	15	12	3		1800
	1125	3	3	2			1000
	1305		1	2			1000
9 Oct	0425	15	11	4	2		1700
	0455	18	12	4	3		1200
	0540	11	14	11	8		2000
	0640	21	15	9	9		1400
	0755	3	15	6	5		1350
	0900	9	10	2	1		1550
	1140	3	3	1	1		1550
	1320		3				500
10 Oct	0620	11	11	6	6		1200
	0900	5	11	2			1000
	1030	5	4	3	3		1200
	1150	2	3	2	3		1200

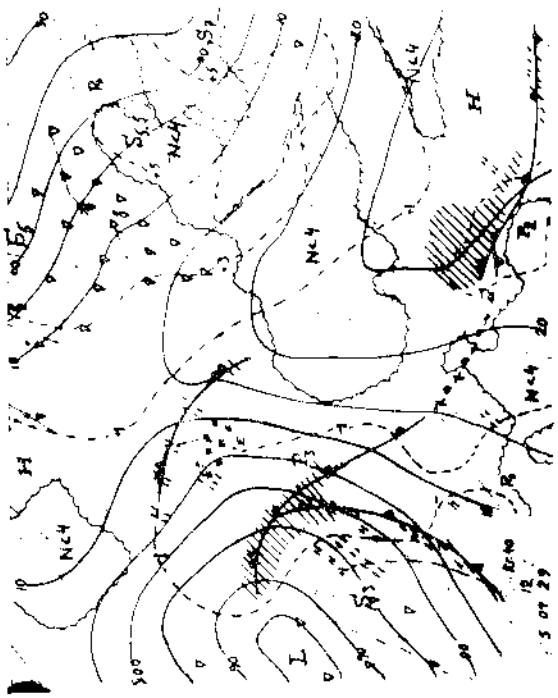
- = No Photo

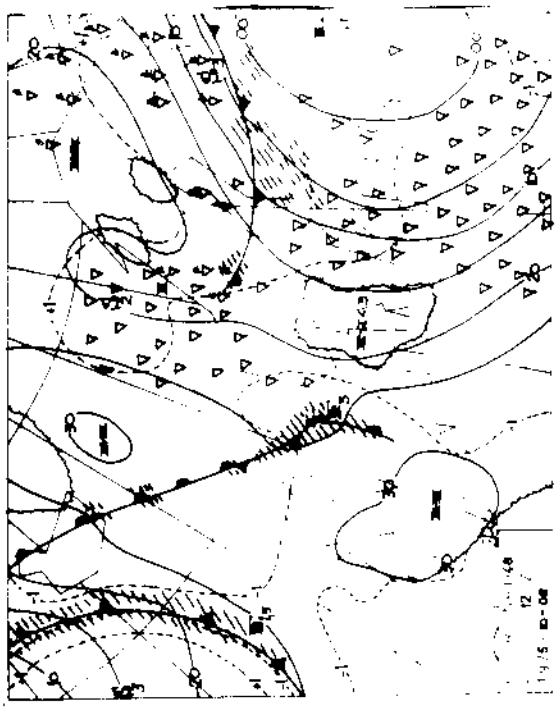




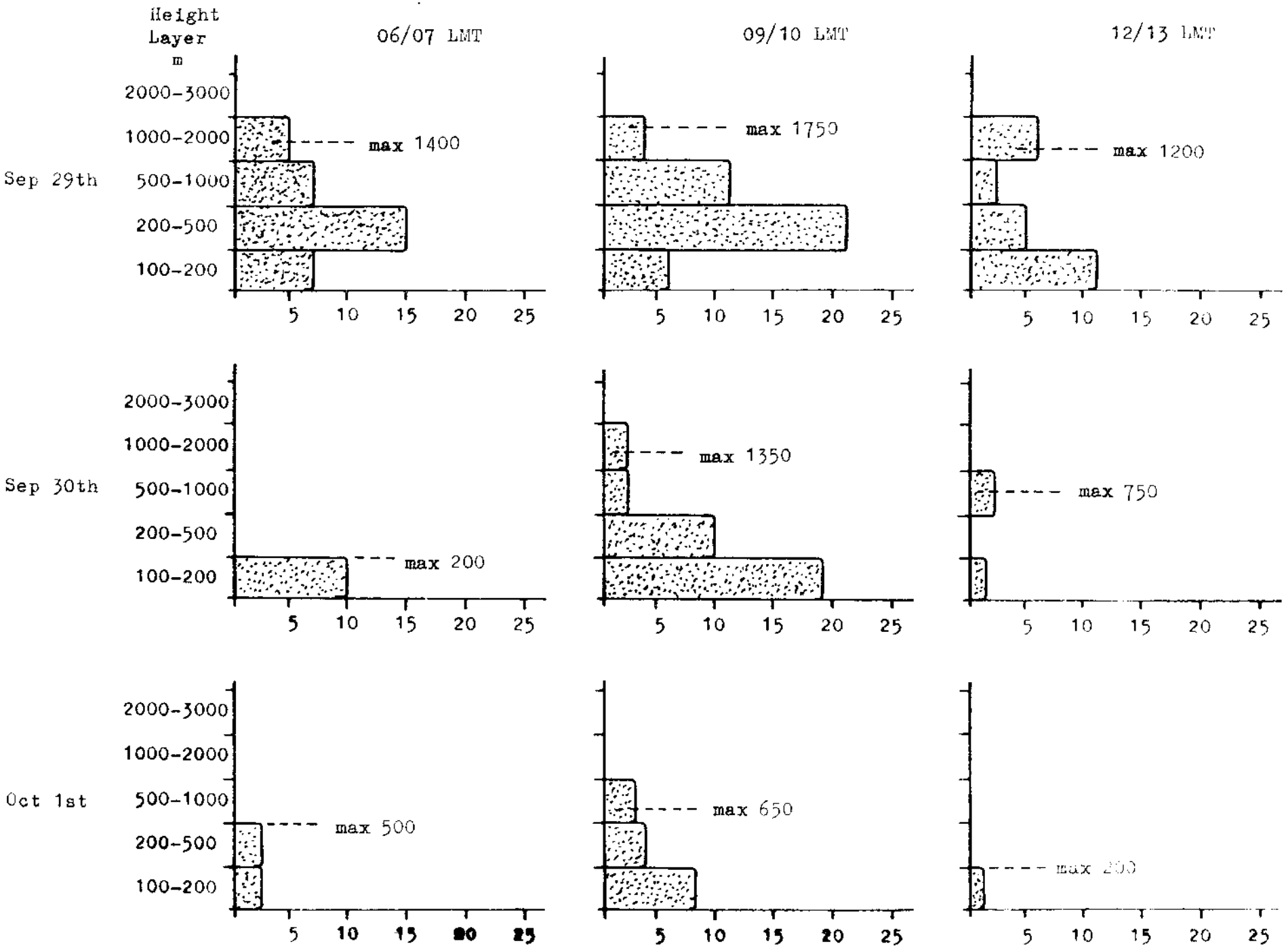






