Determining the Limiting Magnitude

For a beginning amateur astronomer, there are three categories that the sky conditions can be rated: good, bad, and something in between. These are OK until you attempt to compare different nights, possibly months apart. What is needed is a method that is more objective, and to some degree measureable.

What is Limiting Magnitude?

A measure of a star's relative dimness is called it's magnitude. The brightest stars are near magnitude zero (a few are even negative.) Stars can be easily seen in suburban skies down to 4th magnitude, and at dark sites, down to greater than 6th magnitude with the naked-eye. The limiting magnitude is the magnitude of the faintest star that can be seen. This would be easy if we could figure out which star was the faintest. Unfortunately faint stars are not in any order in the sky and comparing two faint stars that are some distance apart is very difficult. The method presented here has the benefit of working around this problem, yet being easy enough for a beginner.

The method for determining the limiting magnitude is from the International Meteor Organization's *Handbook for Visual Meteor Observers*. The tables are from the 1995 edition of that book.

Determining the Limiting Magnitude

The procedure for determining the limiting magnitude to very simple. Look at the charts and find one or more numbered starfields in the area of they sky you are using. Then find the starfield in the sky and count the number of stars you see within it (and yes, count the corner stars too.) Write down the number of the starfield and the number of stars. Later you can look-up the limiting magnitude for the starfield using the tables on pages 180–1. It's that simple.

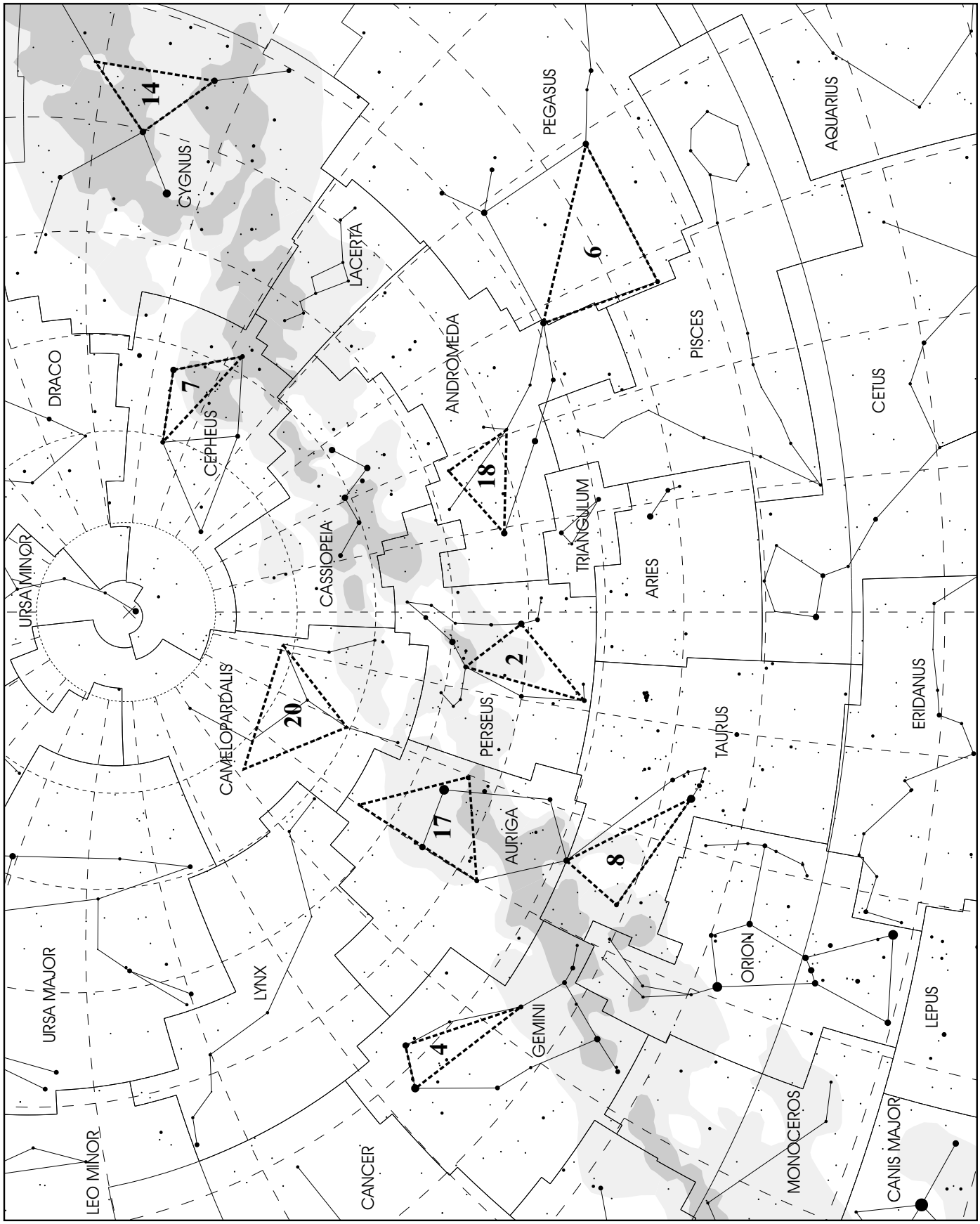
Things to Remember

There are a few things to remember about using this method. This method is observer specific. Other observers may have different limiting magnitudes at the same observing session. This is normal. Items like observer alertness, whether glasses are needed, dark adaptation, age, and experience will all effect the limiting magnitude. Keep track of your own values. Eventually you will train your eye to see more.

