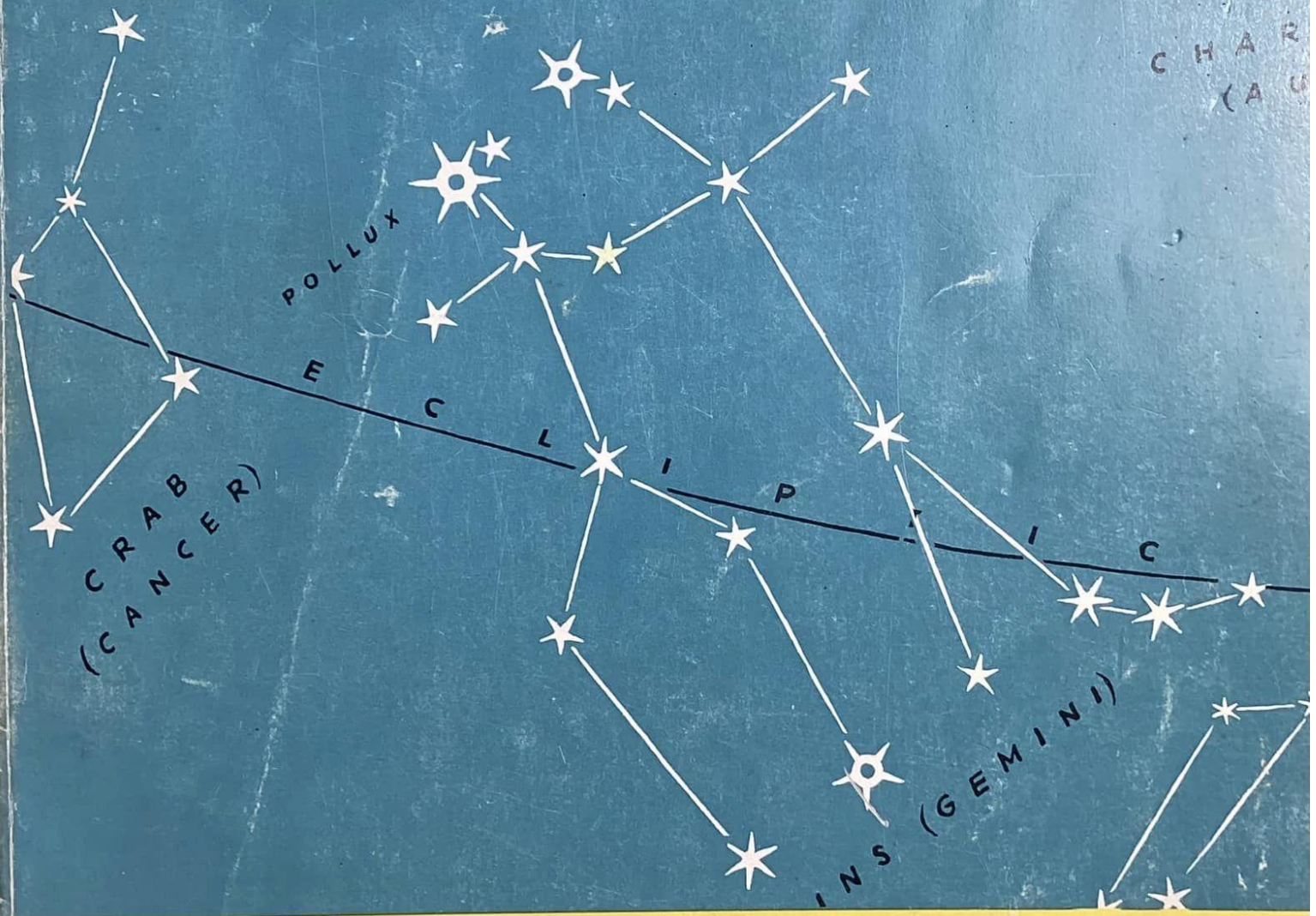


H. A. REY

# The Stars

A NEW WAY TO SEE THEM

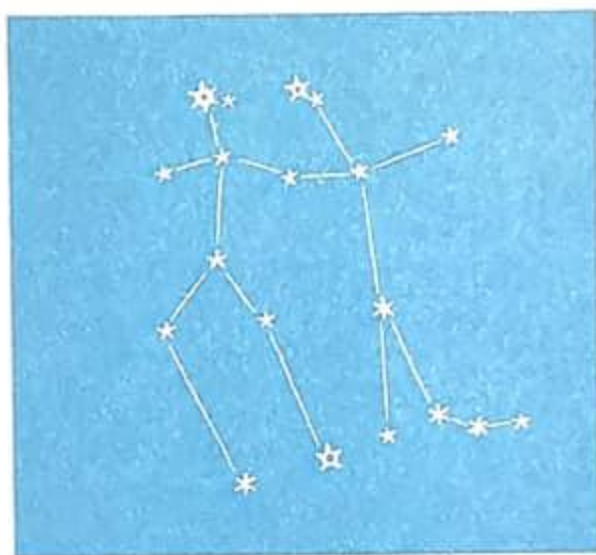


ENLARGED *World-Wide* EDITION

PROCYO

# THE STARS

A NEW WAY TO SEE THEM



by

H. A. REY

ENLARGED WORLD-WIDE EDITION

HOUGHTON MIFFLIN COMPANY, BOSTON

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**T**HE space age is upon us. Rockets are leaving our globe at speeds unheard of only a few years ago, to orbit earth, moon, and sun. People have visited the moon, we have sent space probes to all but one of the planets, and words like “orbit” and “satellite” are picked up by children in the nursery.

And how has all this affected the age-old pleasure of watching the starry sky? Has it made stargazing obsolete?

It has not, and it never will. For we live on this earth and always shall. After the day is gone we shall go out, breathe deeply, and look up—and there the stars will be, unchanged, unchangeable. Even from the moon or Mars, or from Pluto, the outermost planet, the stars look the same as they do from the earth.

Night after night they are there. And night after night they arouse our curiosity, our urge for knowledge.

Stone age or space age, man will be asking the question his grandparents have asked before him and his grandchildren will ask after him: “What star is that?”



# CONTENTS

	PAGE
PART 1      SHAPES IN THE SKY	9
PART 2      MEET THE CONSTELLATIONS	26
PART 3      THE STARS THROUGH THE YEAR	66
PART 4      SOME WHYS AND HOWS	108
INDEX-GLOSSARY	151
UNIVERSAL SKY CHART	157

PART I  
SHAPES IN THE SKY

## PART ONE

### SHAPES IN THE SKY

**T**HIS BOOK is meant for people who want to know just enough about the stars to be able to go out at night and find the major constellations, for the mere pleasure of it.

Of course one can enjoy the stars without knowing them. But if you know them at least a little the pleasure is infinitely greater. It is fun to watch them announce the seasons, to see them rise at the expected times and places and follow their paths year in, year out, more reliable than anything else.

Besides, if you know the stars you are not easily lost. They tell you the time and direction on land, on sea, and in the air, and this can be valuable on many occasions.



And should you venture into outer space, anywhere in the solar system, where no earthly landmarks exist, the constellations would be your only guideposts, and familiar ones, too.

In short, to be familiar with the stars is both enjoyable and useful, and most of us would like to know them. The trouble is, few of us do.

This is odd. We do not look at the atlas often but we have no difficulty pointing out the fifty states. We can see the stars any clear night, ready to be studied and a challenge to our curiosity, yet hardly any of us can point out fifty constellations.

Not that we don't try. At one time or another we make an effort and begin to study a book about the stars but few of us ever get beyond knowing the Big Dipper.



There are, of course, plenty of books about the subject, and they do very well in most respects. But in one important point they seem to fail us: *the way they represent the constellations*.

The constellations have such intriguing names—somehow we expect the books to show us groups of stars in the shape of a Lion, a Whale, a Virgin, and so forth. But they show nothing of that sort.

Some books show, arbitrarily drawn around the stars, elaborate allegorical figures which we cannot trace in the sky (see figure 2). Others, most of the modern ones, show the constellations as involved geometrical shapes which don't look like anything and have no relation to the names (see figure 3). Both ways are of little help if we want to find the constellations in the sky—yet this is precisely what we are after.

The result is that for most of us the constellations never come to life, and the sky remains as unfamiliar as before. Discouraged, we give up.



## TWINS, BEARS AND WHALES

This book sets out to remedy the situation. It shows the constellations in a new, graphic way, as shapes which suggest what the names imply: it shows the group of stars known as the Great Bear, in the *shape* of a bear; the Whale in the shape of a whale; the Eagle as an eagle, and so on. These shapes are easy to remember, and once you remember them you can retrace them in the sky.

In addition, the English names for the constellations are used throughout the book. In most books only the Latin and Greek names are used but words like *Taurus*, *Boötes*, or *Cygnus* mean little unless you are something of a linguist, while *Bull*, *Herdsman*, or *Swan* immediately evoke an image.<sup>1</sup>

The following illustrations show the new method and the ones used so far. Take for instance the TWINS (Gemini):



Figure 1: The Twins—A Group of Stars

These are the stars which make up the constellation as you see them in the sky, some bright, some faint, an irregular group.

<sup>1</sup> Many nations use native names for the constellations in popular books on the stars—the French, Germans, Italians, Russians, to mention a few with high standing in astronomy. They reserve Latin names for technical works. It's sensible to start with the familiar. If you want the Latin and Greek names, you find them all on pages 30–62, on the list on page 157, and in the index.

The books and charts which use allegorical drawings show the Twins like this:



Figure 2: The Twins—Allegorical

This may look decorative but the drawing has little to do with the stars. You cannot see it in the sky. It is confusing rather than helpful.

The books which use geometrical figures show the Twins somewhat like this:

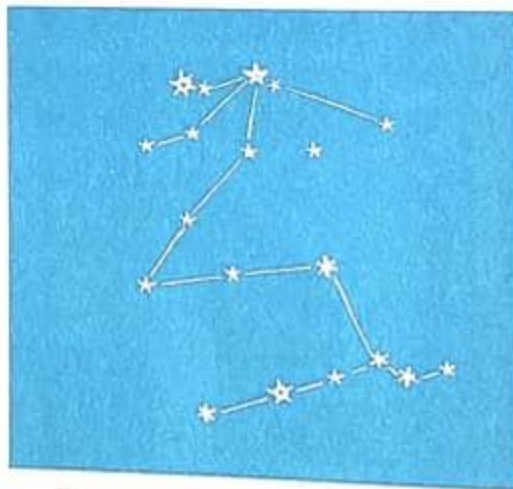


Figure 3: The Twins—Geometrical

This looks at least rational. No fancy frills. But it is a hieroglyph without a meaning. It certainly does not suggest twins. You lose track when you try to trace it in the sky, and to remember such a shape is next to impossible.

This book, which uses the new, graphic way, shows the Twins like this:

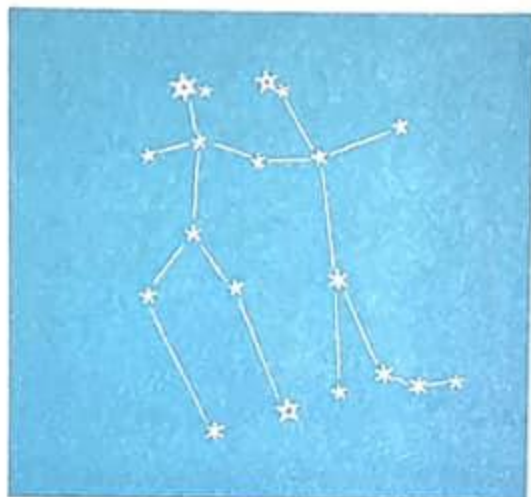


Figure 4: The Twins—Graphic

The connecting lines between the stars are drawn with a definite shape in mind, the shape which the name of the constellation suggests. The stars are exactly the same as on the other three drawings. Check them: their correct position has not been tampered with. But now the shape has a meaning: you see two matchstick men holding hands—the *Twins*. You can trace them in the sky, first with the help of the chart, and later from memory.

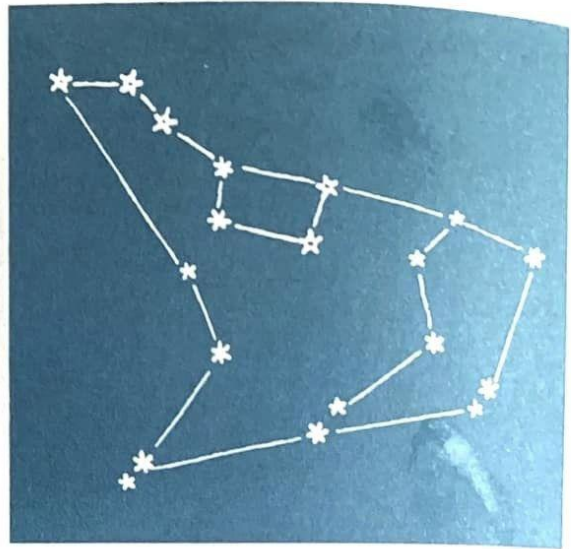
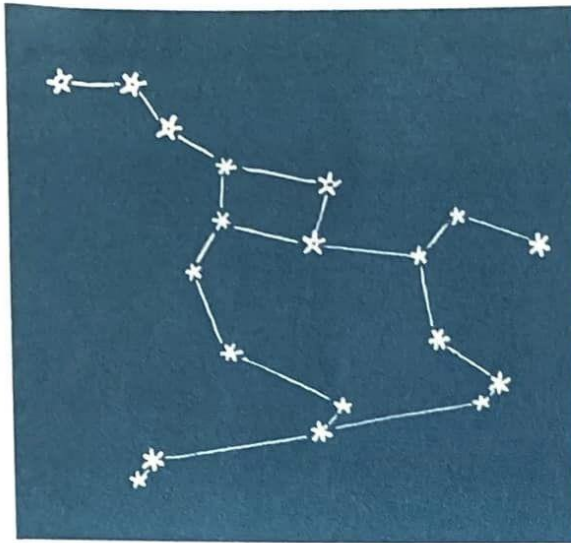
This graphic method has been employed throughout the book for all constellations where it was possible. Only a few—those with just two or three stars—could not be brought into a fitting shape, for obvious reasons. You can't have everything, even from the stars.

On the following two pages a few more examples are given comparing the old and the new way.

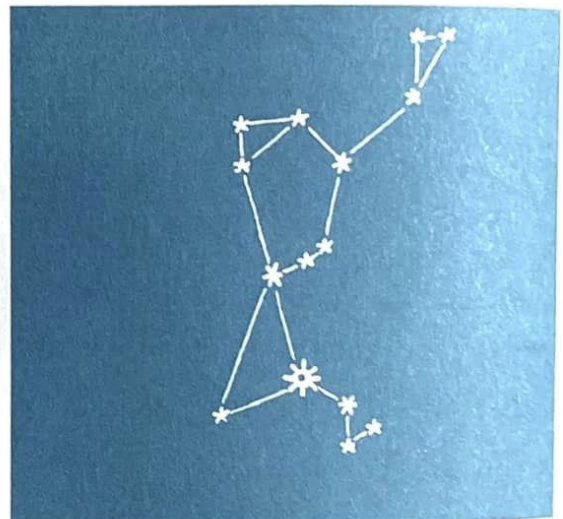
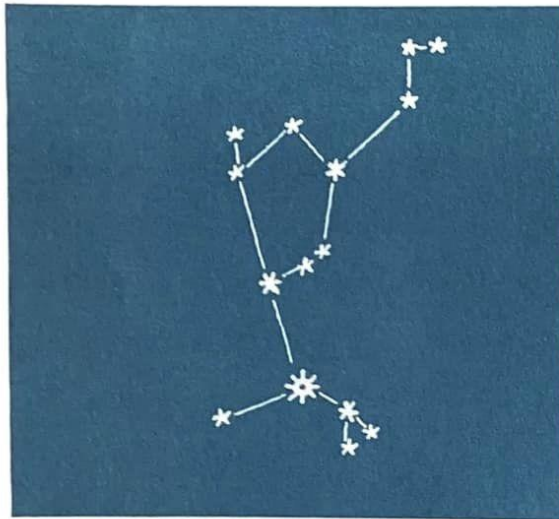
THE OLD WAY

THE NEW WAY

GREAT BEAR  
(Ursa Major)



HERDSMAN  
(Boötes) he's sit-  
ting and smoking  
a pipe



VIRGIN  
(Virgo)

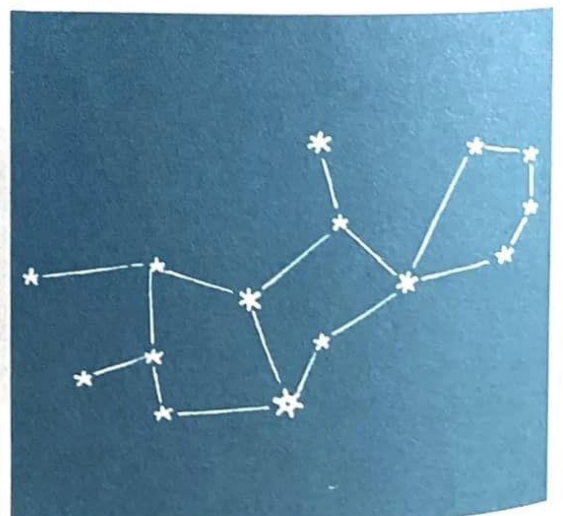
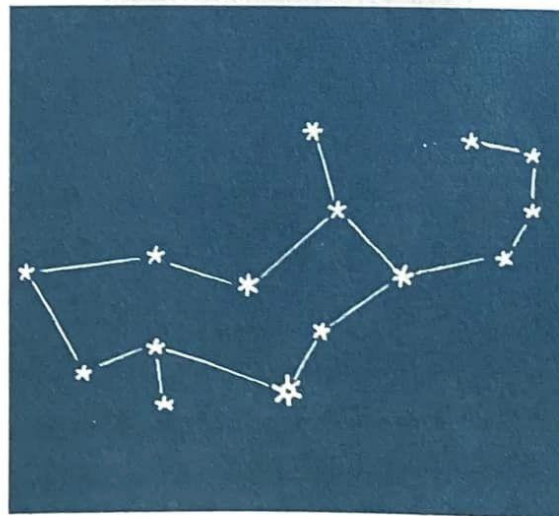
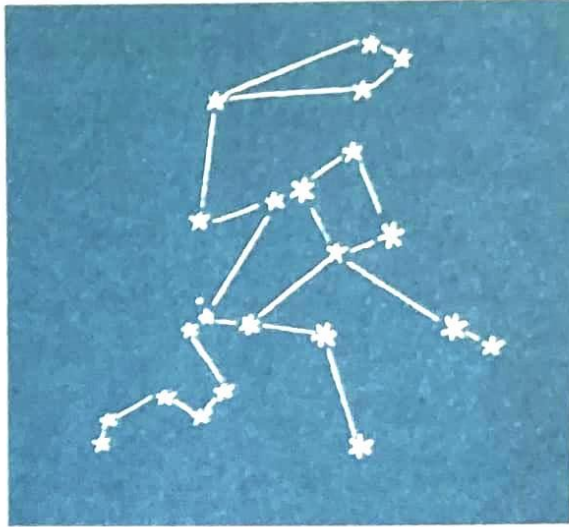
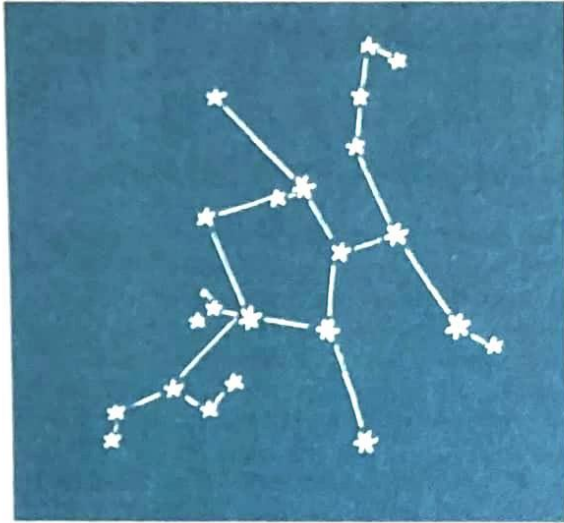