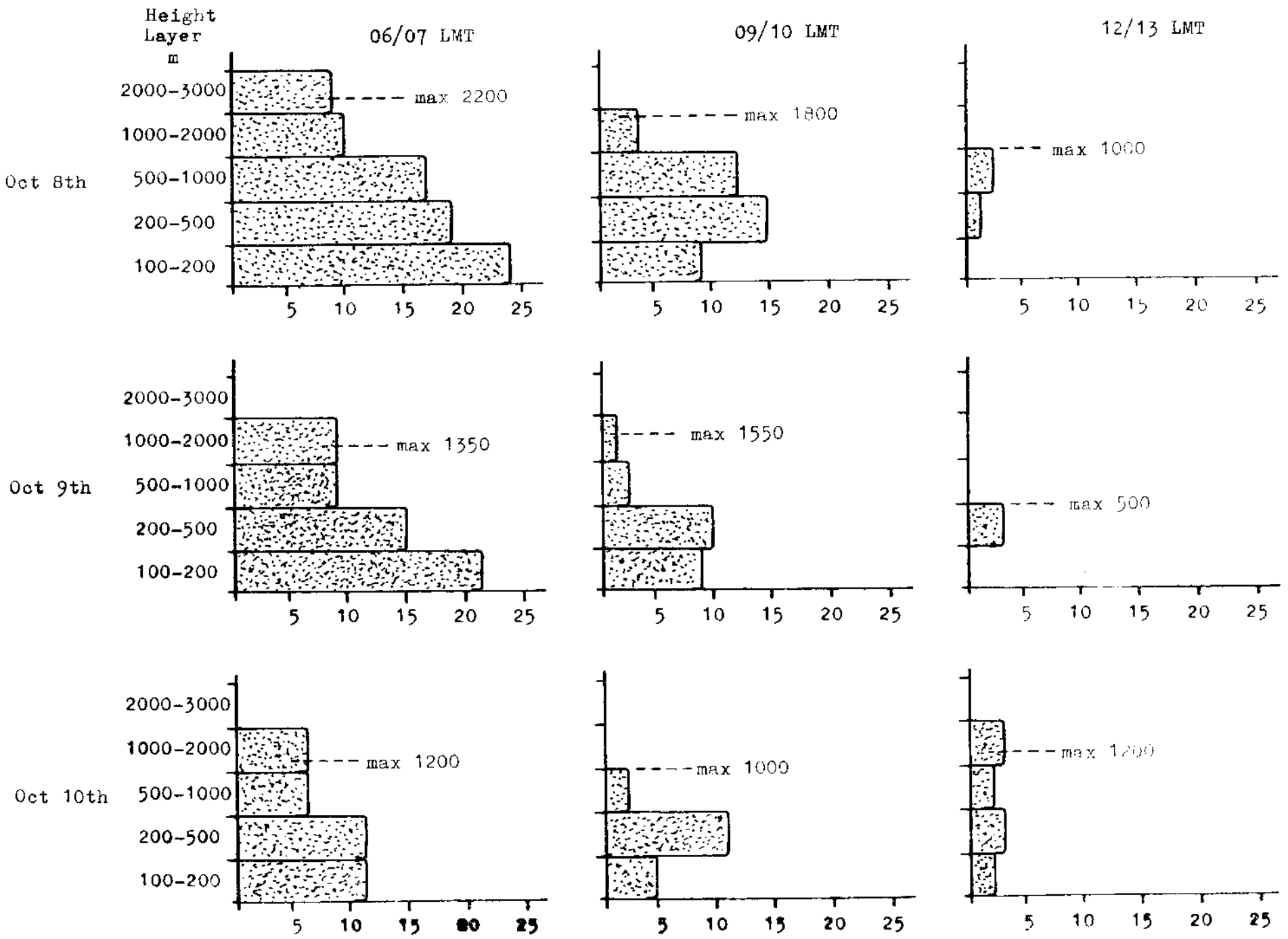


Number of echoes per 100 m and 25 km^2.

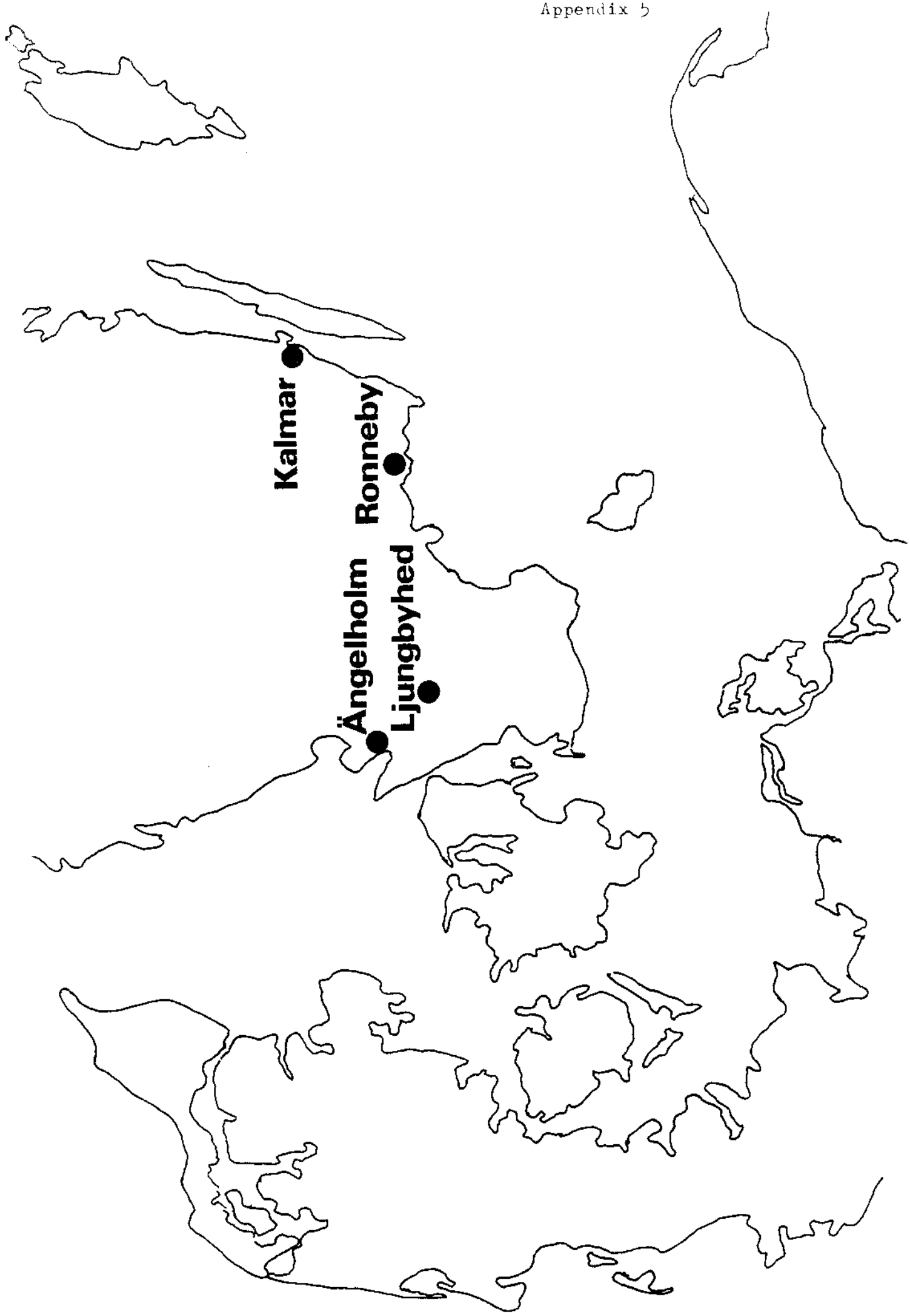


Appendix 3

Number of echoes per 100 m and 25 km^2.



Appendix 4


Kalmar
Ronneby
Ängelholm
Ljungbyhed