The method laid out in the IMO's handbook is slightly different, basically, dealing with how these tables are used. *Be sure to read the instructions in the IMO handbook before recording meteor observations.*

Corner Stars of Limiting Magnitude Fields

Field	Corner Stars							
1	χ DRA	$-\zeta$ DRA	$-\delta$ DRA	$-\xi$ DRA				
2	β PER	$-\delta$ PER	$-\zeta$ PER					
3	23 UMA	$-\theta$ UMA	$-\beta$ UMA					
4	α GEM	$-\epsilon$ GEM	$-\beta$ GEM					
5	ζ AQL	$-\gamma$ AQL	$-\delta$ AQL					
6	α AND	$-\gamma$ PEG	$-\alpha$ PEG					
7	α CEP	$-\beta$ CEP	$-\delta$ CEP					
8	α TAU	$-\beta$ TAU	$-\zeta$ TAU					
9	α LEO	$-\beta$ LEO	$-\gamma$ LEO	$-\delta$ LEO				
10	α VIR	$-\zeta$ VIR	$-\gamma$ VIR					
11	α CRB	$-\gamma$ BOO	$-\alpha$ BOO					
12	α SER	$-\beta$ LIB	$-\delta$ OPH					
13	β LYR	$-\zeta$ LYR	$-\theta$ HER	$-\nu$ HER				
14	ϵ CYG	$-\eta$ CYG	$-\gamma$ CYG					
15	β DRA	$-\tau$ HER	$-\pi$ HER					
16	α CVN	$-\epsilon$ UMA	$-\eta$ UMA					