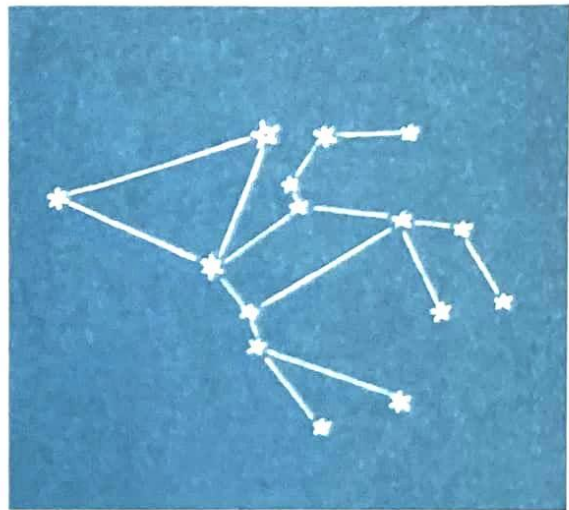
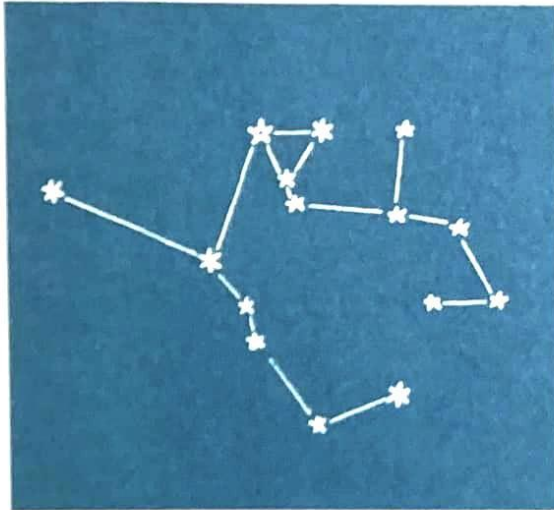
Figure 5: Old and New  
*The stars in both columns are identical; only the connecting lines are different.*

THE OLD WAY

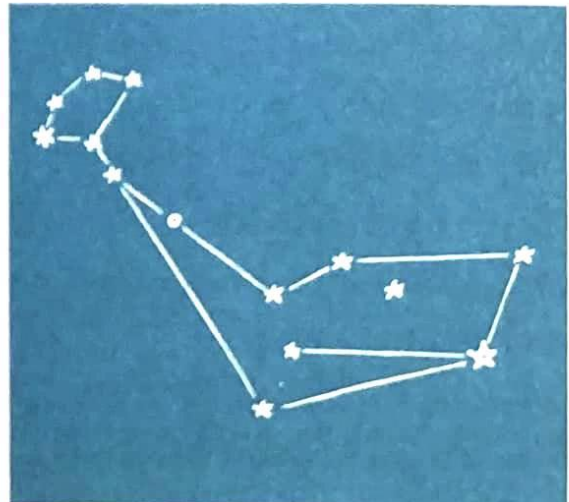
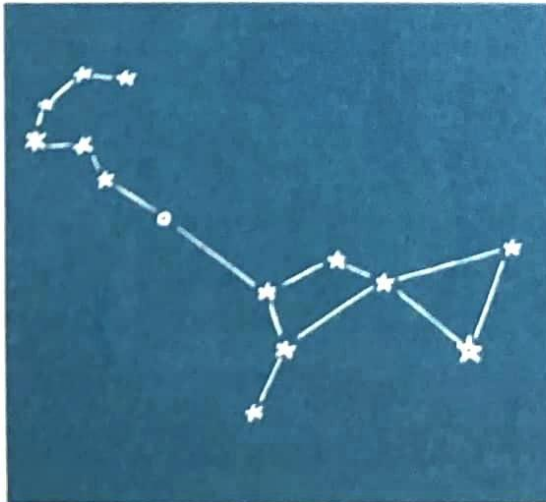
THE NEW WAY



HERCULES  
(man with club)



PEGASUS  
(the winged  
horse)



WHALE  
(Cetus)

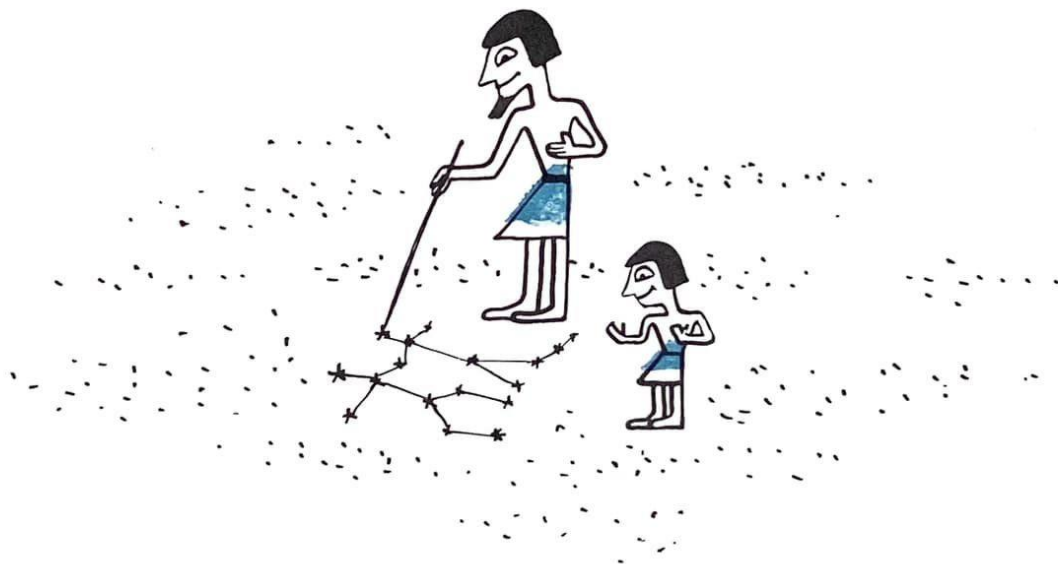
Figure 6: Old and New

*The stars in both columns are identical, only the connecting lines are different.*

It may even be that this new way is not so new after all.

The human eye *wants* to see shapes with a meaning. Even without intending to we see shapes of familiar things—people, animals, objects—in clouds, trees, and mountains. This is more than a pastime. It is a trend deeply rooted in the human mind, and we have good reason to believe that, long before recorded history began, man first found his way among the bewildering multitude of individual stars by *seeing figures* formed by star groups. Perhaps we are doing here precisely what he did.<sup>1</sup>

In Egypt and Mesopotamia where more than 5000 years ago most of our present constellations had their origin, and where no illustrated books existed for the common



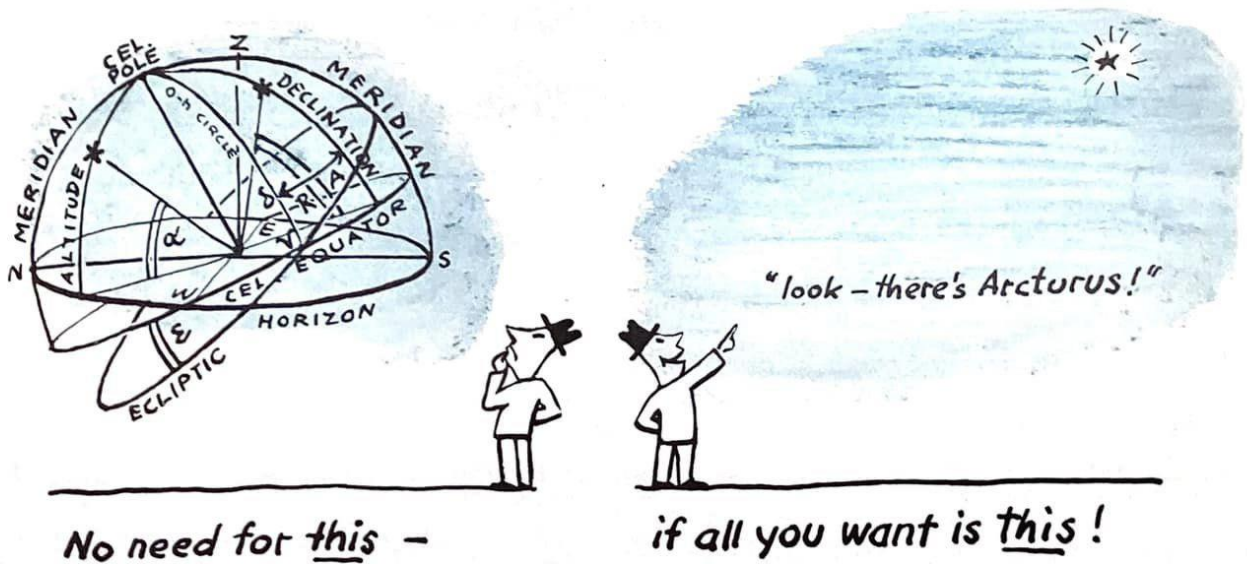
reader, parents may have taught the stars to their children by drawing such figures in the sand with a stick.

But it does not matter whether they did or didn't. In past ages, men interpreted the sky after their fashion. We today are free to do likewise, and if the present interpretation makes things easier for those who want to know the stars, this book has fulfilled its purpose.

<sup>1</sup> A hint that our ancestors long ago *saw pictures* in the sky can be found in the fact that in all Germanic languages but English the word for constellation is literally "*star picture*": Swedish: Stjärnbild; Norwegian: Stjernebilde; Danish: Stjernebillede; Icelandic: Stjörnumerki; German: Sternbild; Dutch: Sterrenbeeld.

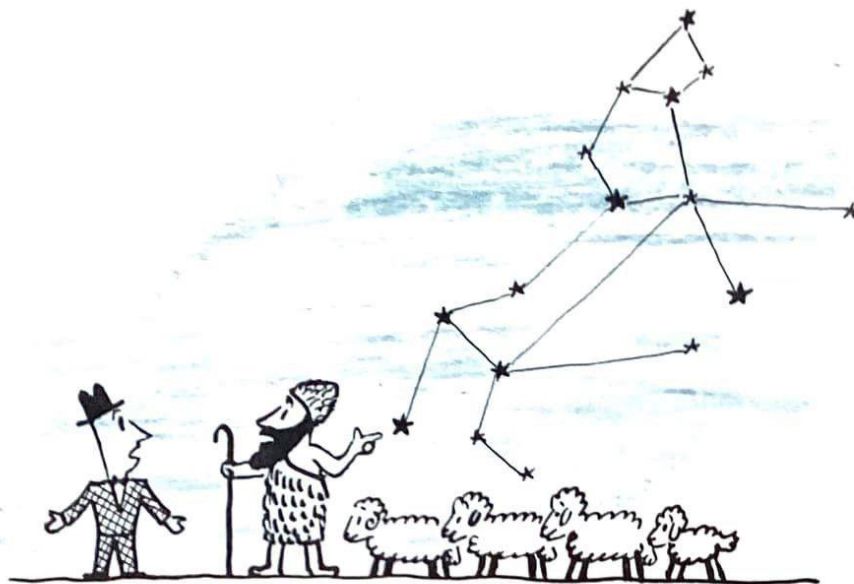
## FIRST STEPS AND PLAIN FACTS

**NO MATHEMATICS REQUIRED:** This is a practical book, to be used outdoors. We shall therefore limit ourselves at the start to pointing out merely *what* we can see and *where* and *when*. The *why's* can come later. If we started out with a discussion of the ecliptic, or why the sidereal day is about four minutes shorter than the solar day, your reaction might well be: Do I have to go through all this? All I want is to see the constellations! And you would be right. You can become so familiar with the stars that you can say after one glance at the sky: look, there's Arcturus! without going into mathematics or even without knowing that the earth is a globe and revolves around the sun.



A plain Chaldean shepherd, more than three thousand years ago, probably knew the sky better than most of our college graduates today, yet to him the earth was a flat disc and he probably believed that the stars were little lamps carried by special deities

across the solid ceiling of the sky vault every night, in strictly prescribed and never-changing formations.



*Why, stranger, you mean to say you don't know the LION?*

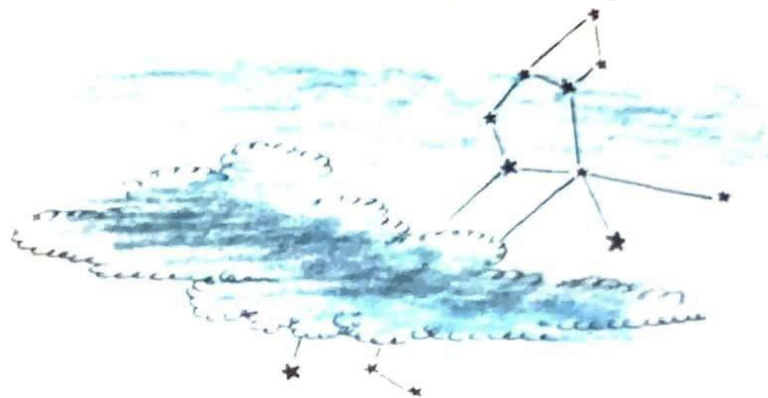
Only after we have done some stargazing or while we are at it do the questions of the *why* arise. Then will be the time to peruse the last part of this book—from page 107 onward—where some of those questions are briefly treated. However, if you want to go over those pages now, you are welcome to it. But don't be discouraged if all does not become clear at one reading.

And now let us start with practical steps.

**GO OUT AND LOOK:** If you want to know the stars you have to go out as often as you can and look at the sky. Pick a spot where street lights, houses, or trees don't obstruct your view too much. If you live in the city, the roof of an apartment building makes a good observatory. Clear moonless nights are ideal for stargazing, of course, because the moon has a jealous way of blotting out all faint stars. But



such nights are rare, so don't wait for them. Even with some moonlight or a few clouds you can see a good number of stars. Try to make out some constellations even if they are only partly visible. Slight obstacles like these make the game only more entertaining, and it all helps to build up your acquaintance with the heavens.



**NO EQUIPMENT NEEDED:** You need no equipment. All you have to take along is this book and a *flashlight* so you can see the charts in the dark. It's a good idea to paint the glass of the flashlight *red* with nail polish (works beautifully) because red light will not blind your eyes for the stars as white light would.

Leave your compass at home. You can find *north* easily without a compass if you know the *Big Dipper*. If you don't, almost anybody can show it to you.

You won't need field glasses either. They are fine if you want to study individual objects—the moon, planets, a nebula—but they are not much help in spotting a whole constellation because they narrow your field of vision too much. Besides, the stars which make up the constellation figures in this book can all be seen with the naked eye if the night is clear and dark.

Another thing to leave at home is the notion that stargazing is difficult. It requires less mental effort than a medium-tough crossword puzzle and is at least as much fun.

**HOW MANY STARS?** People not familiar with the skies are apt to overestimate greatly the number of stars one can see, without glasses, on a clear night. Most will

guess that one can see scores of thousands but that's far off the mark. With the naked eye one sees *only about two thousand* at a time, under very best conditions. So if poets talk of millions of stars, they are either using a telescope or they exaggerate. That's their privilege and must be taken with a grain of salt.



Of course one does not have to know two thousand stars individually. They make up the constellations; that's all there is to it as far as the casual stargazer is concerned. But there are about thirty stars which are particularly bright or interesting. It is good to know those by name and to know where to find them: Sirius, Capella, Vega, for example, and also the *Pole Star* which we shall meet in a moment.

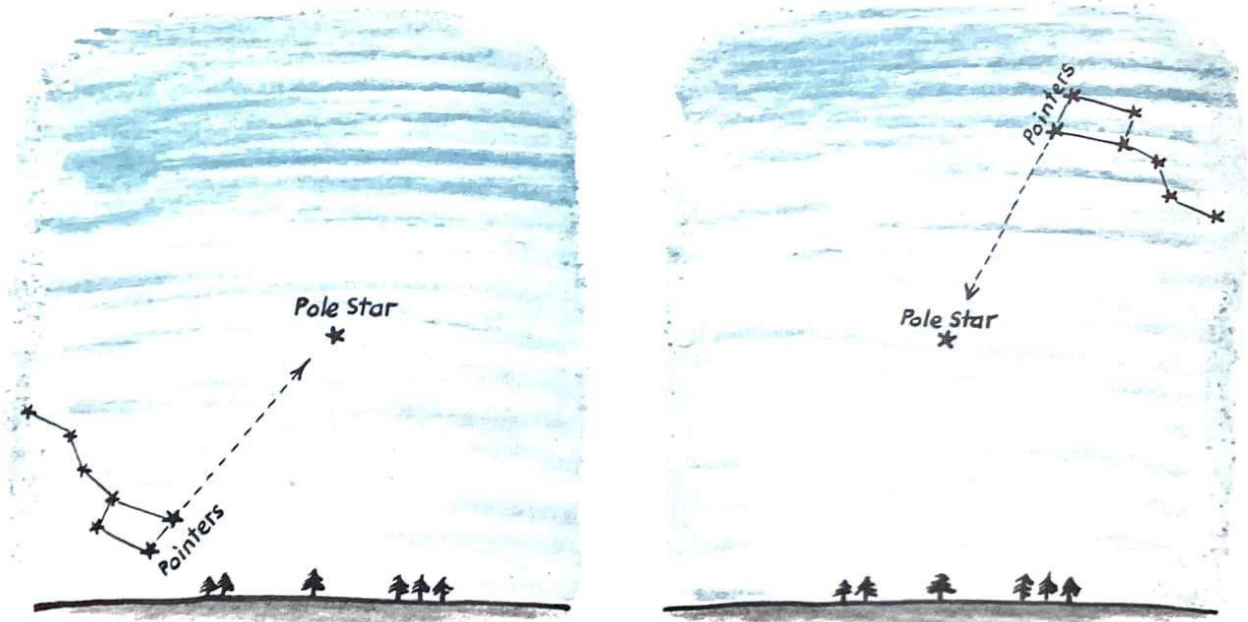
The number of constellations is not overwhelming either. There are only eighty-eight in the entire sky. About sixty can be seen in our latitudes<sup>1</sup> but we never see them all at once: only about two dozen are visible at any given moment. If you know *thirty constellations*, the more important ones, you have a good working knowledge of the sky. Make the acquaintance of two or three each time you go out and you will soon be familiar with all thirty.

The remaining constellations are mostly small and have no bright stars in them. They fill the chinks between the more important ones, and you will probably pick them up as you go along.

**FINDING NORTH AND THE POLE STAR:** To spot the constellations you have to take your bearings first. You find *north* without a compass with the help of the *Big Dipper*. Here is how: first you spot the Dipper; then you draw a line, in your imagination, between the two stars at the end of the bowl farthest from the handle.

<sup>1</sup> The only place where you can see all constellations is the equator, but even there you cannot see them all at once.

and prolong this line about 5 times, the way the sketch shows; this line will hit a fairly bright star: POLARIS, the Pole Star. You can't miss it: there are no bright stars near it. Those two stars in the Dipper's bowl are very logically called the POINTERS because they always point to the Pole Star.



*The Pointers always point to Pole Star, no matter how Dipper stands*

Figure 7: Dipper and Pole Star

Polaris is a very important star because of its unique location. It is almost exactly at the pole of the sky: the point around which the whole sky appears to be moving (we shall take up that motion in a moment), and the Pole Star therefore remains, practically, always at the same place in the sky: almost *exactly north* (hence it is also called North Star) and, at a latitude of about  $40^\circ$  north,<sup>1</sup> almost halfway up in the sky; half the way, that is, from the horizon to the point directly overhead, the *zenith*. If you face the Pole Star you are facing *north*, so to your right is *east*, to your left *west*, and right behind your back you have *south*, without the help of a compass.

<sup>1</sup> This is, roughly, the latitude of New York, Philadelphia, Indianapolis, Denver, and Salt Lake City. The farther north you are, the higher up the Pole Star will be, and the farther south, the lower. More about that later.

