

5. COORDINATES

The location of a point on the surface of the Earth can be defined in a number of ways, for instance by a distance and a bearing from a given point. The traditional system of reference, however, relies on a grid of **parallels of latitude**, and **meridians of longitude**.

5.1 Latitudes and longitudes

The **latitudes** are now measured in degrees, minutes of angle, and tenths of minutes. Minutes of angle (or “minutes of arc”) are 1/60th of a degree. Latitudes are counted from 0° of latitude at the Equator, to 90° of latitude north at the North Pole, and to 90° of latitude south at the South Pole. Yellowknife (NWT) is at 63° of latitude north; Santiago (Chile) is at 33° of latitude south.

Longitudes are now measured in degrees, minutes of angle, and tenths of minutes. Longitudes are counted half way around the Earth, from 0° to 180° east, or from 0° to 180° west, from a meridian of reference in Europe.

There were considerable discussions, in the 17th and 18th centuries, as to where the **meridian of reference** for the longitudes should be. The British wanted to use the Greenwich Meridian; the French wanted the Paris Meridian, while others suggested a meridian at the most westerly end of the land occupied by Europeans, i.e. at the edge of one of the Azores islands, off the coast of Africa. The debate was concluded during the Chicago Convention of 1884, when countries agreed to use the Meridian of Greenwich. The GPS meridian of reference is, through an initial technical error, 102 m East of the Meridian of Greenwich. GPS receivers account for this discrepancy and give longitudes off the Greenwich Meridian.

For navigators who fly back and forth from one hemisphere to another, the system of coordinates introduces a risk of error. In Europe, for instance, the latitudes north increase from **bottom to top** on the chart, and the longitudes east increase from **left to right**. In Madagascar, the latitudes south increase from **top to bottom** on the chart, and the longitudes east increase from **left to right**. In Canada, the latitudes north increase from **bottom to top**, and the longitudes west increase from **right to left**.

In Celestial Navigation, the system of coordinates is simpler: longitudes are called “Greenwich Hour Angle” and are counted westward exclusively, following the sun, from 0° to 360° all the way around; this greatly facilitates calculations, and reduces the risk or errors.

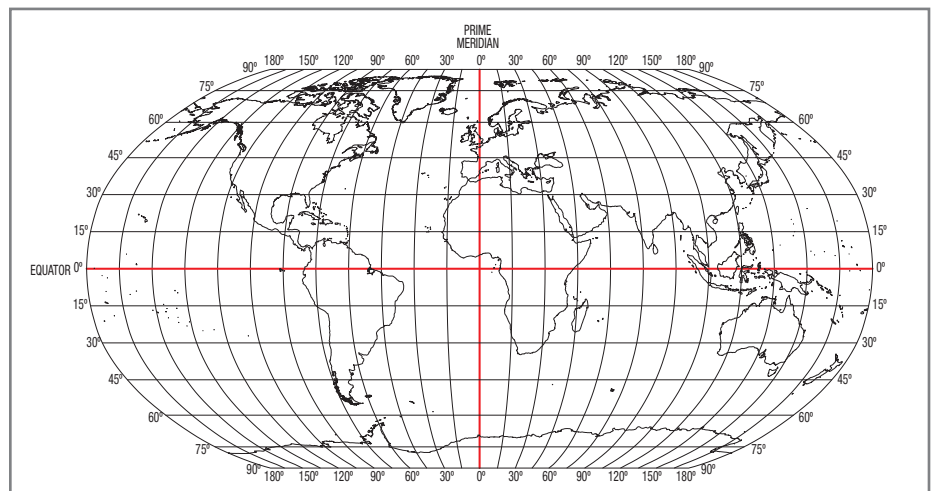


Fig. 5.1 Watch in what direction the meridians and parallels increase or decrease depending on the quadrant.