17	ϵ AUR	$-\theta$ AUR	$-\delta$ AUR					
18	μ AND	$-\gamma$ AND	$-\phi$ AND					
19	κ DRA	$-\alpha$ DRA	$-\beta$ UMI					
20	42 CAM	$-\beta$ CAM	$-\gamma$ CAM					
21	α PSA	-98 AQR	$-\delta$ AQR					
22	β LEP	$-\beta$ ORI	-53 ERI					
23	δ CRV	$-\gamma$ CRV	$-\epsilon$ CRV	$-\beta$ CRV				
24	β LIB	$-\gamma$ LIB	$-\sigma$ LIB	$-\alpha$ LIB				
25	α SCO	$-\epsilon$ SCO	$-\chi$ LUP					
26	γ TRA	$-\alpha$ TRA	$-\eta$ ARA	$-\alpha$ CEN				
27	β CEN	$-\alpha$ CRU	$-\gamma$ CRU					
28	β CAR	$-\epsilon$ CAR	$-\iota$ CAR					
29	γ HYD	$-\alpha$ HYD	$-\beta$ HYD					
30	α TUC	$-\alpha$ PAV	$-\epsilon$ PAV					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LACERTA
PEGASUS
AQUARIUS
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DRACO
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CEPHEUS
ANDROMEDA
PISCES
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TRIANGULUM
CASSIOPEIA
ARIES
URSA MINOR
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CAMELOPARDALIS