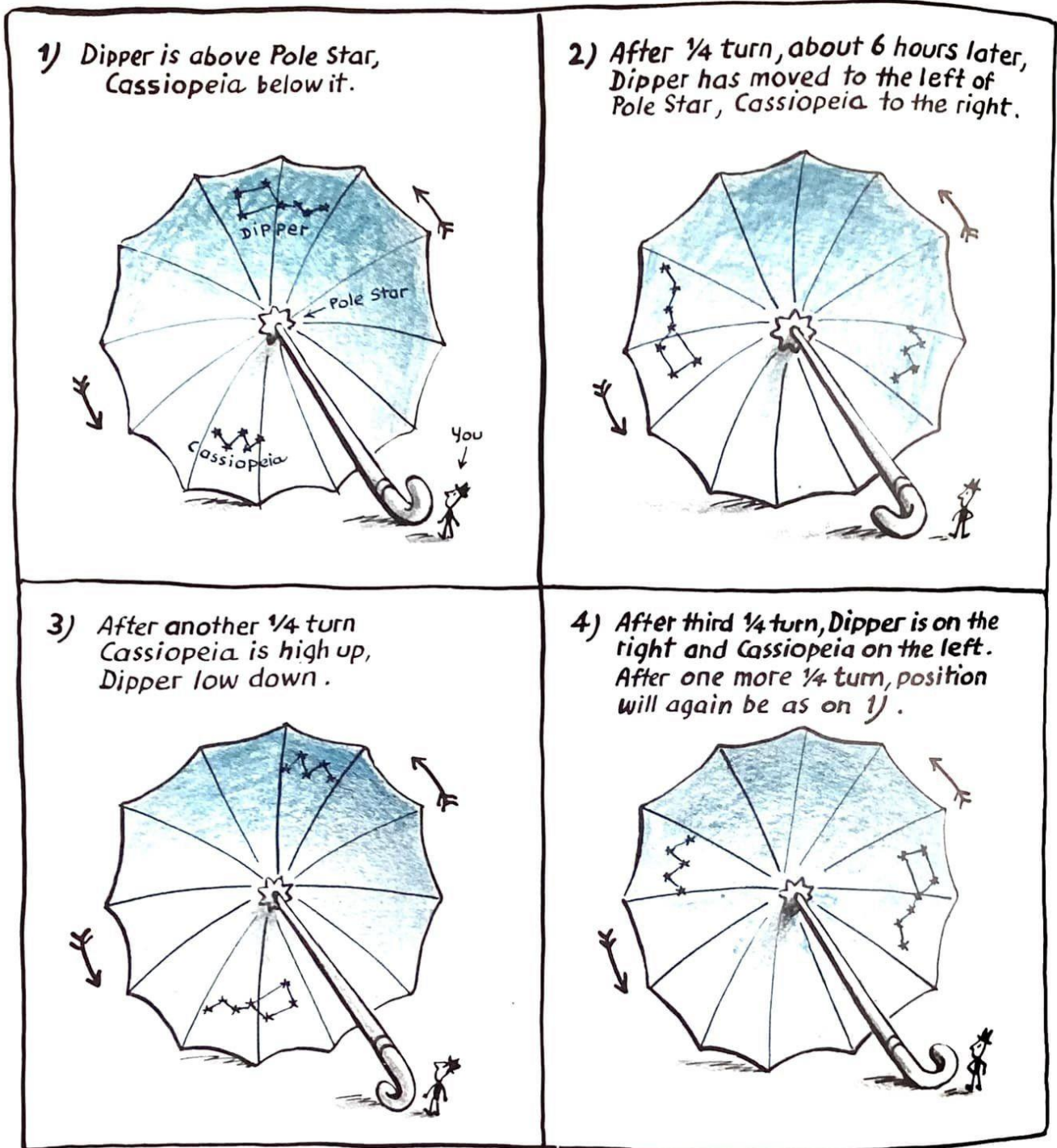


Figure 8: Umbrella Planetarium

**UMBRELLA PLANETARIUM:** The Pole Star is the only star which keeps its place in the sky. All the other stars and constellations wander around the pole *once daily*, counterclockwise, as though they were fixed to the inside of a vast hollow globe.

In other words, we see the whole sky slowly *rotate around the Pole Star*. (One turn takes 23 hours 56 minutes, to be more exact; these four minutes less than a day are important, as we shall see on pages 122–123, but we need not worry about them here.)

To visualize this rotation imagine a giant umbrella, with the Pole Star as its center and yourself at the handle. On the umbrella are the Big Dipper and Cassiopeia. You see them go around the Pole Star as the umbrella slowly turns.

We know of course that the sky does not really turn but that it is the earth which does the turning. The effect, however, is the same.

While the sky as a whole rotates, the stars do not change their position in relation to each other: the Pointers always point to the Pole Star, Cassiopeia is always opposite the Dipper, and so on. Therefore the stars, in contrast to the Planets, are called *Fixed Stars*.

Big Dipper, Cassiopeia, and four fainter constellations (Little Dipper, Cepheus, Dragon, Giraffe) are arranged around the pole and not very far from it. They are called CIRCUMPOLAR CONSTELLATIONS. They can be high or low in the sky as they travel around the Pole Star but they are always above the horizon. They never rise or set and can be seen at any time of the year.<sup>1</sup>

The constellations farther from the pole—the great majority—also travel around the pole once a day but part of the time they go below the horizon. They rise in the eastern part of the sky, travel across the sky, and set in the western part. They are out of sight for longer or shorter periods of the year. There is no use in looking for the Lion in November, for instance, or for Orion in May. (Let us just note the fact, for the moment. We shall see the “how and why” later.)

Some constellations cannot be seen at all in our latitudes because they make their whole daily turn below the horizon: the famous *Southern Cross*, for instance. To see the Cross and other far southern constellations you have to travel far south, the

<sup>1</sup> At a latitude of about 40° north. In the southernmost states, such as Florida, Hawaii, or in Puerto Rico and the Virgin Isles, they dip partly beneath the horizon when they are low in the sky.

farther the better. If you do, take this book along. It is designed mainly for our northern latitudes, from 30 to 50 degrees, but it also has charts to show the skies as far north as Alaska and as far south as Australia and Argentina.

There you can see the Southern Cross any night of the year, but you will look in vain for the familiar shape of the Big Dipper. No reason, though, to envy the people in Sydney or Buenos Aires. Those who have seen both, Dipper and Cross, agree that the Dipper is the finer one of the two.



*The Dipper? never seen it...*



**PART 2**

**MEET THE CONSTELLATIONS**

## PART TWO

# MEET THE CONSTELLATIONS

ON THE FOLLOWING seventeen charts you find the constellations, a few at a time. Study their shapes at leisure: once its shape is familiar you can spot a constellation in the sky even if you can't see it whole, just as you can recognize a friend's face even if he has got a hat on and his collar up on a cold day.

The blue field in the center of each chart merely serves to emphasize the constellations under discussion. Around that field the neighboring groups are shown to give you the context. The small numbers in circles indicate the charts where you find them discussed; you don't have to go back to the index if you want to look them up.

The stars on the charts are represented by the following symbols:



which indicate the degree of brightness, or *Magnitude*, of each star (zero, 1st, 2nd, 3rd, etc., magnitude). The lower the figure of magnitude the brighter the star. The difference in brightness between stars is great and much more pronounced in the sky than on a chart. This strikes you again and again and is something to keep in mind



when you trace the constellations outdoors with the chart in hand.<sup>1</sup> The fainter stars are often blotted out completely by even a slight haze, and in big cities you can see them only on exceptionally clear, moonless nights when they are high up in the sky.

Stars of zero and first magnitude (mag. for short) are usually grouped together as 1st-mag. stars. There are 21 of these in the entire sky, and you will soon know them by name. They are the brightest ones; you cannot fail to see them as soon as you go out at night, even before your eye has become adjusted to darkness.

Not quite as bright are the 2nd-mag. stars, about 50 in all; some of those, too, we shall come to know by name, and one we have already met: Polaris, the North Star.

The 3rd-mag. stars, about 150, are still fairly bright. All 1st-, 2nd-, and 3rd-mag. stars are on our charts, and also more than 600 4th-mag. stars, faint by comparison but plainly visible on clear nights. Stars of 5th mag. are about the faintest you see under good conditions; there are roughly 1500 of them (the fainter the stars the more there are of them), but less than a hundred appear on these charts—those that are not isolated but, together with brighter stars, help to form a distinct shape and thus become more easily visible, as in the Dolphin, the Cup, the Fishes, among others. No 6th-mag. stars are shown here. Only the eagle-eyed can see them without glasses, under perfect conditions. For anything fainter, binoculars or a telescope are needed.

Stars not only differ in brightness, they also have *different colors*. At first glance they may all appear silverish white but a closer look reveals that quite a few are colored: bluish, reddish, yellowish, even greenish. It is only a faint tinge but the more you study them the more you become aware of it. A good example are bluish *Vega* and orange-colored *Arcturus*. When you see them both in the sky at the same time you notice the contrast distinctly.

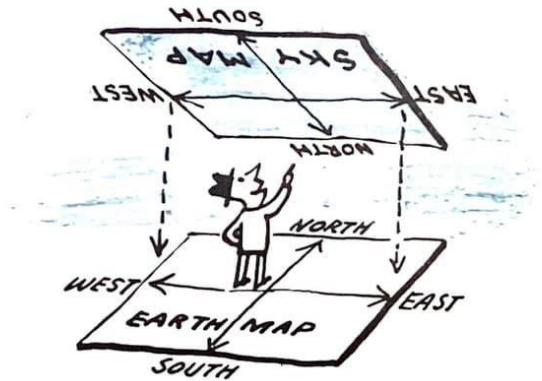
<sup>1</sup> The terms *mag. 0, 1, 2, 3, etc.*, are only approximations. Few stars oblige by being *exactly* mag. 0 or 1 or 2, etc. Thus two stars of, say, 2nd mag. need not be equally bright: e.g., the star Castor, in the Twins, is of mag. 1.58, while Polaris is mag. 2.12, yet both are classed as 2nd mag. A star of mag. 0.0 is about 2½ times as bright as one of mag. 1.0; one of mag. 1.0 is 2½ times as bright as one mag. 2.0, and so on, which means that a star of mag. 0.0 is 100 times as bright as one of mag. 5.0. Magnitudes brighter than mag. 0 are marked by a minus sign. Only four stars are that bright: Sirius (mag. -1.42); Canopus (mag. -0.72); Alpha Centauri (mag. -0.27); Arcturus (mag. -0.06).

A list at the end of the book (page 160) gives you magnitude and color of the 20 brightest stars.

To the astronomer, a star's color is a clue to its physical condition and temperature. For us here, it's one more way to identify a star. Besides, it looks charming.

A mark on each chart indicates the points of the compass: north, east, south, and west. You may be puzzled to find that with north up, east is to the left and west to the right, the opposite of terrestrial maps.

The reason is that terrestrial maps show the ground you are standing on while sky maps show the region overhead. Hold a sky chart over your head, and the directions will fall in place: east on east, west on west, etc.



The notes on the pages opposite the charts are non-technical, and there is nothing in them that has to be memorized. If a term or a name is not familiar you will find its meaning or pronunciation in the index at the end of the book, which doubles as a glossary.

The Constellation Charts show you *what* to look for. The *where* and *when* is shown on the Calendar Charts.

## THE CONSTELLATION CHARTS

# CONSTELLATION CHART 1

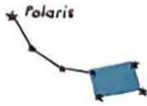
## BIG DIPPER, LITTLE DIPPER, DRAGON

**BIG DIPPER:** Best-known group of stars. We can't call it best-known constellation because it is not a constellation<sup>1</sup> by itself but only part of the large constellation Great Bear (see chart 3). Next to Orion it is the most impressive figure in our skies. It helps find the Pole Star and north by way of the **POINTERS**, the two stars at the tip of the bowl.



Close to the middle star of the handle, **MIZAR**, sits a tiny star, **ALCOR**, faint but famous. Before the age of eyeglasses and oculists' charts, Alcor used to serve as an eye test. If you could see it your vision was considered normal. Mizar and Alcor are also called "Horse and Rider."

**LITTLE DIPPER (LITTLE BEAR—URSA MINOR):** Resembles a Dipper more than a Bear, so why not stick to that name. The Little Dipper is much less conspicuous than the Big Dipper but it contains the most important star of our skies, **POLARIS**, the *Pole Star*, which always remains on the same spot (nearly) while all other stars circle around it. Polaris is not one of the brightest stars—only of 2nd mag.—nor was it always the star closest to the pole. On account of the "wobble" of the earth's axis (see page 128) the celestial pole slowly shifts as the centuries go by, and different stars become pole stars at different times.



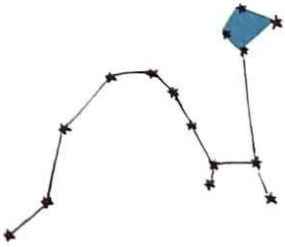
Most of the Little Dipper's stars are faint. Only the two at the end of the bowl are fairly bright. They are called *Guardians of the Pole* as they march around the pole like sentries. The brighter one of the Guardians, **KOCHAB**, was the Pole Star at the time of Plato, about 400 B.C.

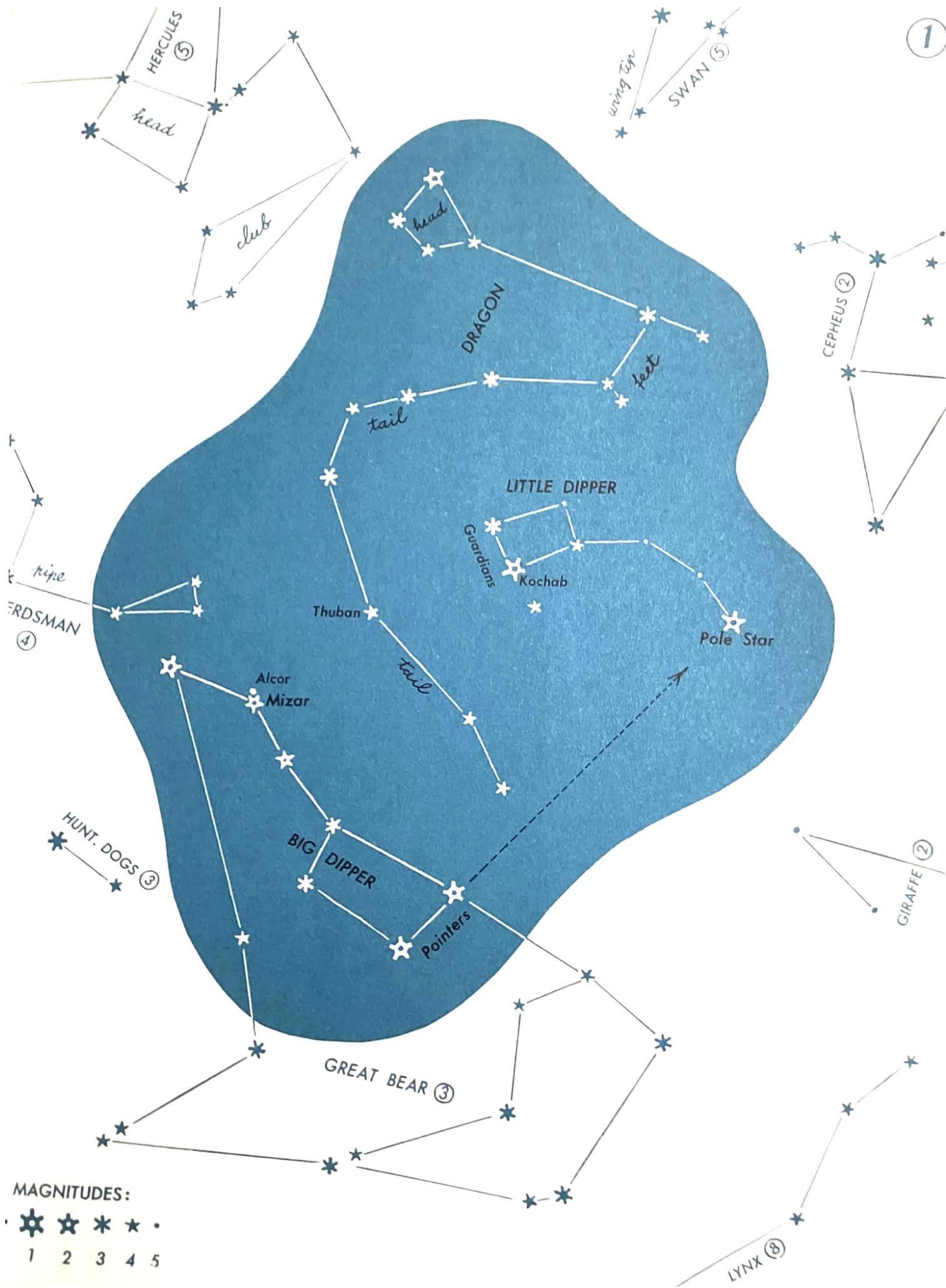
**DRAGON (DRACO):** Large constellation but not very bright. A string of stars winding around the Little Dipper makes up its long *tail*, two pairs of stars mark the legs. Its most conspicuous part is the *head*, an irregular quadrangle not quite half the size of the Big Dipper's bowl, with two fairly bright stars which look a little like the Guardians; don't confuse them.

The faint star in the Dragon's tail halfway between Mizar (the Horse and Rider) and the Guardians is **THUBAN**. Thuban is one of the Elder Statesmen: it was the Pole Star when the Pyramids were being built, some four or five thousand years ago. It will be the Pole Star again some twenty thousand years hence.

**BIG and LITTLE DIPPER** can be seen all year around. The **DRAGON** can best be seen from late May to early November (Calendar Charts 6, 7, 8, 9, 10).

<sup>1</sup> You might ask: why is the Big Dipper not a constellation? The answer is that only the *SS* groups of stars that are officially recognized and listed as constellations can rightfully go by that name. The group known as the Big Dipper, famous as it is, has no official status. Such a group is called an *asterism*.





MAGNITUDES:

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## CONSTELLATION CHART 2

### CASSIOPEIA, CEPHEUS, GIRAFFE



**CASSIOPEIA:** Important constellation, not very large but bright, in the Milky Way. Next to Big Dipper and Orion, it is the constellation best known because its shape is easy to remember: a neat W formed by 5 bright stars, or an M, depending upon its position. To find Cassiopeia draw a line from the star where the handle joins the Dipper's bowl to the Pole Star and beyond.

According to myth Cassiopeia was an Ethiopian queen (see note below). The constellation is thought to represent either the queen herself or her chair, a flattering alternative. Opinions are divided on the issue, so we shall stick to the well-known "W."



**CEPHEUS:** Named after King Cepheus of Ethiopia,<sup>1</sup> Cassiopeia's husband. He is rather dim—his wife is much brighter—but when the constellation is not too low you can make out the large triangular cap or crown, the king's squarish face beneath it, and a sort of a pigtail at the back of the king's head.

To find Cepheus, continue the line from the Pointers beyond the Pole Star: it hits the king's cap (see chart). Cepheus is in the Milky Way, partly, and his three brighter stars are all candidates for the pole starship, 2000, 4000, and 6000 years from now (see figure 24, page 129), and Cepheus will then be a very important person.



**GIRAFFE (CAMELOPARDALIS):** Faint constellation, hard to spot and not worth bothering with unless you are a perfectionist. It is a *modern* constellation, a term explained on page 147.

**BEST TIMES** for CASSIOPEIA and CEPHEUS: August through January.

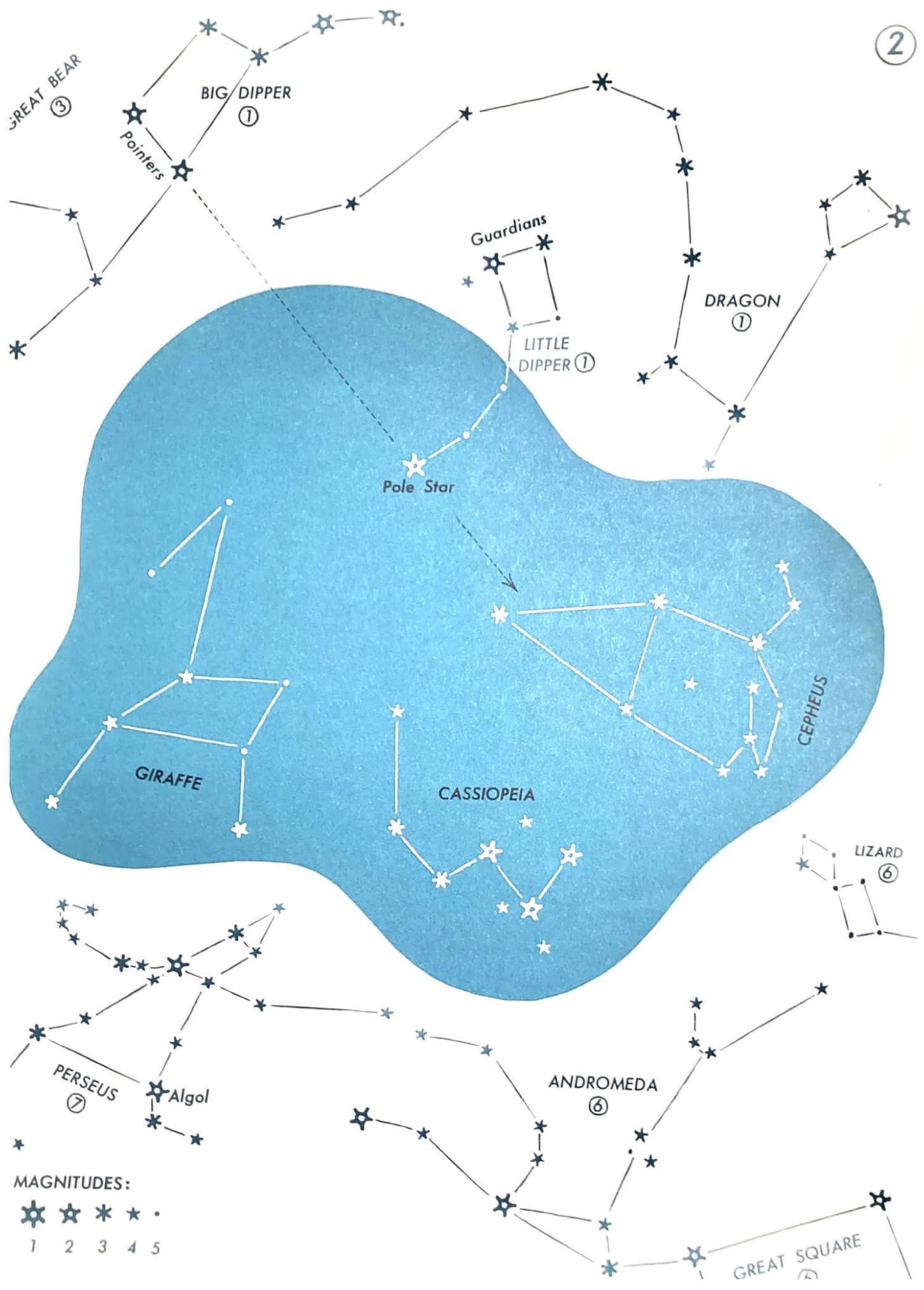
GIRAFFE: November through March.

