Chapter 8: Approximate Latitude from Polaris

Polaris, the Northern star, is easy to find in the northern hemisphere by imagining a line extended four times the distance between the two stars forming the back end of the Big Dipper (Chapter 19, fig. 19.1). Polaris is fairly close (approximately 1.5°) to the prolongation of the axis of rotation of Earth. In fact, a camera pointing towards Polaris and left open for several hours will show the star going around a very small arc of circle of 1.5° of radius as Earth spins during the night.

The exact determination of our latitude from Polaris requires a number of small corrections to account for this slight offset. These can be done from special tables in the Almanac (see Appendix 2, pages 27 and 28), but the corrections depend, amongst other factors, on the position of Aries, the point of reference used to locate the stars. Until we learn to use the tables based on the coordinates of Aries (Chapter 15), we can estimate our latitude from a sight on Polaris with an error of 1.5° (90 miles) at the most.

Although lacking precision, the method might be of assistance if we have been drifting across the ocean for weeks in a life raft, and don't have a sun Declination table that would allow us to determine our latitude from a noon sight. Christopher Columbus is reported to have used Polaris, as well as noon sights, to estimate his latitude.

Our latitude is simply the altitude of Polaris above the horizon (fig. 8.1). If Polaris is 90° above the horizon, i.e. exactly above our head, its altitude is 90°. Our latitude is therefore 90° North, and we must be at the North Pole. On the other hand, if Polaris is visible just on the horizon, i.e. the altitude of Polaris over the horizon is zero, then our latitude is zero. We must be along the equator.

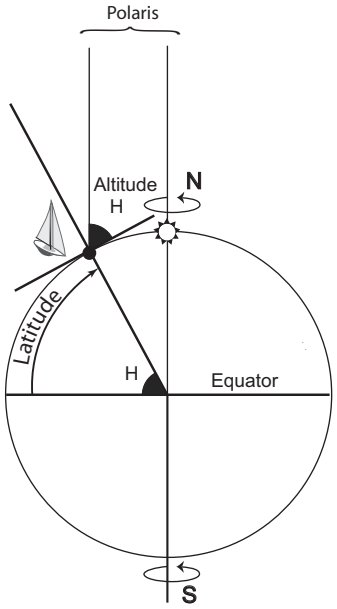

Fig. 8.1 The (approximate) latitude of the boat is the Altitude of Polaris, i.e. the angle at which Polaris is seen above the horizon.

Approximate latitude of the boat (within 1.5°) = Altitude of Polaris above the horizon.

The main potential error with this method lies in 1.5° offset of Polaris from the axis of rotation of Earth. If Polaris happens to be exactly east or west of the Earth axis (right or left when we look North), then its altitude does not require any adjustment, and our calculated latitude is exact. Our estimation of the true north, however, will be off by 1.5° to the east or the west.

If, on the other hand, Polaris is in line with the true north, either just above or just below the extension of the axis of rotation of Earth, then the altitude that we measure with the sextant will be too high or too low, and our latitude will be off by as much as 1.5° one way or the other. Our direction for the true North, however, will be

exact. It is interesting to note that Polaris is on the Cassiopeia side of the North Celestial Pole (Chapter 19, fig. 19.3): this means that, when Cassiopeia is approximately east or west of Polaris (rather than north or south), the use of Polaris as a substitute for the North Celestial Pole leads to a minimal error in measured latitude (but a maximum error in direction).

In all cases, averaging two sights on Polaris at 12 hours interval (one sight at dawn, and the other at dusk) will provide excellent latitude and direction (i.e. True North).

Other corrections for Polaris, in the Almanac, are extremely small: typically one minute of arc or less. These depend on the latitude of observation, which affects refraction, and the month of observation, which affects the angle at which we see Polaris from various points of the orbit of Earth around the Sun.