PERSEUS
TAURUS
ERIDANUS
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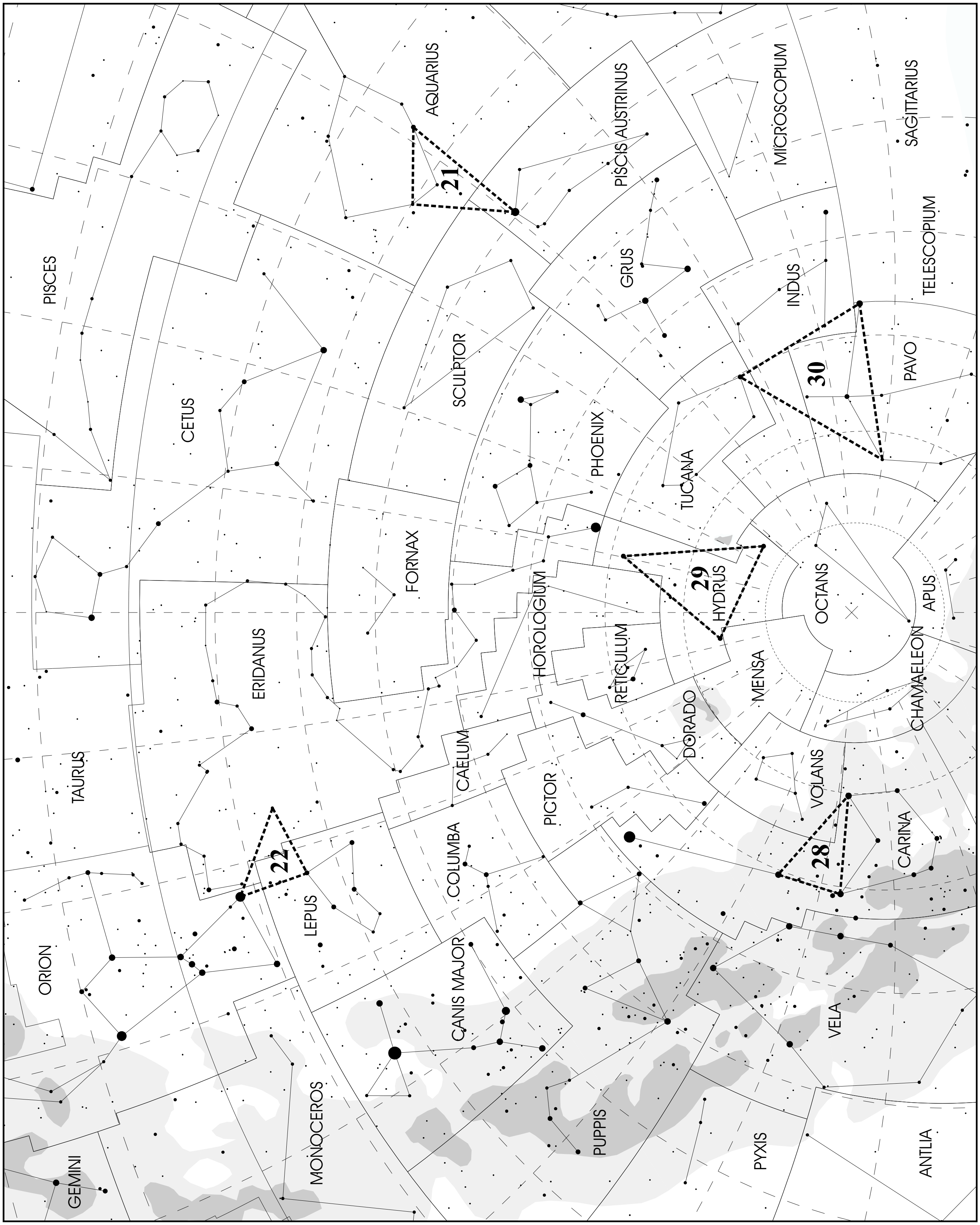
CANIS MAJOR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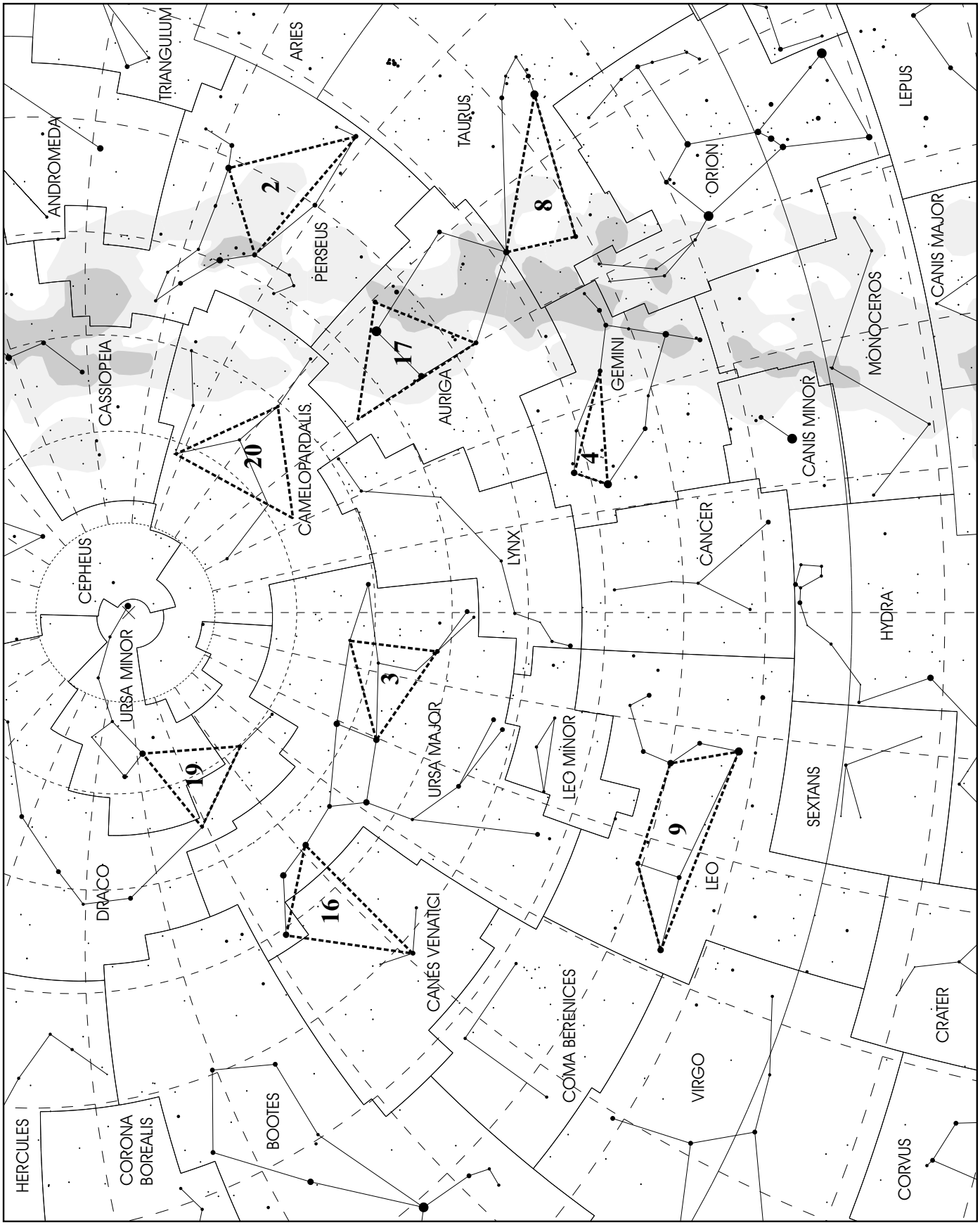
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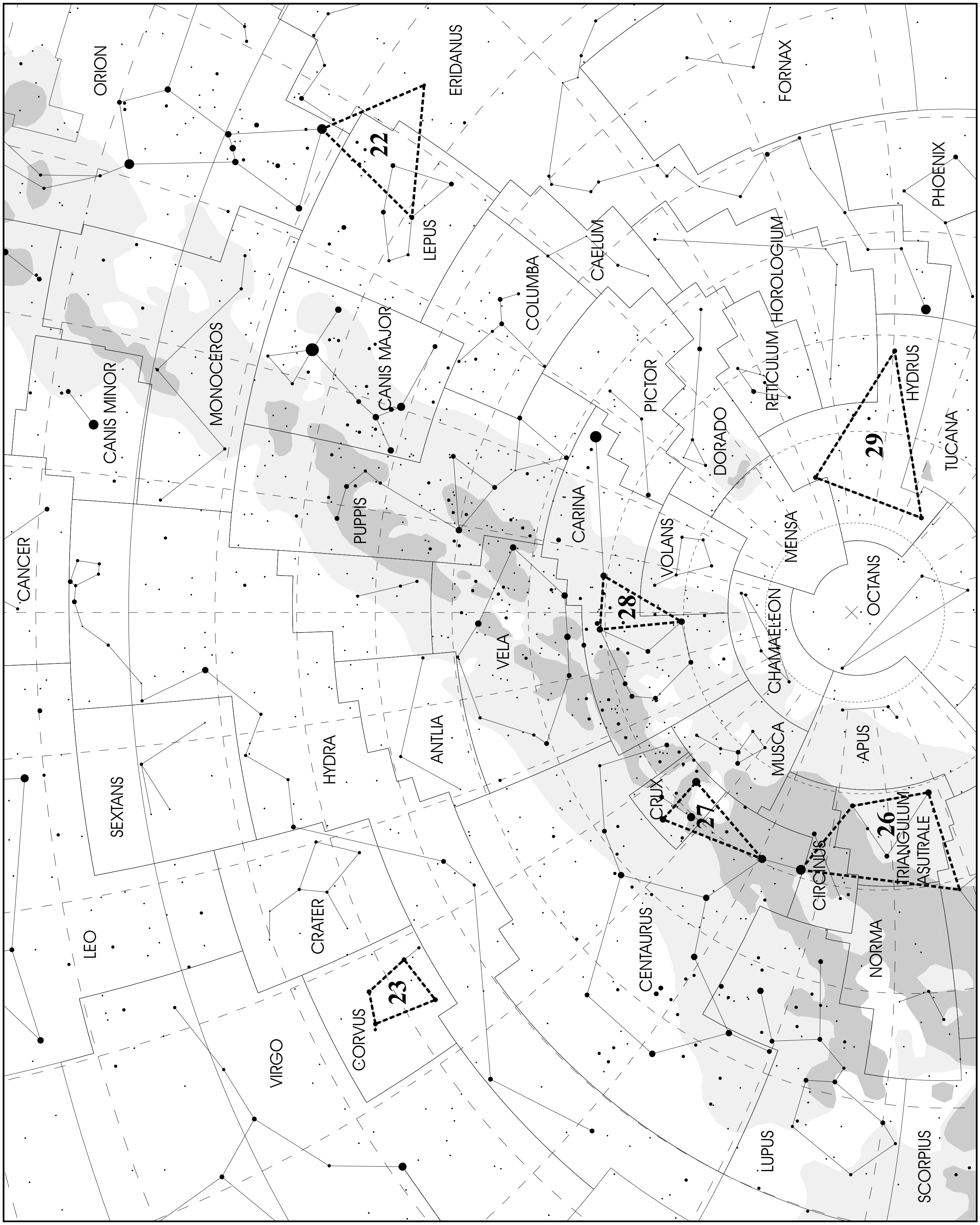
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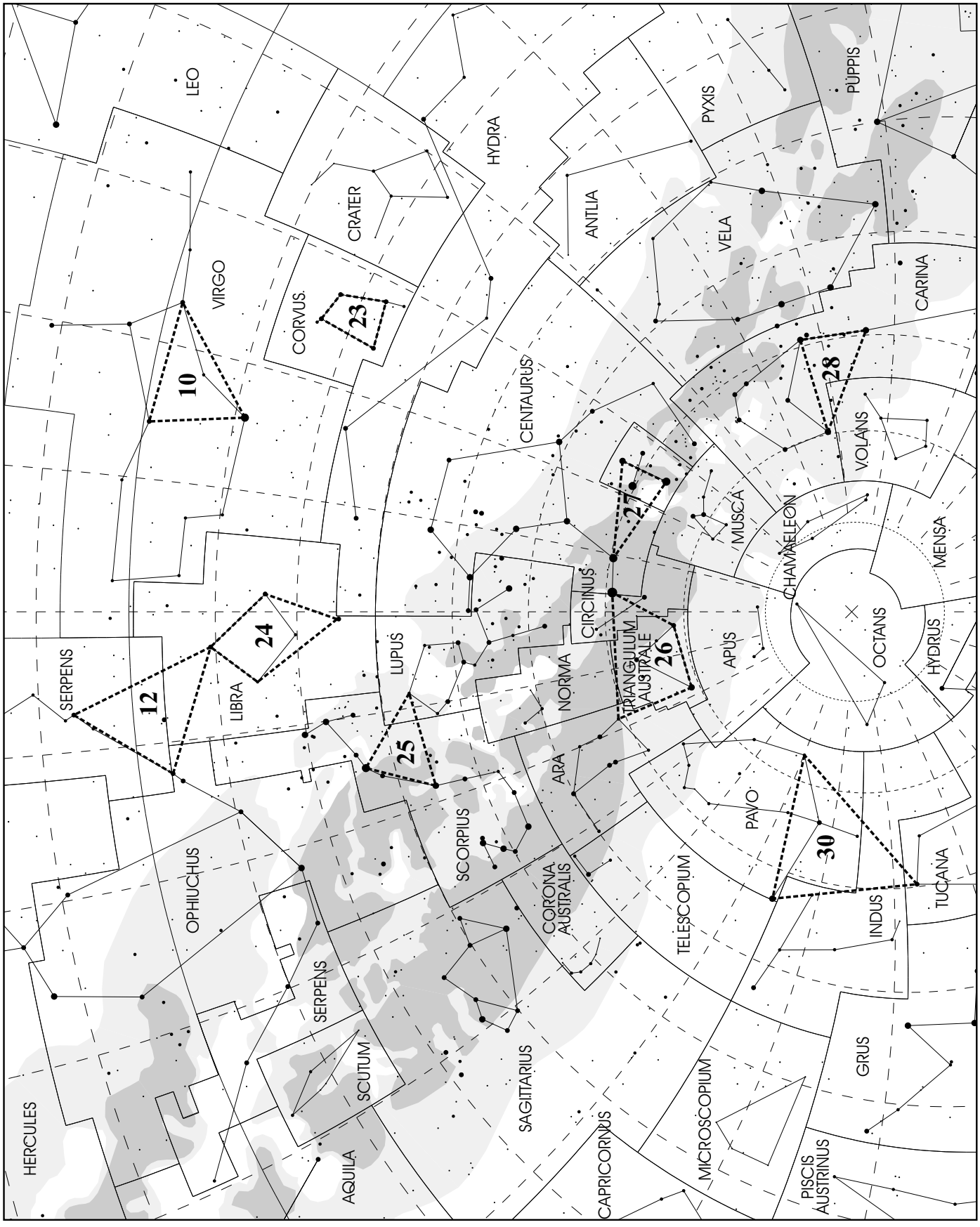
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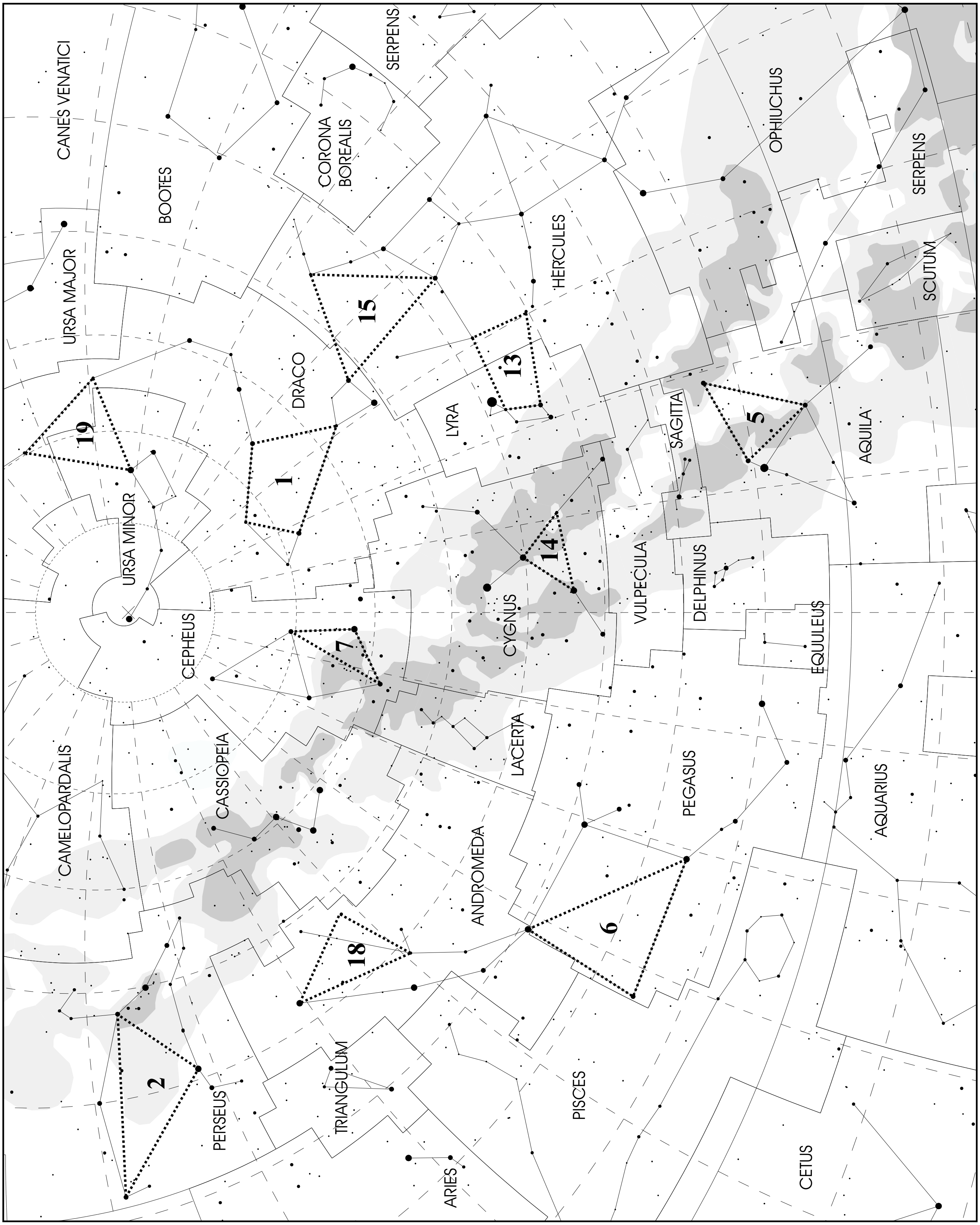
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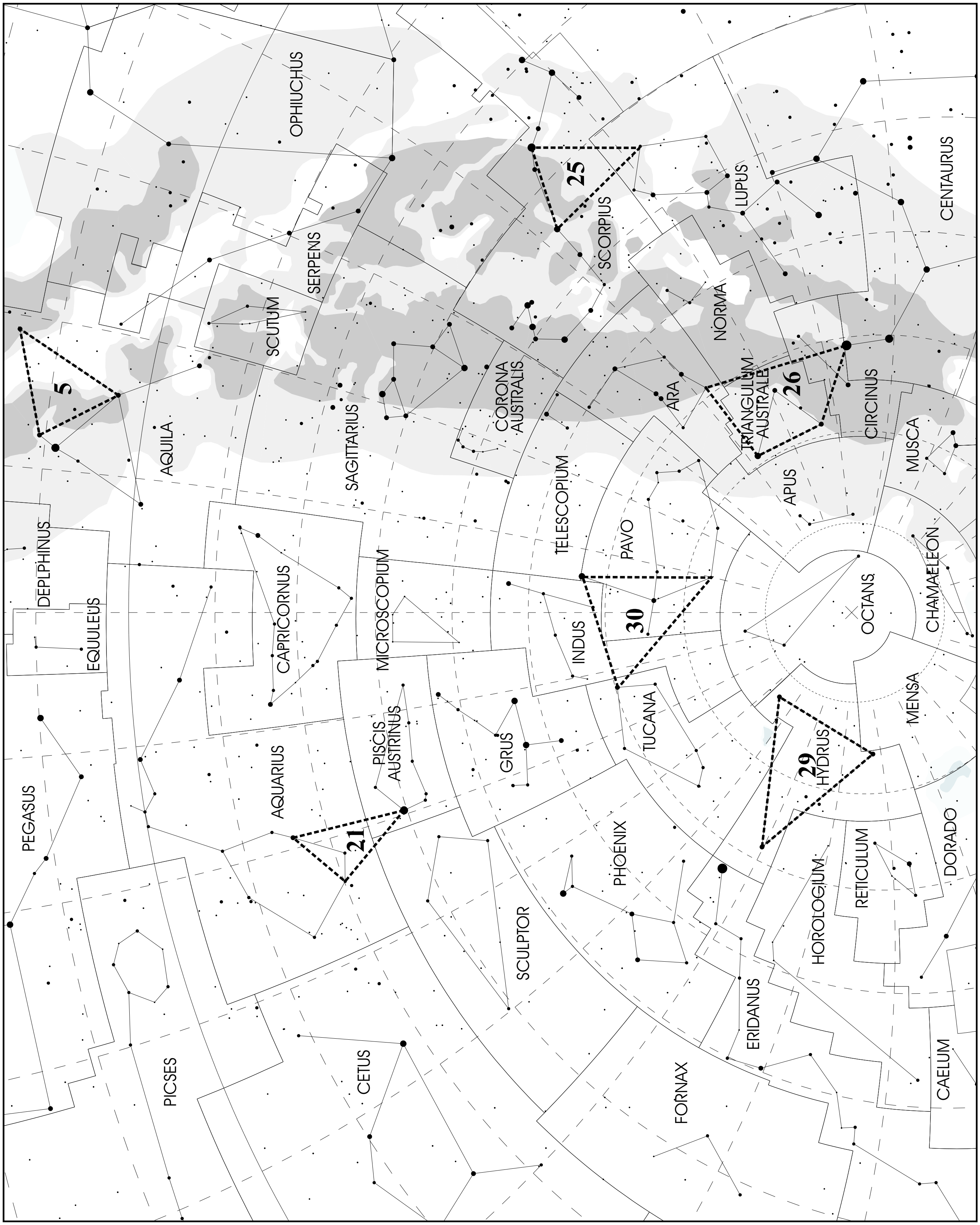
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Use these tables to look-up the limiting magnitude. After counting the number of stars you can see in the star field, look up the count (N) for that field to find the limiting magnitude (LM).

1		2		3		4		5		6		7		8		9		10	
N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM
5	4.2	6	5.0	5	4.5	5	4.3	4	4.6	4	4.7	3	4.0	4	4.7	7	4.4	4	4.5