Being circumpolar constellations they are on all twelve Calendar Charts.

**NOTE:** There is a myth about Cassiopeia and some adjoining constellations which helps to remember them as being together in the same section of the sky: Cassiopeia and Cepheus had a daughter, *Andromeda* (see chart 6). Cassiopeia's boasting about Andromeda's beauty so angered the sea nymphs that they prevailed upon the sea god Poseidon to dispatch a sea monster, the *Whale* (chart 15), to ravage Ethiopia's coast. To appease the Whale, Cepheus had Andromeda chained to a rock to be devoured by the monster. Fortunately the hero, *Perseus* (chart 7), happened to pass by. He killed the Whale, liberated and married Andromeda, and the two made off on Perseus' winged horse, *Pegasus* (chart 6).

When Cassiopeia is high up in the sky, in late fall and early winter, Cepheus, Andromeda, Perseus, Pegasus, and the Whale can also be seen well.

<sup>1</sup> Some have identified this mythological king (*Kepheus* in Greek spelling) with the Egyptian Pharaoh *Cheops*, or *Khufu*, ca. 2700 B.C., of pyramid fame. Such matters of mythology are hard to prove or disprove, but it's a plausible thought.



GREAT BEAR ③

BIG DIPPER ①

Pointers

Guardians

LITTLE DIPPER ①

DRAGON ①

Pole Star

GIRAFFE

CASSIOPEIA

CEPHEUS

LIZARD ⑥

PERSEUS ⑦

Algol

ANDROMEDA ⑥

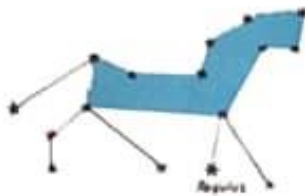
MAGNITUDES:  
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 1 2 3 4 5

GREAT SQUARE ②

GREAT BEAR, LION, HUNTING DOGS, LITTLE LION



**GREAT BEAR (URSA MAJOR):** Very large constellation. Its best-known part is the Big Dipper: the bowl sits on the Bear's shoulder like a saddle, the tip of the handle forms the Bear's nose. To trace the whole figure, look for the Dipper first, then for the three pairs of stars which form the Bear's paws.  
 The Greek word for bear is *arktos*, hence the name *Arctic*, literally *bearish*, for the far northern parts of the earth where the Great Bear appears even more dominant than in our latitudes.



**LION (LEO):** Large constellation with three bright stars. The brightest one, REGULUS, is easy to find when the Big Dipper is high up: use the two stars of the Dipper's bowl next to the handle and draw a straight line toward the Bear's paws and beyond; it will first hit the star in the Lion's shoulder and then Regulus. Bluish-white Regulus is the faintest of our 1st-mag. stars but even so it shines about twice as bright as Polaris. It is about 80 light-years away and over 100 times as luminous as the sun.

The Lion's bright tail-light is the star DENEbola, interesting because it forms, with Arcturus (chart 4), Cor Caroli, and Spica (chart 11), the *Virgin's Diamond* (see Calendar Chart 3).

The Lion is in the *Zodiac*, a belt formed by 12 constellations girdling the sky (see page 130 for fuller explanation). Sun, moon, and planets always travel within this belt, so at one time or another you may expect to see a planet in the Lion, or even more than one.

Along the middle of the zodiac runs the *ecliptic*, the apparent path of the sun among the stars through the year (see page 119)—an imaginary line, of course—and Regulus is almost exactly on it. The moon, which crosses the ecliptic at regular intervals, may occasionally pass in front of Regulus and hide it: an interesting sight called *occultation* and more fully described on page 139.

The Lion's front part is known as the *SICKLE*, and it looks like one.

Sorry - no shape  
only two stars



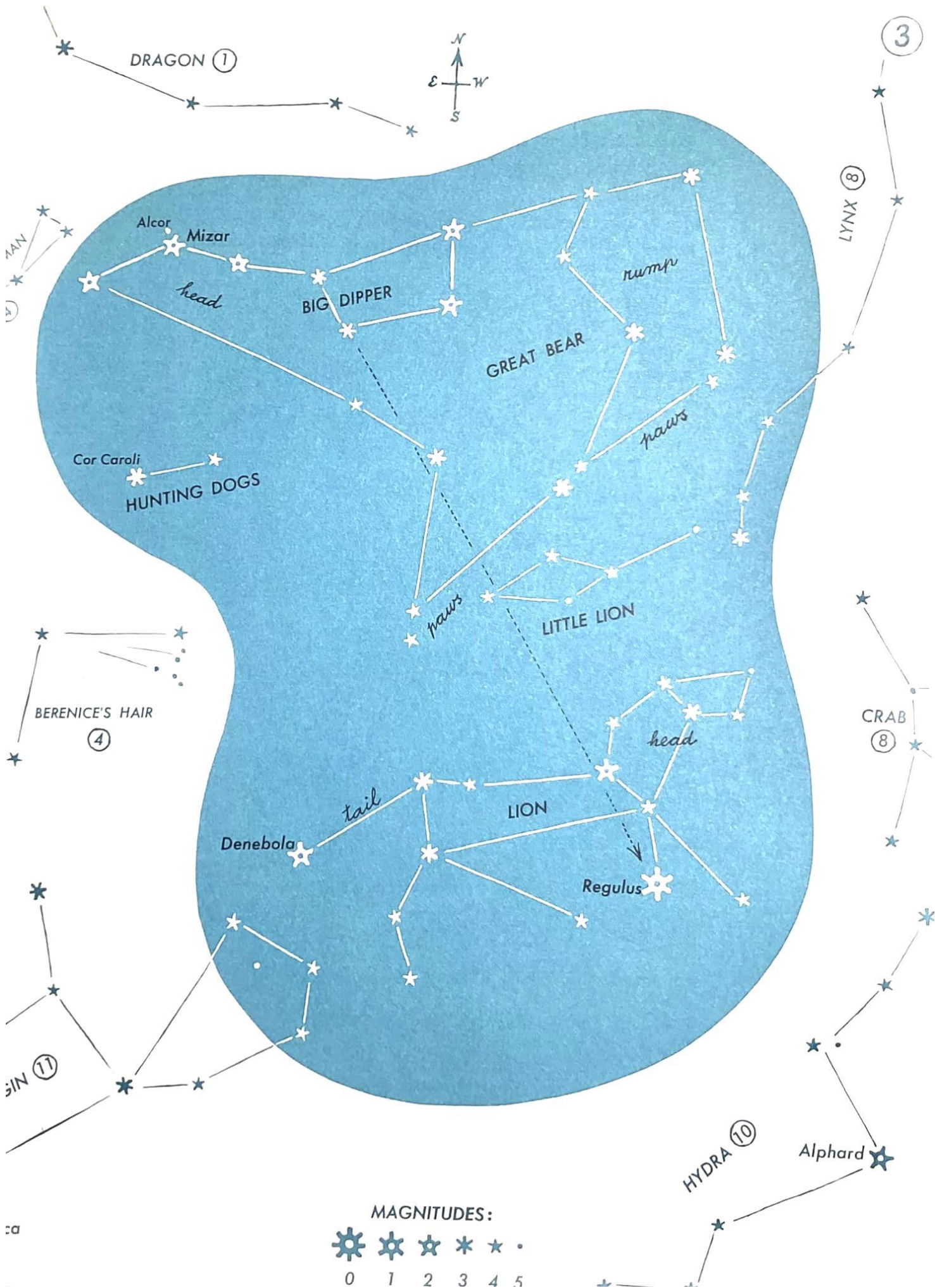
**HUNTING DOGS (CANES VENATICI):** Small modern constellation with only two naked-eye stars. The brighter one, COR CAROLI (Charles' Heart after Charles II of England), belongs to the four stars which form the *Virgin's Diamond* (see above).

**LITTLE LION (LEO MINOR):** Small modern constellation, very faint, looks like a mouse rather than a lion's cub.

**BEST TIME:** February through June; Calendar Charts 2 to 6.

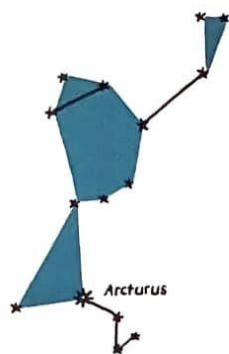
**NOTE:** You become familiar with the sky more easily if you remember some constellations *in groups*. The constellations shown here all represent carnivores: Great Bear, Big and Little Lion, Hunting Dogs; and also Lynx, Dragon, and Little Bear adjoining them. This region of the sky could be called *Carnivores' Corner*. It is best seen from early spring to early summer. Crutch for memory: bears hibernate; the other carnivores in the sky follow their example, therefore they are harder to find during fall and early winter.





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## HERDSMAN, NORTHERN CROWN, BERENICE'S HAIR



**HERDSMAN (BOÖTES)**: Among the oldest recorded constellations. Looks like a man sitting and smoking a pipe, a sensible thing for a herdsman to do. Its main star, orange-colored ARCTURUS, is the fourth brightest of all the stars. You find Arcturus easily if you follow the sweep of the Big Dipper's handle, away from the bowl.

Arcturus is remarkable not so much because it opened the Chicago World's Fair in 1934 by shining on a photoelectric cell, but because it changes its place in the sky more rapidly than any other of the bright stars. It moves toward the Virgin by about one degree (which is about twice the apparent width of a full moon) in 1600 years, so at the time of the Battle of Hastings it was about one full moon's width farther northeast in the sky than it is now. Besides it is a giant star, about 25 times the diameter of the sun, and 100 times as luminous. It is a relatively close neighbor of ours, only 40 light-years away.<sup>1</sup> In late spring and early summer, Arcturus is the first star you see after sunset, high up in the sky.

To trace the rest of the constellation, try to find the triangular body first, then the large head, then the pipe close to the Bear's nose, then the tiny feet. Pipe and feet are rather faint; it takes a clear night to see them.



**NORTHERN CROWN (CORONA BOREALIS)**: Small but graceful. Looks rather like a tiara, with 2nd-mag. GEMMA, the Crown Jewel, in the middle of the bow. The Dipper's handle—or the Bear's nose if you prefer—points toward Gemma, beyond the Herdsman's head.



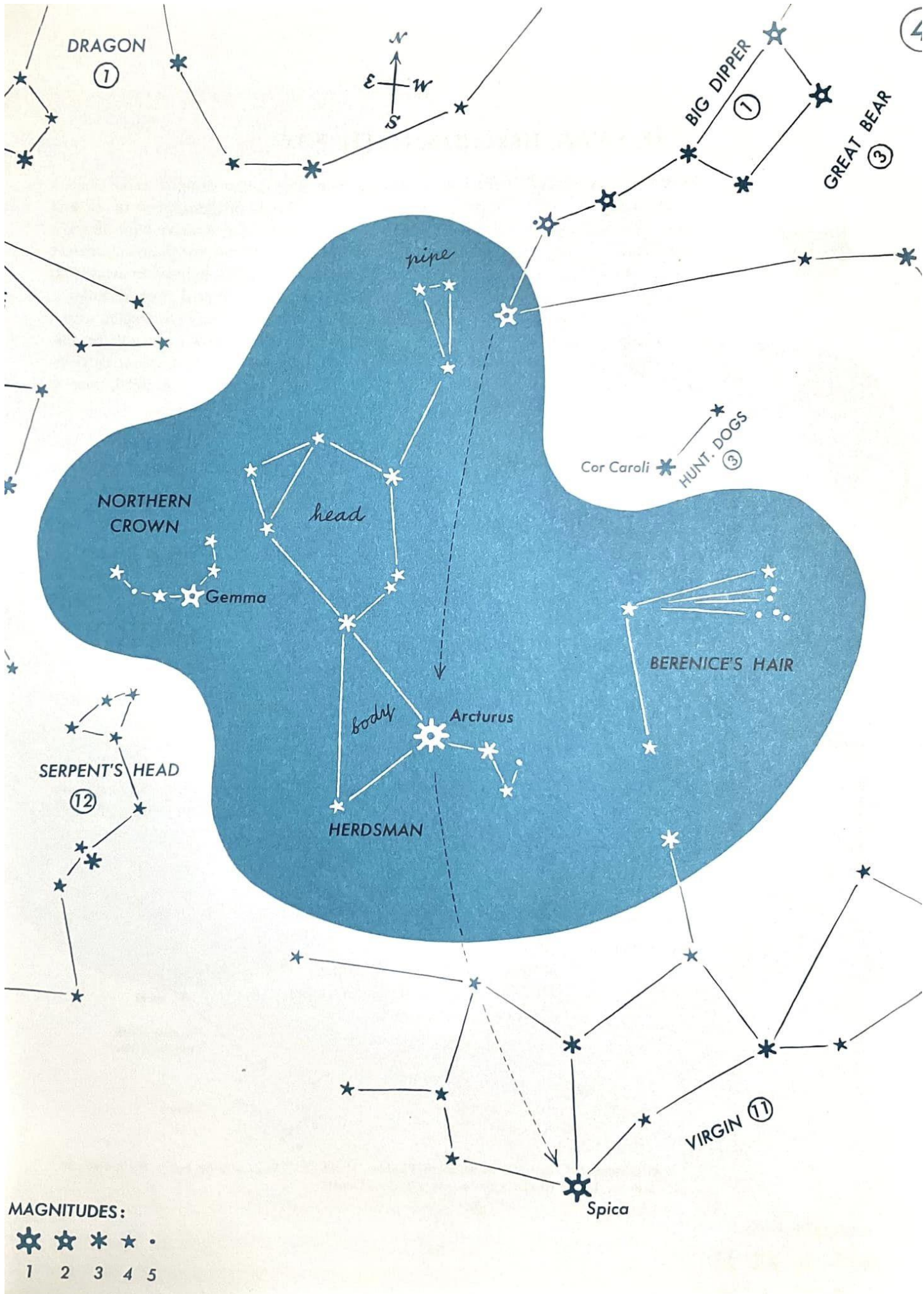
**BERENICE'S HAIR (COMA BERENICES)**: Small and very faint. Contains a group of dim stars, visible only on clear, moonless nights when the constellation is high up. Shown here as a few strands of hair fluttering from a stick between the star Cor Caroli and the Virgin's outstretched arm.

This constellation owes its name to a theft: Berenice was an Egyptian queen (3rd century B.C.) who sacrificed her hair to thank Venus for a victory her husband had won in a war. The hair was stolen from the temple but the priests in charge convinced the disconsolate queen that Zeus himself had taken the locks and put them in the sky as a constellation.

Of all our constellations, Berenice's Hair is the one farthest from the *Milky Way*. With the queen's hair overhead you don't see the *Milky Way*: it then runs along the horizon, blotted out by the atmosphere near the ground. Thus no hair can ever get into the milk, celestially speaking.

**BEST TIME:** April through August. Calendar Charts 3 to 8.

<sup>1</sup> A LIGHT-YEAR—a measure of space, not of time—is the distance light travels in a year: about six million million miles. Forty light-years is not much, in stellar terms. More about light-years, luminosity, motions, and distances of stars on pages 141-142.



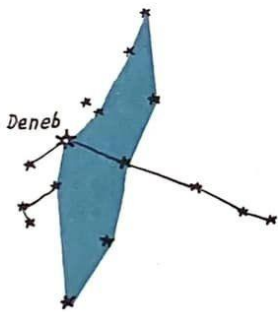
# CONSTELLATION CHART 5

## LYRE, SWAN, HERCULES, LITTLE FOX

**LYRE (LYRA):** Small constellation, looking more like a two-stringed zither than a traditional lyre. The Lyre is important because **VEGA**, fifth brightest of all the stars, is in it, brilliant and bluish white. Vega is below the horizon only about 7 hours daily and you can see it any night of the year, though not always at convenient hours.<sup>1</sup> Like Arcturus, Vega is a close neighbor of ours; only 23 light-years away, it is some 50 times as luminous as the sun, and we are moving toward it at 12 miles a second. We should bump into Vega within 500,000 years (a negligible span, astronomically speaking) if Vega did not move too. In 12,000 years Vega will be the Pole Star, and stargazing will then be easy, with a pivotal star as brilliant as that. In addition, Vega was the first star to have its photograph taken, in 1850, over a century ago. The Dragon's head, not far away, points toward Vega.

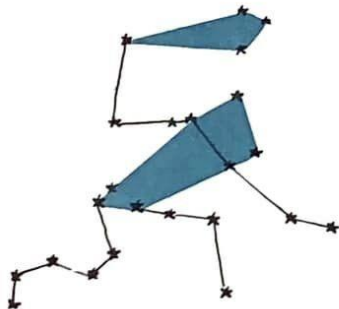


**SWAN (CYGNUS):** Large magnificent constellation. Part of it is known as the **NORTHERN CROSS**: this part is drawn in slightly heavier lines on the chart. The Swan's wings are spread wide, his neck is stretched out, and his feet, formed by fainter stars, are trailing behind as he flies along the Milky Way.



The brightest star in the Swan is **DENEUB**, white, in the tail. Deneb is below the horizon only about 5 hours daily and, like Vega, can be seen at some time any night of the year. It is almost 500 light-years away, and its candle power must be enormous to make it shine as bright as it does, at this distance: it is supposed to be 10,000 times as luminous as the sun.

A line through the two stars of the Dipper's bowl near the handle and far across the sky leads to Deneb (see sketch below).



**HERCULES:** Large but rather dim and therefore a bit hard to trace. It looks like a man swinging a club, Hercules' favorite weapon. Best way to spot him is by tracing his head first: a keystone-shaped quadrangle, halfway between Vega and Gemma (in the Crown). On very clear nights you may see, on the spot marked on the chart by a tiny cross, a faint, hazy star. This is no single star, though, but a cluster of many thousands of stars, almost 35,000 light-years away: the Great Cluster of Hercules.

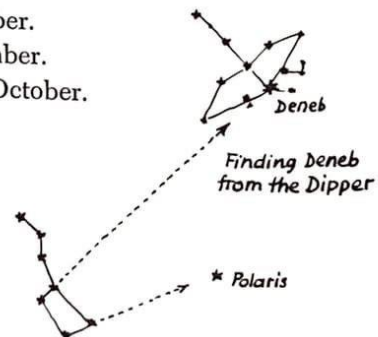
**LITTLE FOX (VULPECULA):** Small modern constellation; don't bother.

