



Garter snake eating minnow.

One of the times when the snakes were fed minnows, the fish bowl was placed in the cage at two in the afternoon and the snakes were put into the water. They were observed for a few minutes and then left in the water. At five p.m. they were still as active as at two. In fact, they were both in the bowl completely submerged. Judging from the amount of water in the sand outside the bowl and the amount of sand in the bowl, they had been in and out of the water all afternoon. There were ten of the 40 minnows left (mostly small ones) which would indicate that each snake ate an average of 15 minnows. We offered a few of the remaining minnows to the snakes and they were most cooperative, opening their mouths when they saw our fingers approaching. When we took the fish bowl out

of their cage the snakes appeared to be quite excited and darted around in their water dish apparently searching for more minnows. The snakes ate both dead and live minnows. The dead minnows were not taken first although occasionally a dead minnow would be eaten when live minnows were still available. Garter snakes evidently will vary their diet to include other than live food.

During the summer the snakes were on a diet of earthworms and frogs, but now are apparently doing well on a diet of raw beef, minnows and other live animals being less readily available. To get the snake to eat raw meat, it was first held and wiggled in front of the snake's nose without it paying any attention to it for a minute or two. Then the snake showed interest by raising its head toward the meat. As the meat was moved gradually back and forth in front of the snake it followed with its head and forepart of its body. After the snake's interest was thus aroused the meat was dropped in front of it. The meat fell on the bottom of the cage. With one dash the snake had it in its mouth and proceeded to swallow it. All that was necessary subsequently to interest the snake in pieces of meat was to hold a piece in front of it. The snake would grab the meat and eat it.

## How Bright the Stars?

by JOHN HODGES, Regina Astronomical Society

In previous articles, we have described the overall motion of the heavens throughout the year and the grouping of the stars in constellations. We have thus shown how to tell when certain constellations will be visible and how to find any particular star we might be looking for. Another problem of the amateur astronomer is how to tell or compare the brightness of the stars. This is not as difficult as it seems.

Most phenomena in the sky are measured by brightness—the nearness of an approaching planet or a comet, a meteor's behaviour as it streaks across the sky, the outlining of a constellation. The measure of this brightness is called magnitude.

The system now in use to measure

a star's brightness had an interesting origin. Hipparchus, the greatest of the Greek astronomers, made two tremendously important contributions to astronomy. He catalogued 1,000 stars, and he divided them into groups according to their brightness. Six divisions or classes of brilliance were established, the first twenty bright stars being described as first magnitude and the faintest that were visible to the naked eye as sixth magnitude. Note that the smaller the number, the brighter the star. Ptolemy, who succeeded Hipparchus, modified the original catalogue, but little realized that his efforts were to remain the standard reference for some 1,500 years. His catalogue of stars was used by Columbus to di-



cover America and by Vasco da Gama to round the Cape of Good Hope.

The original choice by Hipparchus was a very fortunate one as we shall see. When the English astronomer Pogson set about to find how much difference there was between magnitudes in 1850, he was able to report that each magnitude was about two and a half times the previous magnitude. In other words, a magnitude two star is two and a half times fainter than a magnitude one star. It is interesting to note that the ratio between magnitudes one and six is very nearly 100.

Modern star charts indicate magnitude by the size of the dots used to represent stars. A table of a few stars and their magnitudes follows this article. More precise maps may confuse you because of negative magnitudes. As soon as telescopes were used, it was found that some of the brightest stars were brighter than magnitude one and so a zero magnitude was created. Sirius, the brightest star in the sky, is still brighter so it has a magnitude of -1.6 (the use of a decimal point gives a very precise magnitude). By this scale the full moon has a mag-

nitude of -12.6 and the sun a magnitude of -26.8.

Amateurs observing meteors for the I. G. Y. programme are asked to judge magnitude to half a magnitude. This is not too difficult if you are familiar with the more conspicuous constellations and the stars they contain. Let us take the Little Dipper (Ursa Minor) as an example. Polaris, which forms the first star in the handle, is of 2.0 magnitude. The four stars of the bowl are of second, third, fourth and fifth magnitudes. Do not forget that the brightest of these will have the smallest number. You can tell with the naked eye which is which, and you now have a standard.

You may find a few more constellations easily by starting with the Big Dipper (Ursa Major) and using the following scheme. The pointer stars are five degrees apart, and six times this distance away or thirty degrees lies Polaris. The bottom of the bowl in a direction away from the handle points to Castor in the constellation Gemini. The two stars on the handle side of the bowl point to Regulus in Leo. Following the curve of the handle will guide you to Arcturus in Bootes.

TABLE OF MAGNITUDES

Star	Magnitude	Constellation	Month when overhead at 9:00 p.m.
Polaris	2.0	Little Dipper (Ursa Minor)	June, December
Mizar	1.9	Big Dipper (Ursa Major)	April
Castor	1.0	Twins (Gemini)	February
Regulus	1.0	Lion (Leo)	April
Arcturus	0	Shepherd (Bootes)	June

## A Record of *Boloria toddi toddi* double brooded at the Pas, Manitoba

by WALTER KRIVDA, the Pas, Manitoba

I have collected butterflies in the area of the Pas, Manitoba for almost ten years now, but this is the first year that I have found *Boloria toddi toddi* double brooded.

The typical brood appears about the middle of June. The flight period begins with a preponderance of males, followed by the gradual appearance of the females. As the flight ends, fresh females can still be taken on the wing, but males are tattered and worn. The flight is usually over by the first week of July. The females are the last to die.

The best spot for this small Fritillary in the Pas area is Devon Park, which is almost native "lawn" with such plant species as *Anemone riparia*, *Sisyrinchium angustifolium*, *As-tragalus goniatus*, *Antemmaria* sp. (sterile rosettes), *Vicia cracca* and *Poa palustris*. This "lawn" is mowed infrequently, permitting the establishment and persistence of a fine colony of *Boloria toddi*. They probably feed on *Viola rugulosa* growing among the rocks along the Saskatchewan River.

On August 2, 1957, near the east gate of the golf course, in a low,