6	4.9	7	5.1	6	4.6	6	5.0	5	5.1	5	5.2	4	4.5	5	4.8	8	5.0	5	5.8
8	5.0	8	5.4	7	4.8	7	5.1	6	5.2	6	5.4	5	4.6	7	5.1	11	5.6	7	5.9
9	5.2	10	5.6	8	5.2	8	5.3	7	5.4	7	5.7	7	4.9	8	5.3	13	5.7	8	6.0
10	5.3	11	5.7	9	5.4	9	5.6	8	6.0	8	5.9	8	5.2	9	5.5	15	6.0	11	6.1
11	6.0	12	5.8	11	5.7	10	5.7	10	6.2	9	6.2	10	5.4	10	5.9	18	6.1	12	6.4
12	6.1	13	6.0	13	5.8	11	5.9	11	6.4	12	6.3	12	5.5	11	6.0	20	6.3	15	6.5
15	6.3	14	6.1	14	6.0	12	6.1	12	6.5	14	6.4	13	5.9	12	6.1	21	6.4	16	6.7
16	6.4	15	6.2	15	6.1	13	6.2	13	6.6	17	6.5	14	6.0	15	6.2	24	6.6	17	6.8
17	6.5	17	6.3	16	6.2	14	6.3	19	6.9	20	6.6	15	6.1	16	6.3	25	6.7	19	7.0
18	6.6	20	6.4	17	6.3	15	6.4	22	7.0	25	6.7	17	6.2	17	6.4	29	6.9	22	7.1
20	6.7	23	6.6	18	6.4	16	6.5	24	7.1	29	6.8	18	6.3	20	6.5	32	7.0	23	7.2
23	6.8	26	6.7	19	6.5	18	6.6	25	7.2	30	6.9	20	6.4	21	6.6	34	7.1	25	7.3
28	6.9	27	6.8	20	6.6	20	6.7	26	7.3	33	7.0	22	6.5	23	6.7	38	7.2	26	7.4
34	7.0	29	6.9	23	6.7	22	6.9	27	7.4	35	7.1	23	6.8	26	6.8	40	7.3	31	7.5