**BEST TIMES** for LYRE: May through November.

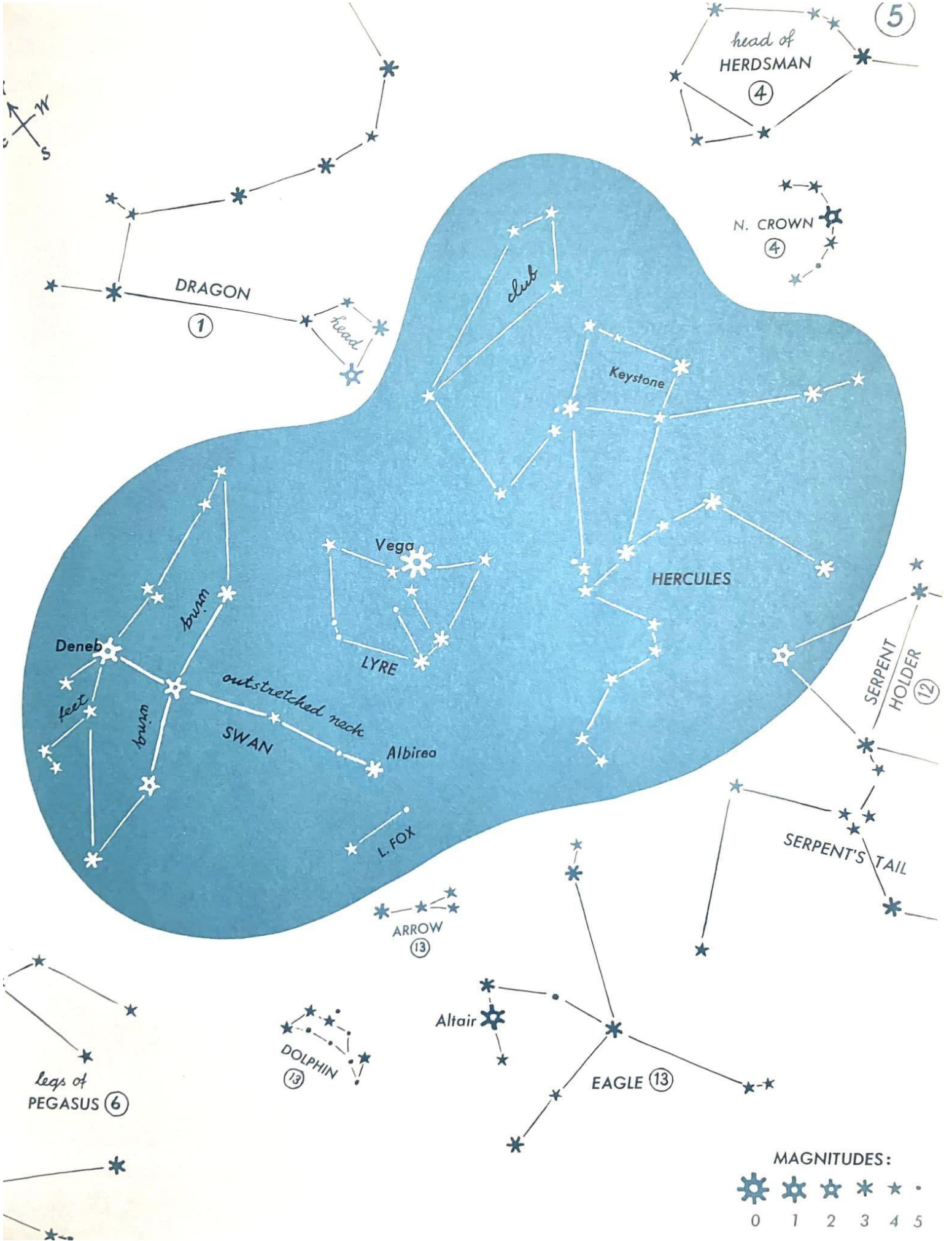
SWAN: June through November.

HERCULES: May through October.

Calendar Charts 5 to 12.

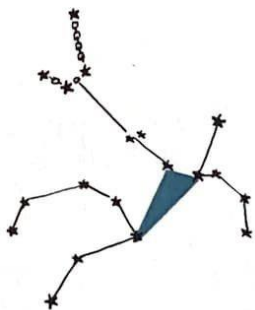


<sup>1</sup> At latitude 40°, that is. In southern Florida (about 25°) Vega will be below the horizon for over 9 hours, but in Alaska it never sets, nor does Deneb.



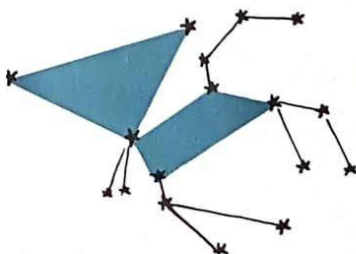
## GREAT SQUARE, ANDROMEDA, PEGASUS, TRIANGLE, LIZARD

**GREAT SQUARE OF PEGASUS:** One of the landmarks of the sky. It is not a constellation in itself<sup>1</sup> but belongs partly to ANDROMEDA, partly to PEGASUS, and helps find both. It is formed by four bright stars. Two of these stars are on a straight line drawn from the Pole Star to the last star in Cassiopeia's W (see chart) and beyond.<sup>2</sup> If you have the right Calendar Chart before you, outdoors, you find the Square easily, and once you know it you won't forget it, it's such a striking figure.

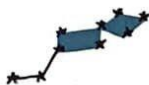


**ANDROMEDA—THE CHAINED LADY:** On this chart, the lady is standing on her head, which is one of the four stars of the Square. Spot first the three bright stars forming one side of the body and one leg, and then the rest. The other leg is formed by dimmer stars. At its bent knee you see a small hazy spot, if the night is perfectly clear and moonless: this is the famous ANDROMEDA NEBULA, the most distant object the human eye can see unaided. It is a *galaxy* like our own, composed of some hundred billion suns and about 2.7 million light-years away. This is a case where glasses are a help because the spot is very faint. More about galaxies on page 143.

For the *Andromeda myth* see note on page 32. The chain which fastened the princess to the rock is dangling from her outstretched arm, and on the lower left of the chart you see the snout of the Whale, sent out to devour her.



**PEGASUS—THE WINGED HORSE:** Trace this constellation from the corner of the Square opposite Andromeda's head. The triangular wing, made up of three of the Square's four stars, is fastened to the Horse's rump. This will look unorthodox to airplane designers but the Horse manages to fly all right. The star at the forward tip of the wing is reddish. Pegasus is not as bright as Andromeda but under good conditions one can trace it well.



**TRIANGLE (TRIANGULUM):** Tiny figure just off Andromeda's brighter foot.

**LIZARD (LACERTA):** Small modern constellation, very faint, in Milky Way.

**BEST TIMES** for SQUARE: August to January.

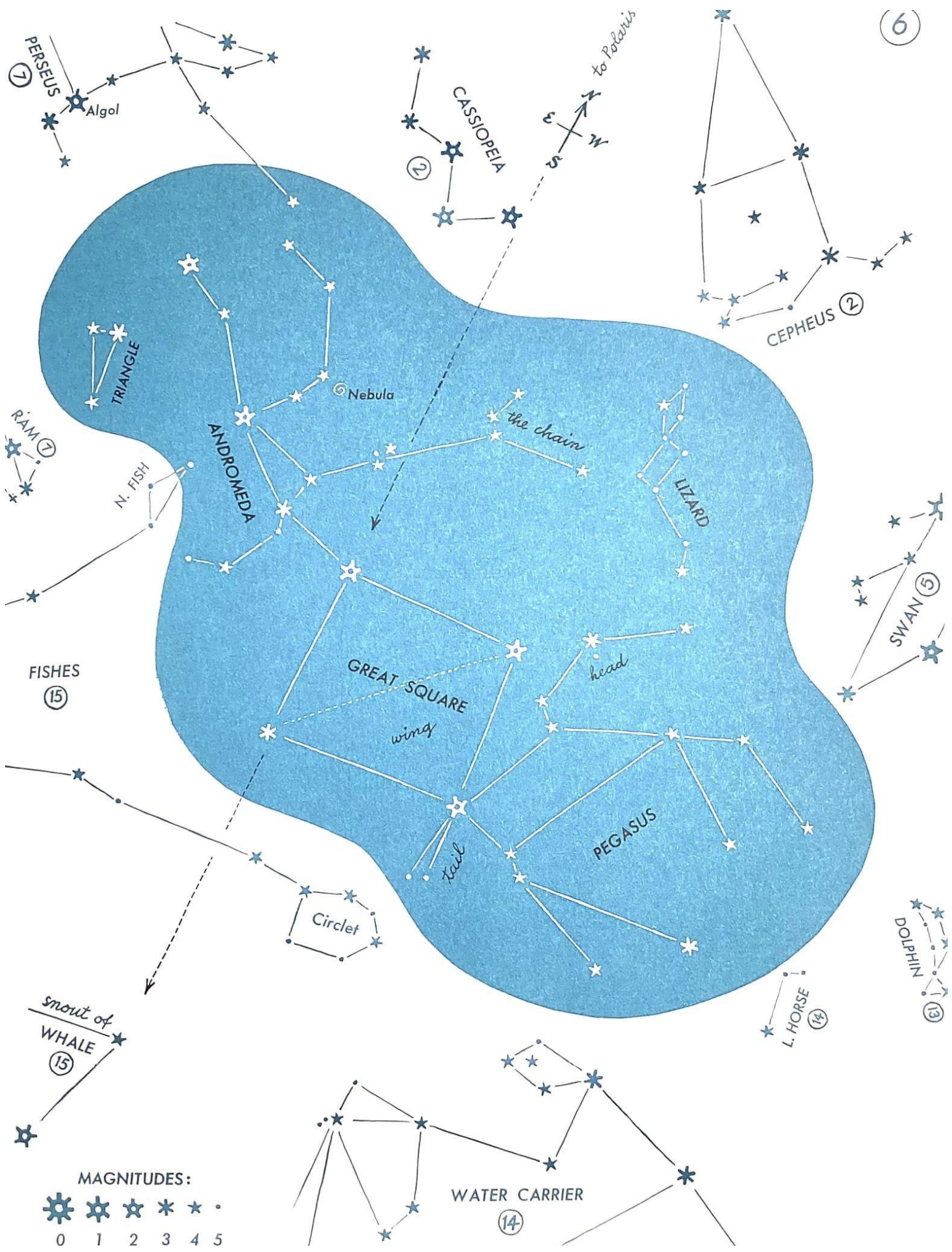
ANDROMEDA: September to January.

PEGASUS: August to October.

Calendar Charts 1, 2, 8 to 12.

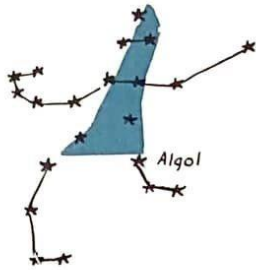
<sup>1</sup> While the impressive Great Square is only an asterism (see note on page 30) there is also a true constellation called the SQUARE (NORMA), a faint little group in the southern sky (Constellation Chart 17). It seems a bit unfair, but that's the way things go, at times, in astronomy.

<sup>2</sup> This line hits the snout of the WHALE if you draw it farther south. It's an interesting line because it marks, roughly, the ZERO HOUR CIRCLE. Hour circles are to the sky globe what meridians or circles of longitude are to the terrestrial globe, and the zero hour circle is so to speak the Greenwich line of the sky. More about hour circles and related items on page 114.



# CONSTELLATION CHART 7

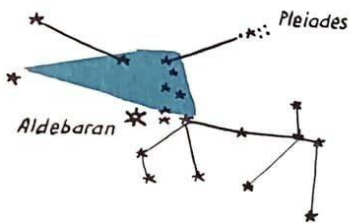
## PERSEUS, BULL, RAM



**PERSEUS:** Interesting constellation, in the Milky Way. Perseus is close to Cassiopeia, his mother-in-law-to-be (chart 2), and to Andromeda, his future bride (chart 6). He looks like a man with a pointed cap, a Persian cap if you like. With one hand he makes a beckoning gesture, with the other he seems about to grab Andromeda's foot: a rough way to liberate a lady.

There are two stars of second magnitude in Perseus. One of them, in his forward leg, is ALGOL (Arabic for Prankster), a famous variable star.<sup>1</sup> For about 2½ days Algol is of second magnitude, then dims down in about 5 hours to third magnitude, and in another 5 hours regains its former brilliance. You can observe the spectacle, with a little patience; look at it off and on during each night for a few nights in a row.

If you enjoy the sight of shooting stars, watch the sky around Perseus after midnight, between August 1 and August 30, for the *Perseid Meteors*.



**BULL (TAURUS):** Large constellation in the zodiac, best known because of the PLEIADES. This group of faint stars looks, at first glance, like a tiny silver cloud, but watching closer you can distinguish 6 individual starlets. The Pleiades are unmistakable, and ALDEBARAN, the Bull's brightest star, is not far off, easy to spot because of its orange color. From there, trace the rest of the constellation. The hind part of the Bull is much dimmer than the large head. The Bull, supposedly, is Zeus in disguise, swimming through the Hellespont to fetch his girl friend Europa; his hind quarters are dim because they are submerged. Aldebaran is a giant star, 36 times the diameter of the sun, 100 times as luminous, and 55 light-years away.

Aldebaran and Pleiades are both near the ecliptic, so you may expect planets nearby, and both are occasionally hidden by the moon. Close to Aldebaran, in the Bull's neck, is a group of stars known as the HYADES. Both Pleiades and Hyades are clusters of stars traveling together through space. (For more about *ecliptic, planets, zodiac*, see pages 118 ff.)



**RAM (ARIES):** This constellation is rather inconspicuous and would be less famous if it were not in the zodiac. Its two brightest stars, in the Ram's head, can be spotted easily halfway between the Pleiades and the Great Square of Pegasus.

**BEST TIMES** for PERSEUS: November through March.

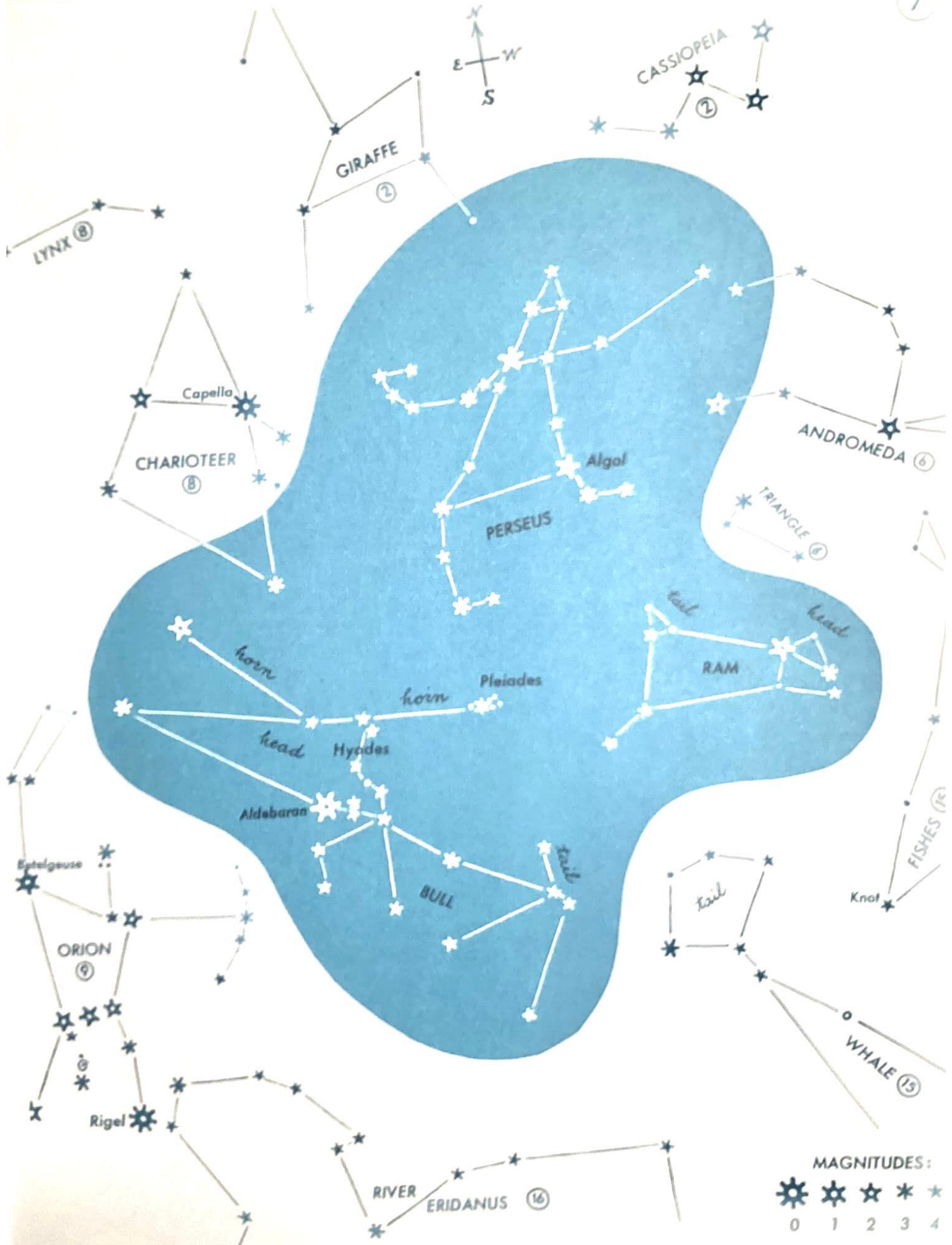
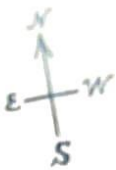
BULL: October through March.

RAM: October through February.

Calendar Charts 1, 2, 3, 10, 11, and 12.

<sup>1</sup> Algol is a double star, or BINARY (see page 141): two stars revolving around each other, and rather close together. One star is bright, the other much darker; when the dark star gets in front of the brighter one, as seen from the earth, Algol dims down.





MAGNITUDES:

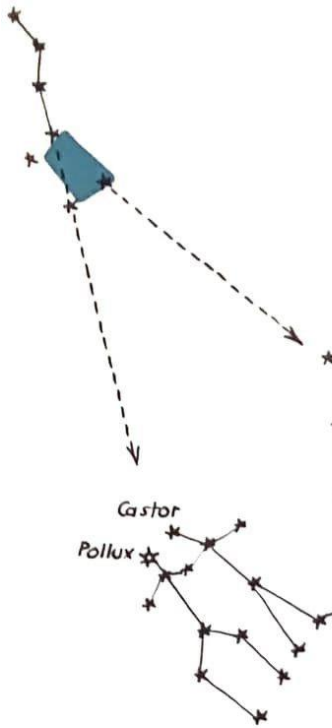


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# CONSTELLATION CHART 8

## TWINS, CHARIOTEER, LITTLE DOG, CRAB, LYNX

**THE TWINS (GEMINI):** Important group. The heads of the Twins are the bright stars CASTOR (white) and POLLUX (yellowish; brighter than Castor). To find the pair from the Dipper, draw a diagonal through the bowl and far beyond (see sketch). The stars in their arms and bodies are fainter than those in their heads and feet; you need a clear night to trace the whole figure. The Twins are in the zodiac where moon and planets travel. If the moon and a planet are near Castor and Pollux you have an impressive show. Incidentally, 2 of our 9 planets were discovered when passing through the Twins: Uranus (1781) and Pluto (1930).



**CHARIOTEER (AURIGA):** Important constellation, named after the mythical inventor of the chariot, shaped like a face under a pointed cap. Blunt nose and jutting chin give it a tough expression, as befits the driver of a war cart. The Charioteer's eye is brilliant CAPELLA, yellowish, almost as bright as Vega, 16 times as large across as the sun, 150 times as luminous, and 42 light-years away. Being relatively close to the Pole it goes below the horizon for less than 5 hours daily,<sup>1</sup> and can be seen, for a short while at least, any night of the year. To find Capella from the Dipper go back from the handle along the bowl's edge and straight on from there; you can't miss (see sketch). Near Capella you find three fainter stars forming the nose,<sup>2</sup> and then the rest.

**LITTLE DOG (CANIS MINOR):** Small but important. Its two bright stars defeat all attempts to show it as a dog or even a puppy, but it has one of the brightest stars of our skies, yellowish-white PROCYON. A sweep from Capella backward to the bright star at the rear of the cap, then onward through Castor and Pollux and beyond (see dotted line on chart), hits Procyon. Sirius (chart 9) is farther along on that same sweep. Procyon is a close neighbor of ours, 10½ light-years away, five times as luminous as the sun, and approaching us by 150 miles a minute. Its name (Greek) means "before the dog": at 40° latitude it rises about 40 minutes before Sirius, the Dog Star.

Procyon  
no shape...

**CRAB (CANCER):** Faintest of all constellations in the zodiac. Its main attraction is the so-called BEEHIVE, a small hazy spot (marked by a cross on the chart), just visible without glasses under best conditions. Glasses reveal a cluster of many faint stars.



**LYNX:** Faint modern group near the Bear's rump. Hard to visualize as a lynx unless he's half hidden with only the back showing, sneaking up on his prey; the Little Lion, perhaps.

BEST TIMES for TWINS and LITTLE DOG: December through May.

CHARIOTEER: October through April.

CRAB and LYNX: January through May.

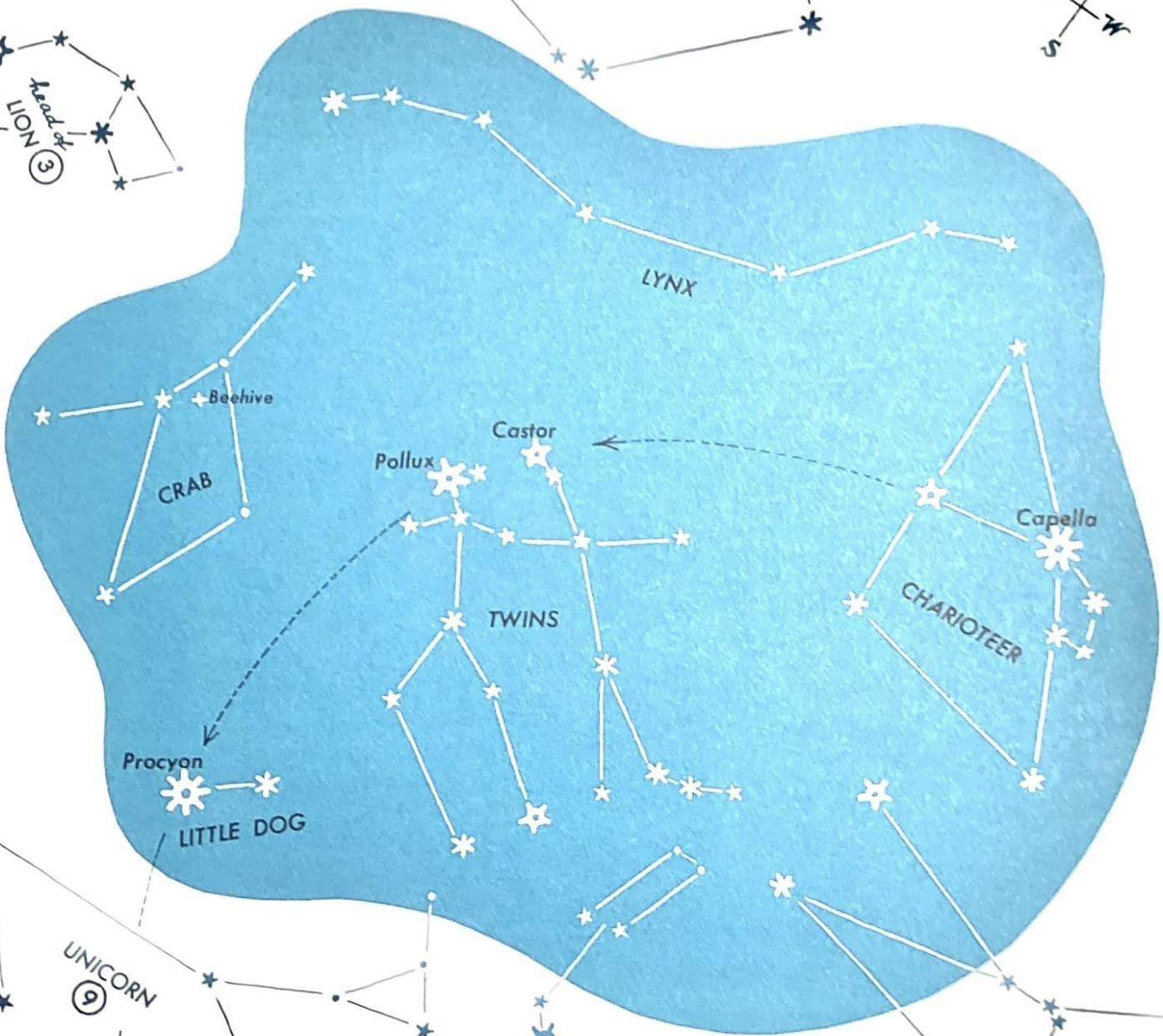
Calendar Charts 1, 2, 3, 4, 5, 11, and 12.

<sup>1</sup> At latitude 40°, that is. In Alaska, Capella never sets, like Deneb and Vega (page 38).

<sup>2</sup> The star nearest Capella, Epsilon Aurigae, is a double star. The larger of the two, itself invisible, dims the brighter one for a period of over 700 days, whence its diameter was found to be 2700 times that of the sun. It is the largest star known so far.

GREAT BEAR

③



Procyon

LITTLE DOG

UNICORN ⑨

ORION ⑨

Aldebaran

BULL ⑦

BIG DOG ⑨

Sirius

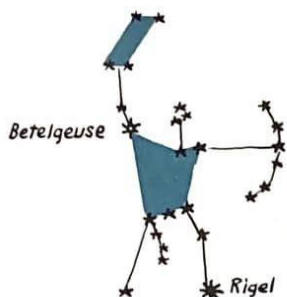
Rigel

MAGNITUDES:

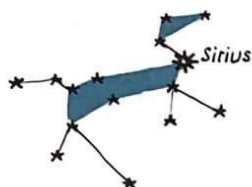


## CONSTELLATION CHART 9

### ORION, BIG DOG, HARE, UNICORN, ERIDANUS RIVER



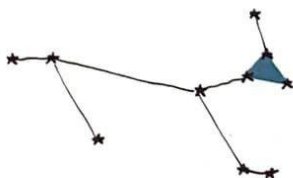
**ORION:** Superb constellation. When Orion is up he dominates the southern sky, you can't miss him. His most striking part is the BELT, three bright stars in a straight row; you easily trace the rest of the constellation from there.—A hunter by profession, Orion is heavily armed, with a raised club, a shield, and a sword dangling from his belt. No other constellation has so many bright stars, five of 2nd mag. and two of 1st mag.: reddish BETELGEUSE in the left shoulder, and bluish-white RIGEL in the right foot. Rigel is a giant star, 33 times the diameter of the sun and 20,000 times as luminous, over 500 light-years away: what you see in the sky these nights is light which left the star before Columbus was born. Betelgeuse is a supergiant,<sup>1</sup> 400 times the sun's diameter, 3600 times as luminous, about 300 light-years away. One of the stars in Orion's sword looks slightly fuzzy; field glasses reveal a hazy spot around it: the GREAT ORION NEBULA, a luminous gas-cloud, extremely thin but so vast that 10,000 stars the size of our sun could be formed from its mass. It looks so small because it is 300 light-years away. For the *Orion myth* see page 52.



**BIG DOG (CANIS MAJOR):** Fine constellation but so far south that it takes a very clear night to see its fainter stars in our latitudes. Its brightest star, however, outshines all others in the whole sky: SIRIUS, the DOG STAR, one of our closest neighbors among the stars, is only 8½ light-years distant. Hence its brightness, though it is only 26 times as luminous as our sun. Its magnitude is negative: minus 1.6.



**HARE (LEPUS):** Modest constellation, but quite graceful. Its head is brighter than its body and easy to spot on clear nights. Orion's sword points toward it. The Hare's ears point toward the star Rigel. The shape of a sitting hare becomes clear if you twist the chart and look at the figure from the lower left.



**UNICORN (MONOCEROS):** Modern constellation, large but very dull. Don't bother.

**ERIDANUS RIVER:** Large but rather faint and shapeless. It just meanders, like a river, through one of the poorer regions of the sky. At a latitude of 40° only part of the constellation can be seen, and its only bright star, 1st-mag. ACHERNAR (chart 16), becomes visible only in the southernmost states.<sup>2</sup>

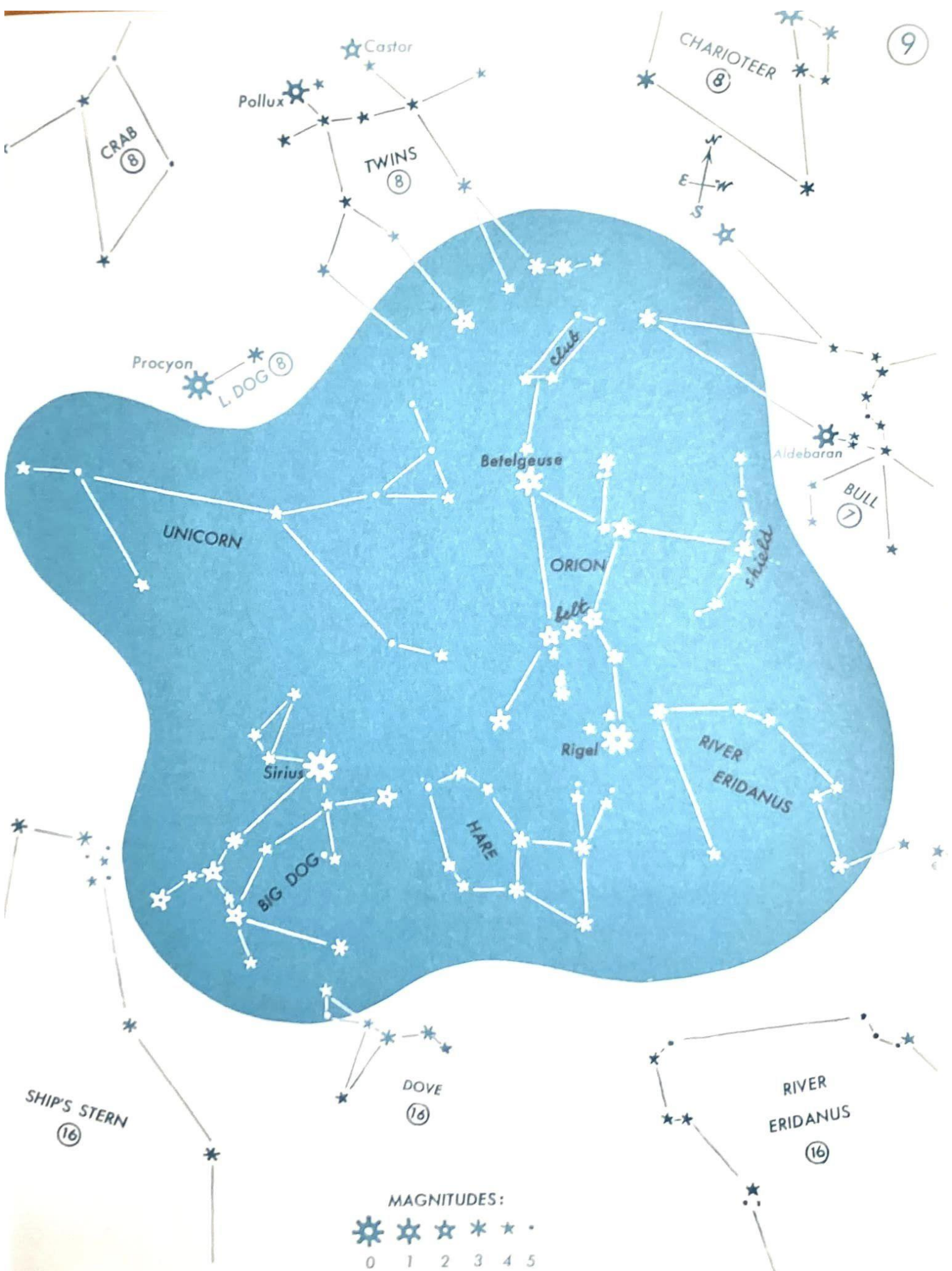
**NOTE:** The region around Orion is the most splendid of our skies. When Orion is high up, you see seven 1st-mag. stars in this relatively small section. Six of them form a vast hexagon: Capella, Pollux, Procyon, Sirius, Rigel, and Aldebaran (see Calendar Chart 1). In the center of the hexagon, more or less, you have brilliant Betelgeuse. The region to the right of Orion's feet contrasts sharply with that splendor: it is the "Wet Region," with Eridanus River, Whale, Water Carrier, and Fishes, none of them having very bright stars.

**BEST TIMES for ORION:** December through March.

**BIG DOG and HARE:** January through March.  
Calendar Charts 1, 2, 3, 4, and 12.

<sup>1</sup> Stars with diameters from 10 to 100 times that of the sun are called giant stars; those with diameters greater than 100 times that of the sun are supergiants. Giant Rigel is so much more away and of smaller size.

<sup>2</sup> The 4th-mag. star in Eridanus, nearest the right edge of the chart, is Epsilon ( $\epsilon$ ) Eridani, a close neighbor, only 10½ light-years away. This star is similar to the sun but smaller, and astronomers hope to find out, by radio telescope, whether it has planets.

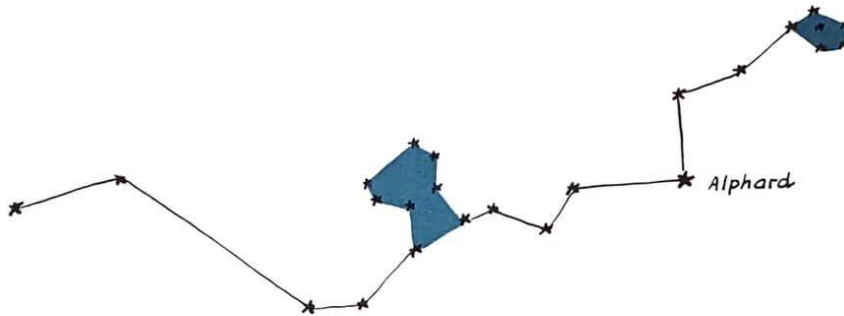


## CONSTELLATION CHART 10

### HYDRA, CUP

**HYDRA**—The **WATER SNAKE**: Largest constellation of our skies and so long it does not fit into one chart: its tail is to be found on the following chart. It spans about one quarter of the sky but has little to show besides mere length. It has only one bright star—ALPHARD, of 2nd mag.—which appears brighter than it is because it has no competition near.

Hydra's head, however, is a pretty little group of stars and worth looking for: about halfway between Regulus in the Lion and Procyon in the Little Dog: a line through the stars which form the Lion's forepaws will hit Hydra's head.<sup>1</sup>



On the back of Hydra sits the **CUP (CRATER)**, a small and rather faint constellation. It is hard to see in middle latitudes but farther south, where it rises higher, its graceful shape can be traced easily on clear dark nights.

The Snake, the Cup, and the Crow (chart 11) are connected by myth: the Crow or Raven, as it is also called, used to be the messenger of the god Apollo. Sent by the god to fetch a drink of water in the cup, the crow dallied under a fig tree till the figs were ripe enough to eat, then came home without the cup, but with the snake in his fangs as an alibi for the unaccomplished mission. Thereupon the angry god put snake, cup, and crow into the sky among the stars, and since that day all crows, formerly silvery white, are as black as night.

The solitary 4th-mag. star below Cup and Hydra belongs to the **PUMP (ANTLIA)**,<sup>2</sup> a dull modern constellation whose other stars are too faint to be shown on this chart. Don't bother.

**BEST TIMES for HYDRA'S HEAD:** February through May.

**CUP:** April and May.

Calendar Charts 2 to 5.

<sup>1</sup> The star at the end of the Unicorn's tail, below Hydra's head, belongs technically to Hydra. Originally part of the Unicorn, it was transferred to Hydra when all constellation boundaries were revised in 1930 (see page 147). The design shown here leaves both (Hydra and Unicorn) in better shapes, but remember Hydra's claim if you are doing some serious observing.

<sup>2</sup> This constellation used to be called Antlia Pneumatica, the Air Pump, but astronomers have shortened it to Antlia, which means just Pump.



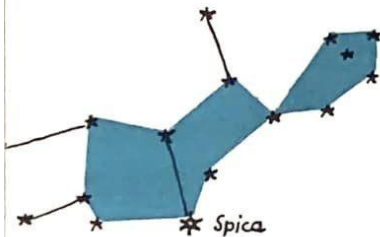
MAGNITUDES:



0 1 2 3 4 5

# CONSTELLATION CHART II

## VIRGIN, SCALES, CROW



**VIRGIN (VIRGO)**: Large constellation but mostly faint. She is lying on her back, stretched out along the ecliptic (see Calendar Chart 5), with her head under the Lion's tail and her arm reaching for Berenice's Hair. She seems to be looking toward the Herdsman but he turns his back on her. She carries her brightest jewel—the bluish 1st-mag. star SPICA—on an unusual spot. To find Spica, follow the sweep of the Dipper's handle to Arcturus (see chart 4) and go on with that sweep: you can't miss Spica, as there are no very bright stars near it.

However, there may be a planet nearby as the Virgin is a constellation of the zodiac. The star Spica is very close to the ecliptic; like Aldebaran, Regulus, and Antares (in the Scorpion) it is sometimes hidden by the passing moon. Spica is not a giant star, only 5 times as large across as the sun but 1000 times as luminous, and about 190 light-years away.

Spica, Arcturus, Cor Caroli (chart 3) and the Lion's tail star Denebola form the *Virgin's Diamond* (see Calendar Chart 3).



**THE SCALES (LIBRA)**: Well known by name for being in the zodiac but not much to look at. It has no bright stars and the shape of a pair of scales is not easy to bring out. The star lowest to the right has a very faint greenish hue: the only green naked-eye star.

**CROW (CORVUS)**: Small but quite bright, below the Virgin's head. The star at the tip of the bill, and the one where the leg joins the bird's body, are rather faint, so the complete shape of a sitting crow can only be seen under best conditions, but the four brightest stars of the constellation, forming a quadrangle, are easily found. The Crow's bill is pointed toward the Virgin's jewel, Spica, as though he were waiting for a chance to grab it.

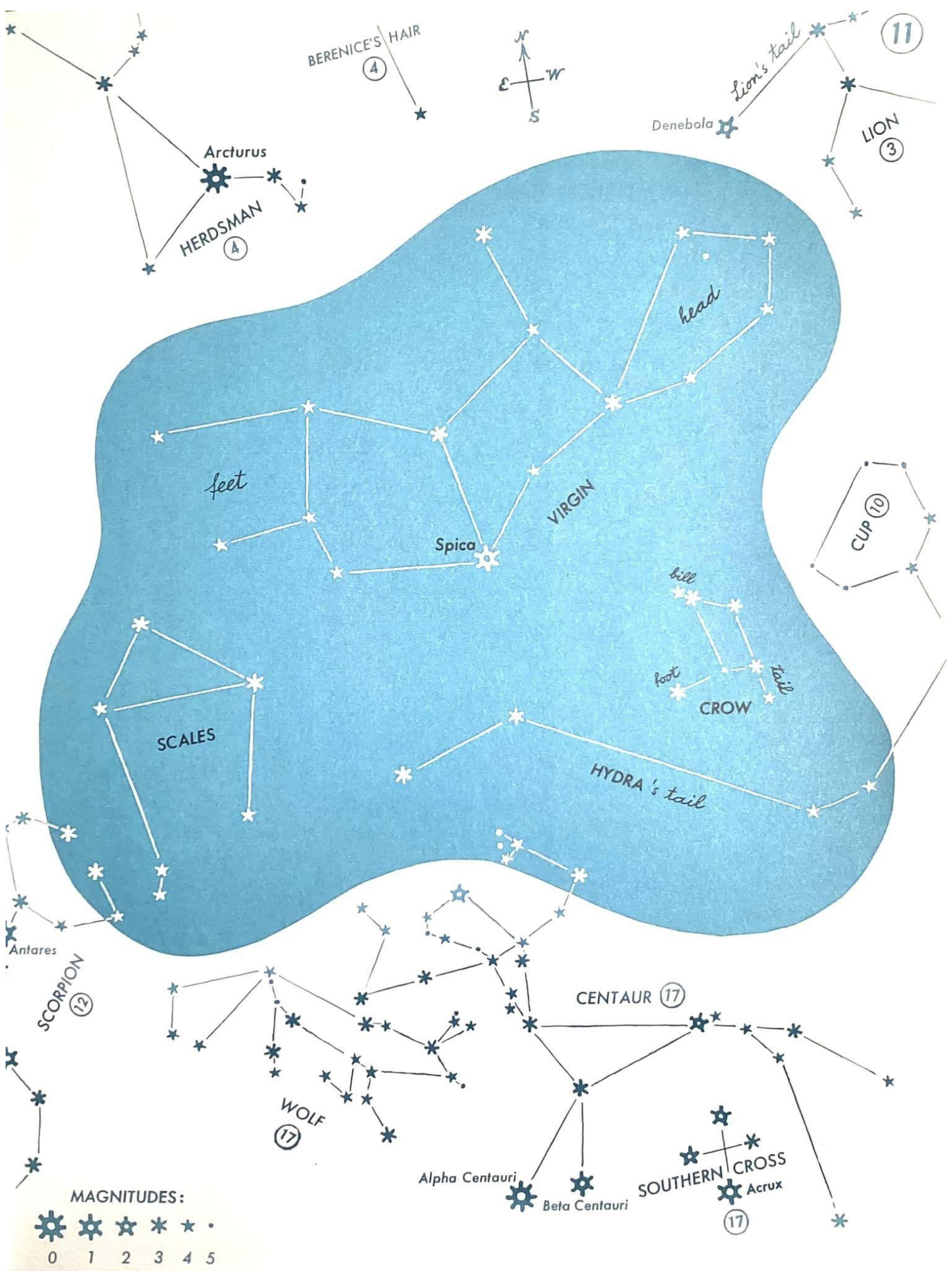
**NOTE:** South of Hydra's tail lie the WOLF, CENTAUR, and the famous SOUTHERN CROSS (chart 17), too far south for most of the U.S., but if you happen to be on the Florida Keys watch the Crow in late winter: when he is due south you may see far below, just above the sea, the stars of the Cross, provided no cloud banks bar your view at the horizon.

**BEST TIMES** for VIRGIN and CROW: April, May, June.

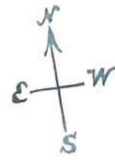
SCALES: June and July.

Calendar Charts 4 to 8.