41	7.1	31	7.0	25	6.8	23	7.0			40	7.2	26	6.9	28	6.9	44	7.4		
46	7.2	35	7.1	27	6.9	25	7.2			43	7.3	33	7.0	29	7.0	45	7.5		
55	7.3	42	7.2	29	7.0	26	7.3			46	7.4	41	7.1	31	7.4				
60	7.4	44	7.3	33	7.1	30	7.5			49	7.5	48	7.2	32	7.5				
73	7.5	54	7.4	37	7.2							49	7.3						
		59	7.5	44	7.3							57	7.4						
				49	7.4							65	7.5						
				54	7.5														

11		12		13		14		15		16		17		18		19		20	
N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM
6	4.5	6	5.2	2	4.0	3	4.0	4	4.9	4	4.6	6	4.2	3	4.2	4	5.2	1	4.2
7	4.7	7	5.3	4	4.3	4	4.8	5	5.1	5	5.1	8	4.6	4	4.3	5	5.4	2	4.4
9	4.9	9	5.4	5	4.5	6	4.9	6	5.5	6	5.7	9	5.1	6	5.0	6	5.7	4	4.7
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14	5.8	17	6.5	12	5.9	12	5.7	18	6.3	13	6.3	14	6.1	11	5.7	14	6.7	9	5.8
17	5.9	19	6.7	13	6.0	13	5.9	21	6.4	14	6.4	16	6.2	12	5.9	15	6.8	10	6.9
19	6.0	20	6.8	15	6.1	14	6.0	22	6.6	17	6.6	17	6.3	13	6.1	16	7.0	13	6.0
21	6.1	22	6.9	16	6.2	15	6.1	26	6.7	19	6.8	20	6.4	14	6.3	17	7.1	15	6.1
23	6.2	23	7.0	17	6.3	16	6.2	32	6.9	22	6.9	26	6.5	17	6.4	18	7.2	16	6.2
25	6.3	24	7.1	18	6.5	18	6.3	33	7.0	24	7.0	30	6.6	18	6.5	21	7.3	18	6.3
27	6.4	30	7.2	20	6.8	20	6.4	35	7.1	26	7.1	35	6.7	24	6.6	28	7.4	23	6.4
30	6.5			23	6.9	24	6.5	38	7.2	27	7.2	37	6.8	27	6.7	32	7.5	28	6.6
32	6.6			27	7.0	28	6.6	48	7.3	28	7.3	41	6.9	31	6.9			33	6.7
36	6.7			32	7.1	32	6.7	54	7.4	33	7.4	44	7.0	33	7.0			37	6.8
39	6.8			36	7.2	34	6.8	61	7.5	36	7.5	50	7.1	37	7.2			45	6.9
45	6.9			42	7.3	36	6.9					55	7.2	41	7.3			50	7.0
52	7.0			43	7.4	41	7.0					60	7.3	46	7.4			56	7.1
55	7.1			52	7.5	46	7.1					68	7.4	52	7.5			60	7.2
60	7.2					49	7.2					81	7.5					67	7.3
69	7.3					54	7.3											74	7.4
73	7.4					61	7.4											82	7.5
86	7.5					65	7.5												

21		22		23		24		25		26		27		28		29		30	
N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM	N	LM
4	4.0	5	4.3	6	5.2	5	4.5	4	4.0	7	4.1	5	4.6	4	4.0	4	4.1	5	4.0
5	4.5	6	4.4	7	5.8	7	5.2	5	5.2	8	4.9	6	4.7	5	5.4	5	4.7	6	4.2
6	4.7	7	4.5	8	6.0	8	5.6	6	5.6	12	5.1	7	5.8	6	5.5	6	4.8	7	4.8