BERENICE'S HAIR (4)



(11)

LION (3)

Denebola

Arcturus

HERDSMAN (4)

head

VIRGIN

Spica

CUP (10)

bill

foot

tail

CROW

SCALES

HYDRA'S tail

Antares

SCORPION (12)

CENTAUR (17)

WOLF (17)

Alpha Centauri

Beta Centauri

SOUTHERN CROSS

AcruX

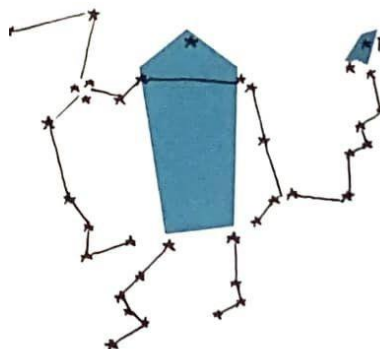
(17)

MAGNITUDES:



## CONSTELLATION CHART 12

### SERPENT HOLDER, SCORPION



**SERPENT HOLDER (OPHIUCHUS):** Vast group, somewhat complex,<sup>1</sup> resembling a voodoo doctor holding the pieces of a snake torn in two. To trace this figure, start with bright star at top of triangular head, left of Hercules' forward foot. The two pairs of stars in the doctor's shoulders are easily recognized. Next trace the huge rectangular body, then the right arm with SERPENT'S front part. The snake's head is a pretty little group, south of the Crown. The left arm with the Serpent's tail comes next, and last the rather dim feet. If you succeed in seeing the whole after a few trials, you feel you have accomplished something.

An odd thing about the Serpent Holder is that it reaches into the zodiac, yet is not by tradition counted among the zodiacal figures, possibly because there would then be 13 constellations instead of 12.



**SCORPION (SCORPIUS):** Beautiful constellation in the zodiac. Unfortunately a little too far south to be seen in all its splendor in the northern United States. It really looks like a scorpion, formed by a number of bright stars. The brightest is brilliant ANTARES, of 1st mag. and distinctly reddish. Antares (Ant-Ares) means rival of Mars, Ares being Greek for Mars. If Antares and the planet Mars are close together, as sometimes happens, they can be confused, because both are red.

Antares is another supergiant, 300 times the sun's diameter and over 3000 times as luminous as our mother star. It would shine even brighter if it were not so far away, almost 300 light-years. Antares is close to the ecliptic and sometimes hidden by the moon, like Regulus, Spica and Aldebaran.

Look for the CAT'S EYES, a close pair of stars in the Scorpion's tail. You will find the name quite fitting.

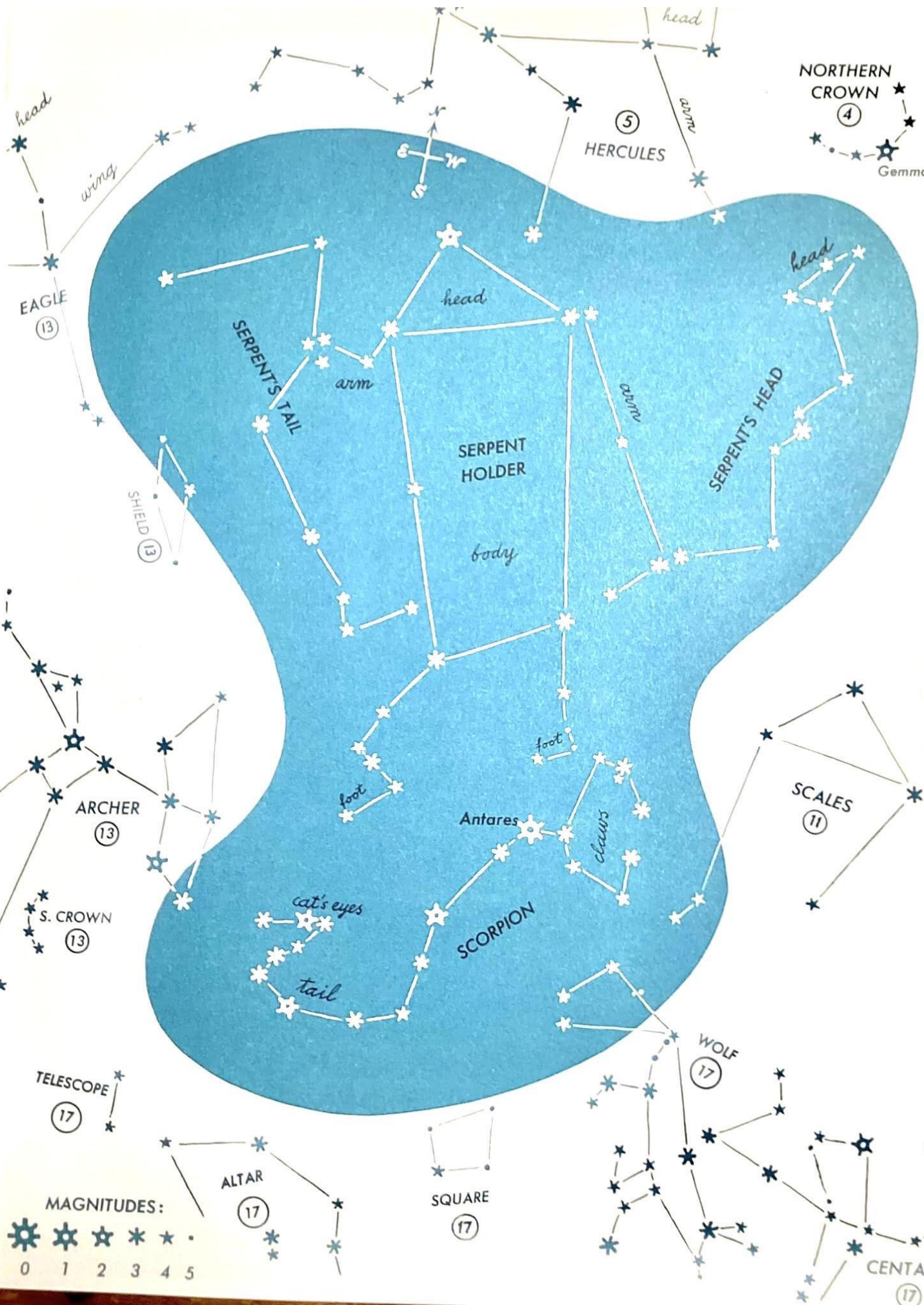
You can't miss the Scorpion if you use the proper Calendar Chart. Remember that there may be planets nearby. In the middle northern latitudes the constellation is never very high up, and always in the southern part of the sky.

**NOTE:** To speak of the *Serpent Holder* as a doctor is not a mere whim. The figure is thought to represent *Asklepios*, Greek god of medicine who can be traced back to the Egyptian *Imhotep* (about 2900 B.C.), eminent physician and architect: first man of science in recorded history. The Serpent Holder thus becomes, indirectly, the only constellation representing a historical person.

In Greek mythology, Asklepios was originally a mortal physician who never lost a patient by death. This alarmed Hades, god of the Dead, who feared unemployment, and when Asklepios tried to revive *Orion*, who had been killed by a scorpion, Hades prevailed on his brother Zeus to liquidate Asklepios with a thunderbolt. In recognition of his merits, however, Asklepios was put into the sky as a constellation, together with the scorpion but far away from Orion to avoid further trouble. Since then, Orion and Scorpion never meet, being on opposite sides of the sky. When you see one, you cannot see the other.

**BEST TIMES** for SERPENT HOLDER and SCORPION: July and August.  
Calendar Charts 6 to 9.

<sup>1</sup> Technically, it's two constellations: one the *man*, the other the SERPENT (SERPENS) in two separate parts: HEAD (CAPUT) and TAIL (CAUDA).



⑤ HERCULES

⑪ SCALES

⑰ WOLF

⑰ CENTAUR

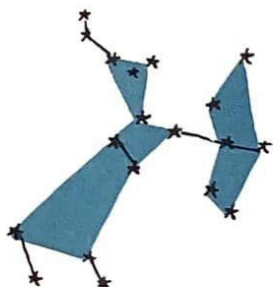
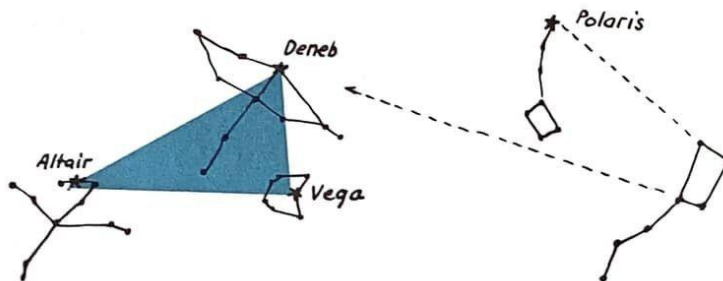
MAGNITUDES:  
 0 1 2 3 4 5

## CONSTELLATION CHART 13

### EAGLE, ARCHER, ARROW, DOLPHIN, SOUTHERN CROWN, SHIELD



**EAGLE (AQUILA)**: Beautiful constellation; the shape of a great bird soaring with widespread wings is impressive. His head, three stars in a straight row, is a landmark of the sky in summer and early fall, you can hardly miss it. One star in the head is faint, another fairly bright; the middle one is the brightest: yellowish-white ALTAIR (1st mag.), next to Alpha Centauri (chart 17), Sirius, and Procyon our closest neighbor among the brighter stars, only 16 light-years away<sup>1</sup> and coming closer by 1000 miles a minute. Altair, Vega (in the Lyre), and Deneb (in the Swan) form a huge right triangle, known to all navigators; see sketch below. The Eagle is flying toward the Swan; they seem about to meet head-on, both in the Milky Way.



**ARCHER (SAGITTARIUS)**: The Eagle's tail points toward this fine constellation. The stars in its lower part are faint and not often seen in our latitudes because of ground haze. Those of the bow and body are brighter. Trace the body first: 4 fairly bright stars forming a small quadrangle (about one-quarter the size of the Big Dipper's bowl). This group is called the MILK DIPPER: it is close to the Milky Way. The Archer's head is adorned with a feather and his bow is pointed toward the Scorpion, apparently with intent to kill—perhaps to avenge Orion's death.

The Archer is partly in the Milky Way and also in the zodiac, so watch out for planets.



**ARROW (SAGITTA)**: Small constellation but quite striking for its size. Halfway between the heads of the Swan and the Eagle, in the Milky Way.



**DOLPHIN (DELPHINUS)**: Very tiny, with faint stars only, but the stars are so close together that the figure is easily seen on clear, dark nights; it looks charming, swimming just outside the Milky Way, not far from the Eagle's head.



**SOUTHERN CROWN (CORONA AUSTRALIS)**: Above our horizon when the Archer is at his highest, but too faint to be seen through the ground haze in middle northern latitudes. It can be seen in the southernmost U.S. but is less impressive than the Northern Crown.



**SHIELD (SCUTUM)**: Modern constellation, small and dull.

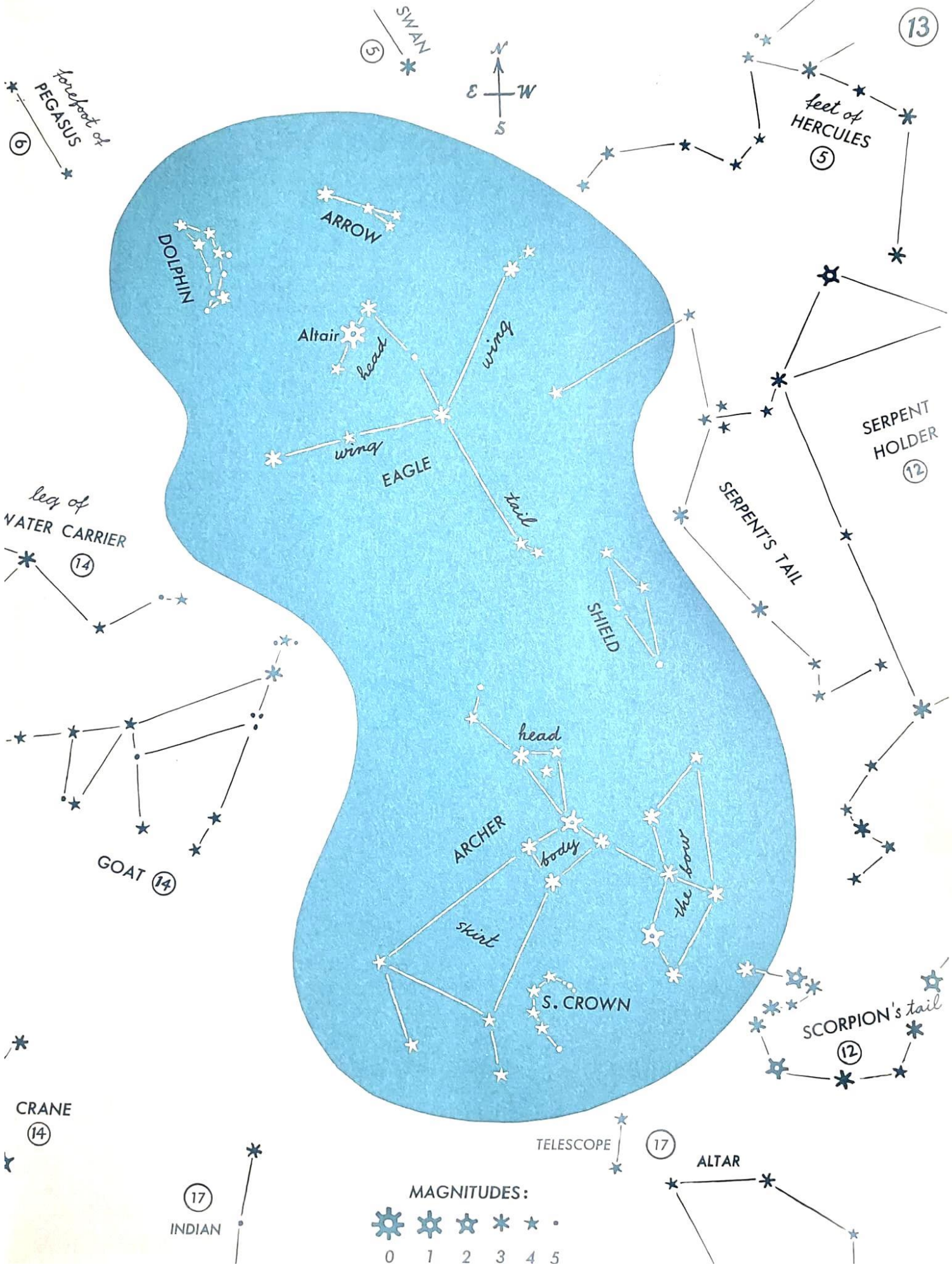
**BEST TIMES for EAGLE**: July through October.

**ARCHER**: July and August.

**ARROW and DOLPHIN**: July through November.

Calendar Charts 7 to 11.

<sup>1</sup> Altair is only 1½ times as large across as the sun, and about 9 times as luminous. We could not see Altair at all if it were as far away as Deneb (500 light-years).



MAGNITUDES:



TELESCOPE

ALTAR

13

5

6

14

14

14

17

17

12

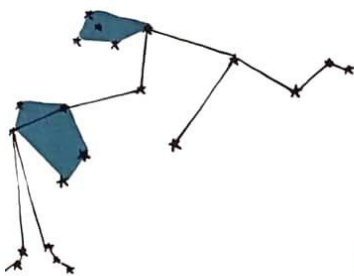
12

## CONSTELLATION CHART 14

### GOAT, WATER CARRIER, SOUTHERN FISH



**GOAT (CAPRICORNUS)**: Faint constellation. If it were not in the zodiac most people would not even know its name. It is in the southern sky and never high up in the northern U.S., which makes it hard to see unless visibility is perfect. The three stars in the Eagle's head point toward the Goat's tail: this part is easiest recognized with its three stars close together. The star at the tip of the horn lies on a straight line from Altair, in the Eagle, to Fomalhaut, in the Southern Fish (see below). If you see a really bright star in the Goat it does not belong to the constellation but is a planet.



**WATER CARRIER (AQUARIUS)**: Faint and complicated. Like Crab and Goat, the Water Carrier owes his reputation to being a member of the zodiac. He seems to be running, holding a vessel with his bent arm; two jets of water are flowing from the vessel down to the *Southern Fish*. The small group of stars which mark the man's head are on a line drawn diagonally across the *Great Square*, from Andromeda's head to Pegasus' tail, and beyond. This group is easy to find; the rest of the sprawling figure can be traced from there, but it takes some effort and a very clear, dark night.



Fomalhaut

**LITTLE HORSE (EQUULEUS)**: Barely visible, it is so tiny and faint. Don't bother.

**SOUTHERN FISH (PISCIS AUSTRINUS)**: The faint stars which make up most of this constellation cannot be seen in our latitudes. They are above the horizon at times but too low to penetrate the ground haze. The constellation's main star, however, is all the more conspicuous: bluish-white FOMALHAUT, one of the 20 brightest stars. You can hardly fail to see it when it is up; a line through the two bright stars on the Pegasus side of the *Great Square* and far downward points straight to brilliant Fomalhaut, solitary in a very dull region. In case you find another bright star halfway between the *Great Square* and Fomalhaut, it's not a star but a planet passing through the Water Carrier.

FOMALHAUT is one of our closer neighbors, about 22 light-years away and 13 times as luminous as the sun. It announces the coming of fall: the leaves begin to turn when you see it for the first time at nightfall, in mid or late September.

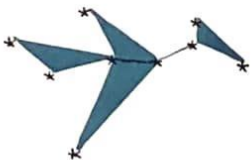
South of the Southern Fish are the constellations **CRANE (GRUS)** and **PHOENIX**. In the northern U.S., both birds just raise their heads above the horizon, and one or two of their brighter stars may be seen SW and SE of Fomalhaut, but in the far south they can be seen whole, under good conditions.

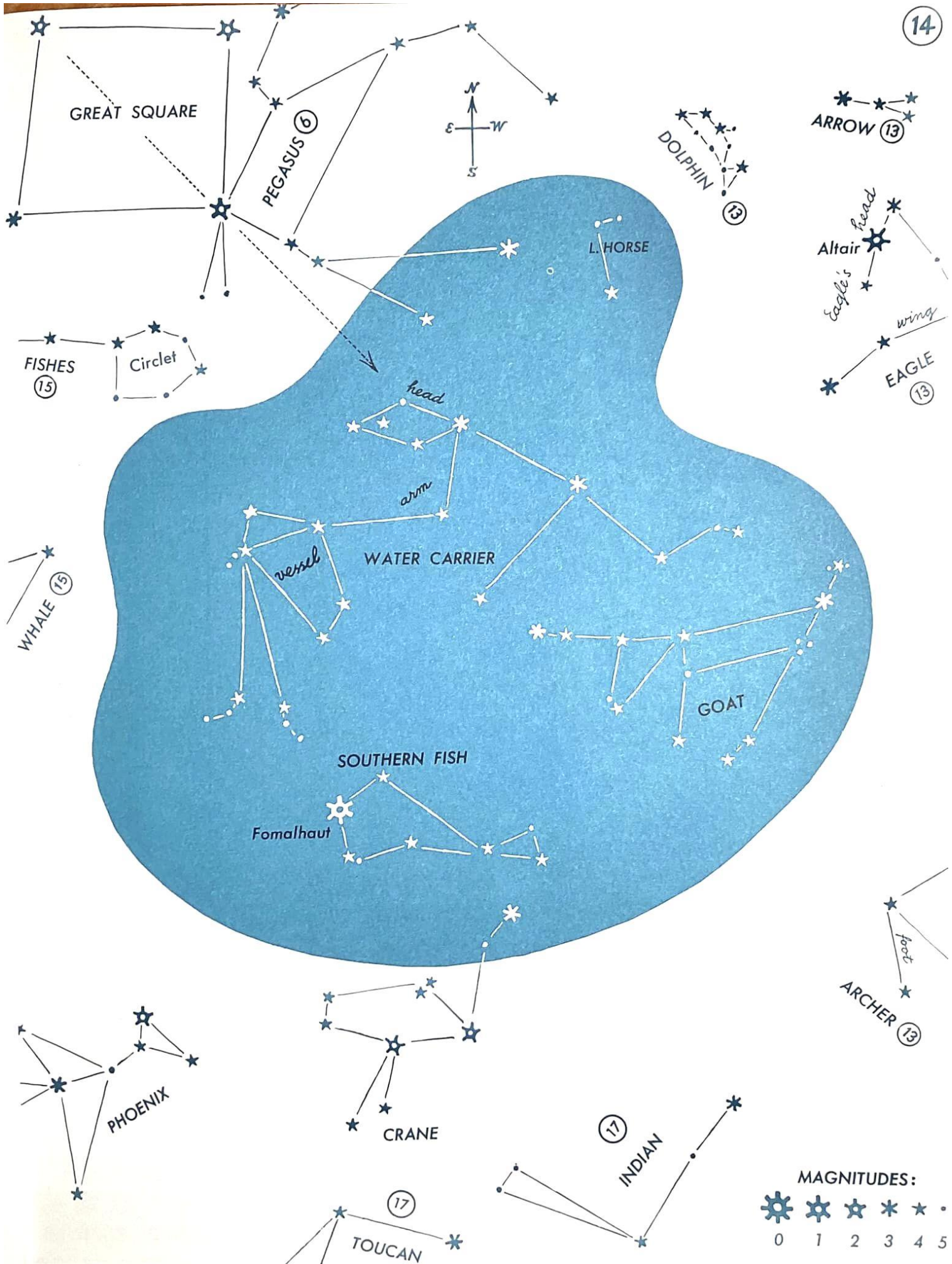
NOTE: Water Carrier and Southern Fish both have to do with *water*. They belong to the group of constellations which make up the "Wet Region" of the sky. Fishes and Whale, on the next chart, and Eridanus River on chart 9, also belong to it. It's a dull region with few bright stars.

**BEST TIMES** for GOAT and WATER CARRIER: August through October.

SOUTHERN FISH: September through November.

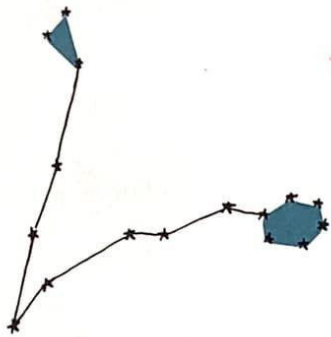
Calendar Charts 8 to 11.





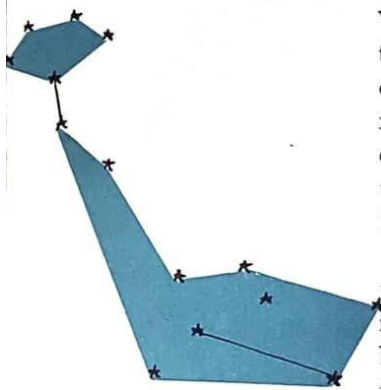
## CONSTELLATION CHART 15

### FISHES, WHALE



**FISHES (PISCES)**: Large but faint constellation; next to the Crab the faintest one in the zodiac. (Look for planets!) It looks like two fishes, each one caught on a line, both lines tied together in a knot. The **NORTHERN FISH** is a small triangle of faint stars just south of Andromeda's hip. The **WESTERN FISH** or **CIRCLET** is a little brighter. Its ring-like shape is easily recognized, on clear nights, south of the southern side of the Great Square. To find the **KNOT** draw a line from Andromeda's brighter foot to the Ram's head and about the same distance beyond.

The V on the chart, to the left of the Circlet, marks the *vernal equinox*, an important point in the sky, on the ecliptic, the sun's yearly path among the stars. When the sun reaches this spot, on or about March 21, night and day are equal (hence *equi*—equal, *nox*—night), and *spring begins* on our hemisphere. More about this on page 119, figure 19. The *zero hour circle* (the sky's "Greenwich line," see page 40) also goes through this point. It is marked roughly by a line from the Pole Star through the last star in Cassiopeia's W, then along the east side of the Great Square, on to the Whale's snout and down to the fairly bright star in the head of Phoenix.



**WHALE (CETUS)**: Very large constellation, but dim. Under orders from Neptune to devour Andromeda (see chart 6), the Whale is swimming around south of that constellation, separated from his chained victim by the Fishes. The Whale's nose is on a line from Andromeda's head, along the side of the Great Square, and straight on downward. It is easier to find than it sounds because there are so few stars in that region that even a faint one stands out. A 2nd-mag. star marks the Whale's large mouth, a little farther down, and the tail points toward the Pleiades.

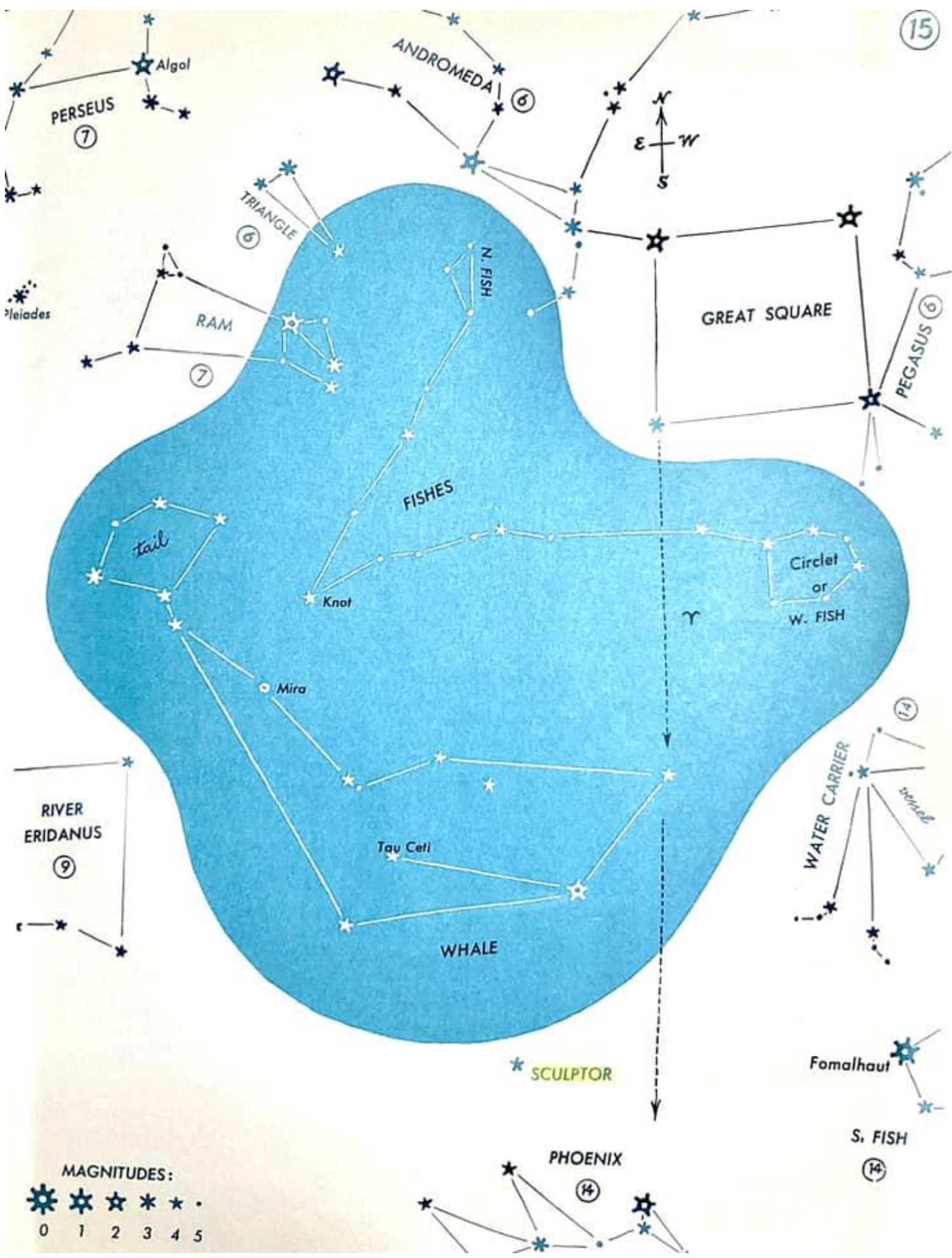
The Whale contains a famous variable star, **MIRA** (Latin for wonderful). Mira varies in 331 days from 10th mag. (invisible without a telescope) to about 3rd mag. and back, and most of the time you don't see it. The solitary 4th-mag. star below the Whale marks the **SCULPTOR**, a dim modern constellation; the other stars in this group are too faint to be shown here.

Whale and Fishes are in the "Wet Region" of the sky mentioned on chart 14. Quite fittingly, these constellations are highest around November, a rainy month in many parts of our hemisphere.

The faint star at the corner of the Whale's mouth is **TAU CETI**, the third nearest star visible to the naked eye in our latitudes; only Sirius and Procyon are nearer. It is about 10 light-years away and only about one-third as luminous as our sun. After having mentioned so many stars brighter than the sun, it seems only fair to point out a star which is dimmer. The brilliant stars are the ones that are talked about, and this creates the impression—an erroneous one—that our sun is a rather poor member of the celestial community. In fact, the sun is a better-than-average star. Among the 20 stars less than 13 light-years away from us, only two are superior to the sun (Sirius and Procyon), one is about the same (Alpha Centauri), and all the others are weaker. This may comfort one's pride as an inhabitant of the solar system.

**BEST TIME** for **WHALE** and **FISHES**: October through January.  
Calendar Charts 1, 9, 10, 11, and 12.

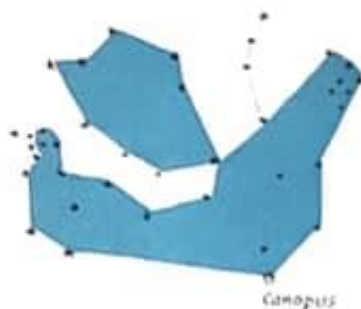




MAGNITUDES:  
 0 1 2 3 4 5

## SOUTHERNMOST CONSTELLATIONS I

The constellations shown on charts 16 and 17 lie close to the south pole of the sky. In middle latitudes, around 40° north, most of them are entirely out of sight. The farther south you go, the more they will come into view, and if you pass the equator you will see them all at one time or another. Except for Ship, Centaur, Wolf, and Altar they are of modern origin, and most of them are rather dull. The Calendar Charts on pages 74–97 show you when to see them or, if you are farther south than latitude 25° north, look at Calendar Charts 14–16.



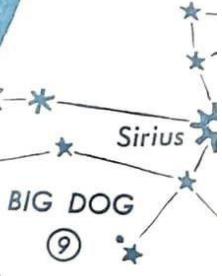
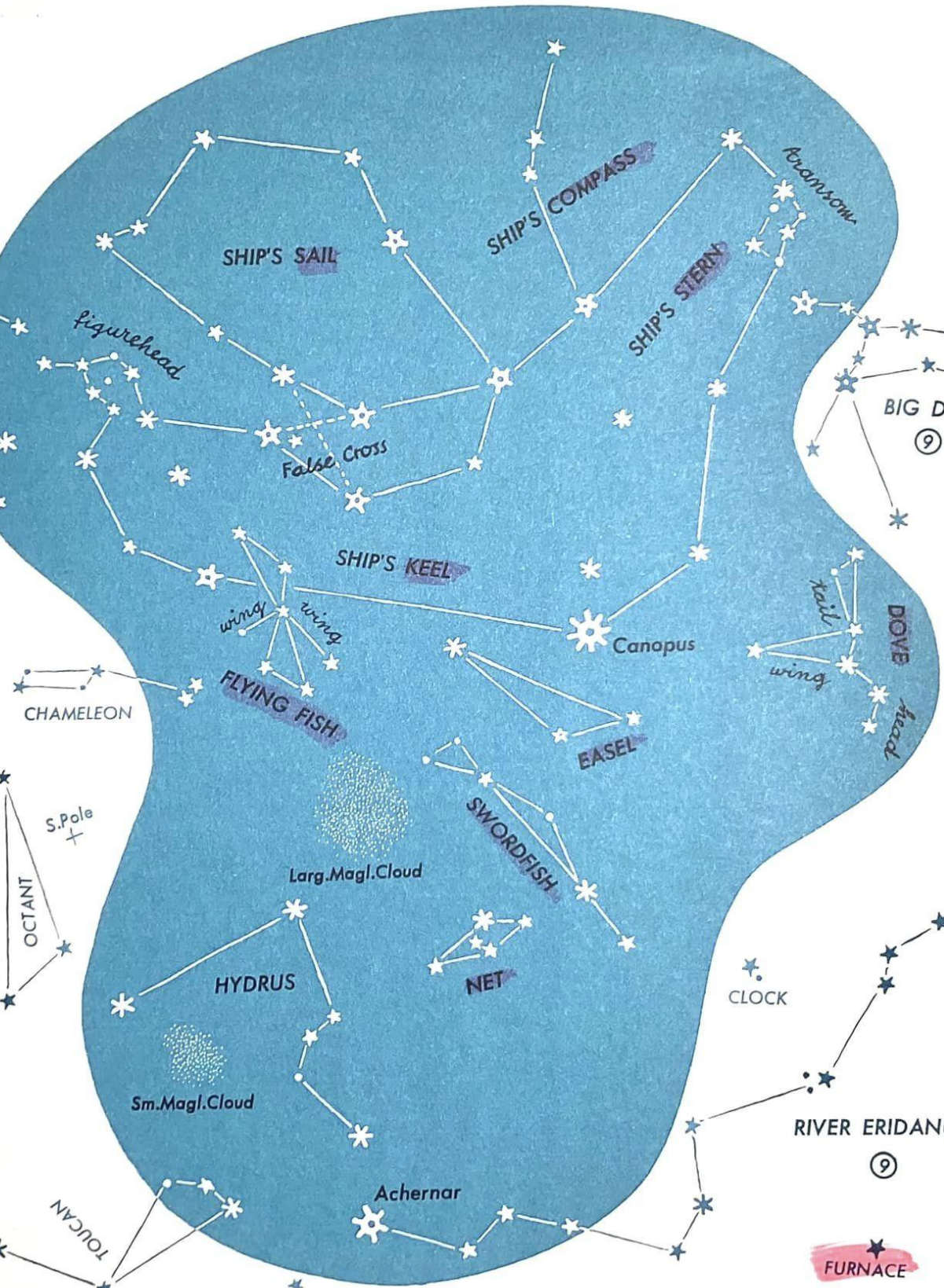
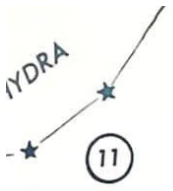
THE SHIP, a large majestic group, is formed by four constellations: **KEEL** (CARINA), **STERN** (PUPPIS), **SAIL** (VELA),<sup>1</sup> and **COMPASS** (PYXIS). Originally they were considered as one—the Ship Argo on which, according to Greek myth, Jason and the Argonauts sailed in quest of the Golden Fleece. The Ship is not too hard to trace when high enough in the sky, and is well worth the effort. Its brightest star, CANOPUS, is second only to Sirius in brightness, yellowish white, 100 light-years away, 2000 times as luminous as the sun. You see Canopus very well in the southernmost states and may even get a glimpse of it as far north as Tennessee. Officially the Ship has no bow but the eastern part of the Keel makes a good substitute, figurehead and all. In the stern a small group of stars marks the transom but the ship's Compass looks rather like a tiller. As the Ship moves across the sky from east to west it is sailing backwards, as though it were trying to correct an error of navigation. The group of four stars joined by dotted lines very much resembles, and is often mistaken for, the Southern Cross nearby, and is aptly called the FALSE CROSS.



The lesser constellations in these parts include two fishes: **FLYING FISH** (VOLANS) and **SWORDFISH** (DORADO); one bird: **DOVE** (COLUMBA); one reptile: **HYDRUS**, the male water snake, supposedly mate of Hydra, which is female; and four objects: **EASEL** (PICTOR),<sup>1</sup> **NET** (RETICULUM), diamond-shaped, a bit small for the Swordfish near it; **CLOCK** (HOROLOGIUM); and **FURNACE** (FORNAX) with just one 4th-mag. star. More interesting is the 1st-mag. star at the bottom of the chart: ACHERNAR, brilliant bluish, at the southern end of the **RIVER ERIDANUS**, 70 light-years away and 200 times as luminous as the sun. At the proper times it can be seen from the southernmost states.

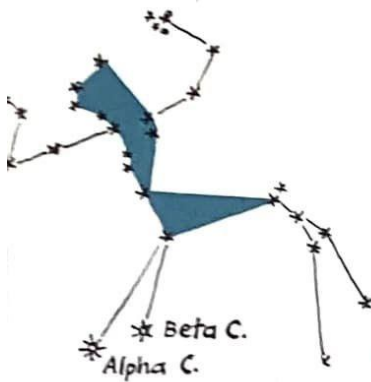
A special feature of this region are the two **MAGELLANIC CLOUDS**, the **LARGER** and the **SMALLER**, named after the great Portuguese sailor Magellan. Faint silvery patches on the dark sky, they look like stray parts of the Milky Way. They are galaxies composed of millions of stars, satellites of our own Milky Way galaxy (see page 145), and small as galaxies go: about 30,000 and 22,000 light-years across and about 140,000 and 160,000 light-years away. To see them well you have to cross the equator although they rise above the horizon at about 15° latitude north.

<sup>1</sup> Vela is plural, the Sails, but the name designates just one constellation, shaped like one sail only, so it seems sensible to use the singular form in English. Pictor is Latin for Painter; this group was originally called Equuleus Pictoris, Painter's Easel, and this name, or just Easel for short, goes better with the triangular shape of the group.



MAGNITUDES:  
0 1 2 3 4 5

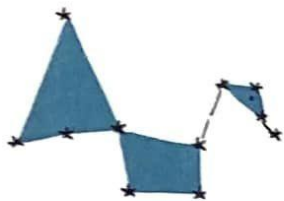
SOUTHERNMOST CONSTELLATIONS II



**CENTAUR (CENTAURUS)**: Large impressive figure, not as hard to trace as you might conclude from its complex shape. Half horse, half man., the Centaur is held to represent Chiron, the teacher of Jason of Argonaut fame. Two 1st-mag. stars mark his forefeet: ALPHA CENTAURI,<sup>1</sup> brighter of the two, yellow-orange, is the nearest of all bright stars, only 4.3 light-years away from the solar system. It's actually a double star, two stars revolving around each other, the larger one about the size of the sun and slightly more luminous. BETA CENTAURI, bluish and not quite as brilliant as Alpha, is 190 light-years away and 1500 times as luminous as the sun. To us Alpha appears brighter because it is so much closer.



**SOUTHERN CROSS (CRUX)**: Small<sup>2</sup> but famous. Its longer bar points almost exactly toward the south pole of the sky which, alas, is not marked by any bright star like its northern counterpart. Beware of the False Cross (page 60) which is larger, less bright, and does not point south. The Cross has two 1st mag. stars, both bluish: Alpha, the brighter one, known as ACRUX, shows up as a double, even in a small telescope; the pair is about 270 light-years away and, combined, about 1400 times as luminous as the sun. The star Beta, or BECRUX,<sup>1</sup> is 500 light-years away, with about 850 times the sun's luminosity. "Crux" is Latin for Cross, without "Southern," for there is no constellation Northern Cross; the group in the Swan so named (page 38) is but an asterism, not a true constellation. But Southern Cross sounds romantic, and the name is popular, so why not keep it. Northern visitors, though, are often disappointed at the sight: it is not as grand as they expected and looks more like a kite than a cross. Still, it's a graceful group.



Only three of the other constellations in this region have stars as bright as 2nd mag.: the **PEACOCK (PAVO)**, marked by a square body and triangular tail; the **SOUTHERN TRIANGLE (TRIANGULUM AUSTRALE)**, brighter and larger than its northern namesake; and the **WOLF (LUPUS)**, quite wolf-like in shape, trots beneath one arm of the Centaur, who seems about to seize him. The **FLY (MUSCA)**, busy little group near the Cross, is the only insect in the sky. The dull **OCTANT (OCTANS)** contains the starless south pole of the sky within its area though not within the shape shown here. Near the Triangle lie two draftsman's tools: the **DIVIDERS (CIRCINUS)** and the **SQUARE (NORMA)**. The **BIRD OF PARADISE** has none of the splendor of his earthly cousin. A close pair of stars, easy to spot, marks the head of the **CHAMELEON**. The **TOUCAN (TUCANA)** should have a prominent beak, and he has. The **INDIAN (INDUS)** looks faintly like a tomahawk. Don't bother about the **TELESCOPE (TELESCOPIUM)**, two 4th-mag. stars near the **ALTAR**, an irregular pentagon with two stars inside marking the altar's flame.



<sup>1</sup> The small letters of the Greek alphabet followed by the constellation's Latin name in the genitive are used in astronomy to mark the stars in a constellation, roughly in order of brightness. Besides, many bright stars have proper names: Alpha ( $\alpha$ ) Leonis (gen. of Leo, Lion) is named Regulus, Beta ( $\beta$ ) Cygni (gen. of Cygnus, Swan) is called Albireo, and so on. The proper names of the Centaur's brightest stars, however (HADAR and WAZN), are no longer used. Instead they are plainly called Alpha and Beta Centauri (gen. of Centaurus) but in navigation Alpha is known as Rigil Kentaurus. The brightest stars in the Cross are widely but not officially called ACRUX, a contraction of sorts of Alpha Crucis, and BECRUX, of Beta Crucis.

<sup>2</sup> In fact, the Cross is the smallest, in area, of all constellations. If other constellations appear smaller on these charts they do so because they have fewer bright stars. The borderlines of the constellations, which determine their areas, are not given in these charts; you find them in any star atlas.