7	5.6	8	4.8	9	6.4	9	5.7	7	6.0	14	5.2	9	6.2	7	5.8	7	5.0	8	4.9
8	5.7	9	5.5	10	6.5	11	5.8	8	6.1	15	5.3	11	6.4	8	6.4	8	5.6	9	5.1
9	6.0	13	5.7	11	6.9	12	6.0	9	6.2	17	5.5	14	6.7	10	6.5	9	5.7	10	5.2
10	6.4	15	6.0	13	7.3	13	6.1	10	6.3	18	5.7	15	6.8	14	7.0	10	6.4	11	5.4
11	6.5	16	6.2	14	7.4	14	6.2	11	6.6	22	5.8	17	7.0	15	7.2	11	6.5	12	5.6
14	6.8	17	6.3	17	7.5	16	6.3	12	6.9	24	5.9	18	7.1	16	7.3	13	6.6	13	5.7
15	7.0	18	6.4			17	6.6	14	7.0	31	6.2	19	7.2	17	7.4	17	6.7	14	5.8
18	7.4	19	6.5			19	6.7	15	7.1	32	6.3	22	7.4	18	7.5	20	6.9	15	5.9
20	7.5	21	6.6			20	6.8			34	6.4					23	7.0	16	6.2
		22	6.7			21	6.9			37	6.5					24	7.1	18	6.3
		23	6.8			24	7.0			38	6.6					26	7.2	19	6.4
		24	6.9			26	7.1			40	6.7					29	7.5	20	6.5
		25	7.2			27	7.3			42	6.8							22	6.6
		27	7.3			30	7.4			43	6.9							23	7.0
		29	7.4			31	7.5			44	7.0							28	7.1
										46	7.1							31	7.3
										49	7.2							32	7.5
										50	7.4								
										51	7.5								