5.2 Units of measure

A degree of latitude and longitude can be divided into 60 minutes of arc (60'); the minutes themselves are no longer divided into seconds of arc, but into tenths of minutes (0.1'). For instance, near Vancouver Harbour, the coordinates of the Point Atkinson light are:

Lat = 49° 19.8' N

Long = 123° 15.9' W

Latitudes are always given first. The degrees of latitude should always be given with two digits, even if the first one is a 0; the degrees of longitude should be given with three digits, with one or two zeros up front when needed. For instance,

Longitude of Notre Dame Cathedral (Paris) = 002° 21.0' E

5.3 Coordinates on a chart

The scale of latitudes is marked vertically, along the left and right sides of the chart; the scale of longitudes is marked horizontally along the top and bottom edges.

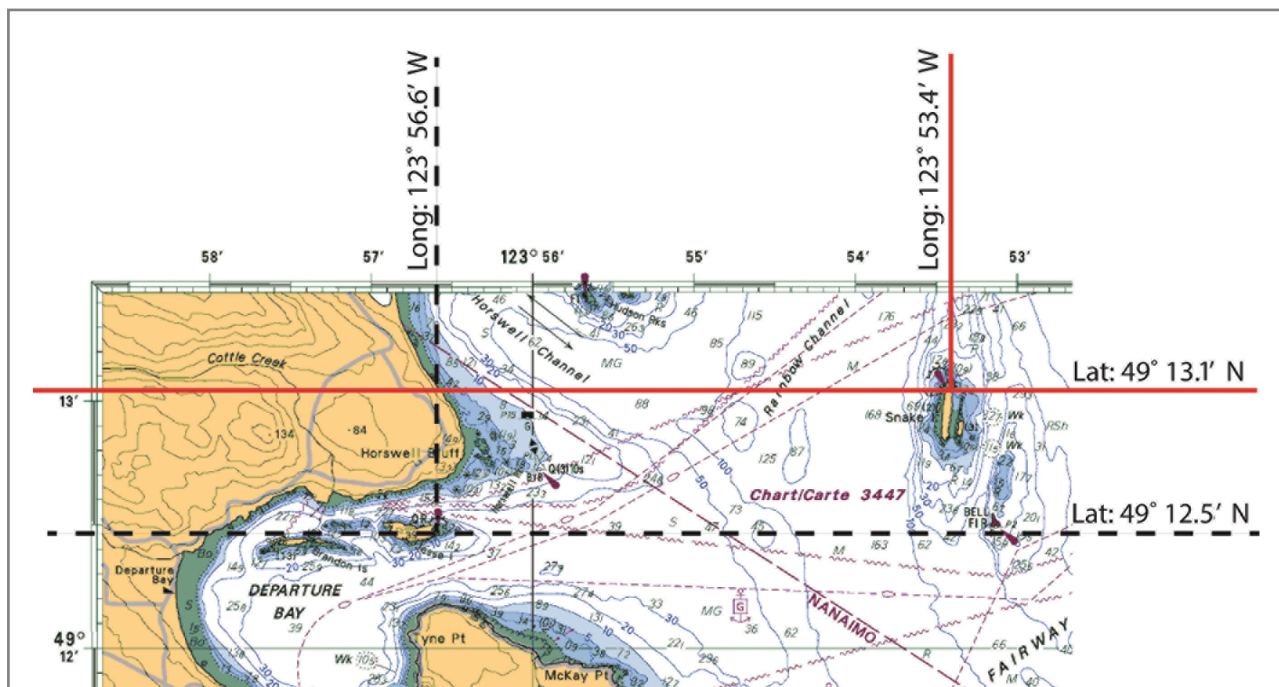


Fig.5.2 Measuring the coordinates of a point.

Note that coordinates of a symbol or a navigation aid are taken from the small circle attached to the icon (Fig. 5.3):

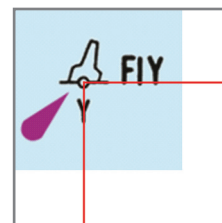


Fig.5.3

5.4 Measures of coordinates

On a chart, **longitudes** are best measured directly, on the top or bottom scales, using parallel rulers placed vertically on the chart. Given the width of the Canadian charts, long parallel rulers are required: 40 cm (15"). Longitudes can also be measured, perhaps less accurately, with dividers capturing the East -West distance between the points on the chart and the nearest meridian.

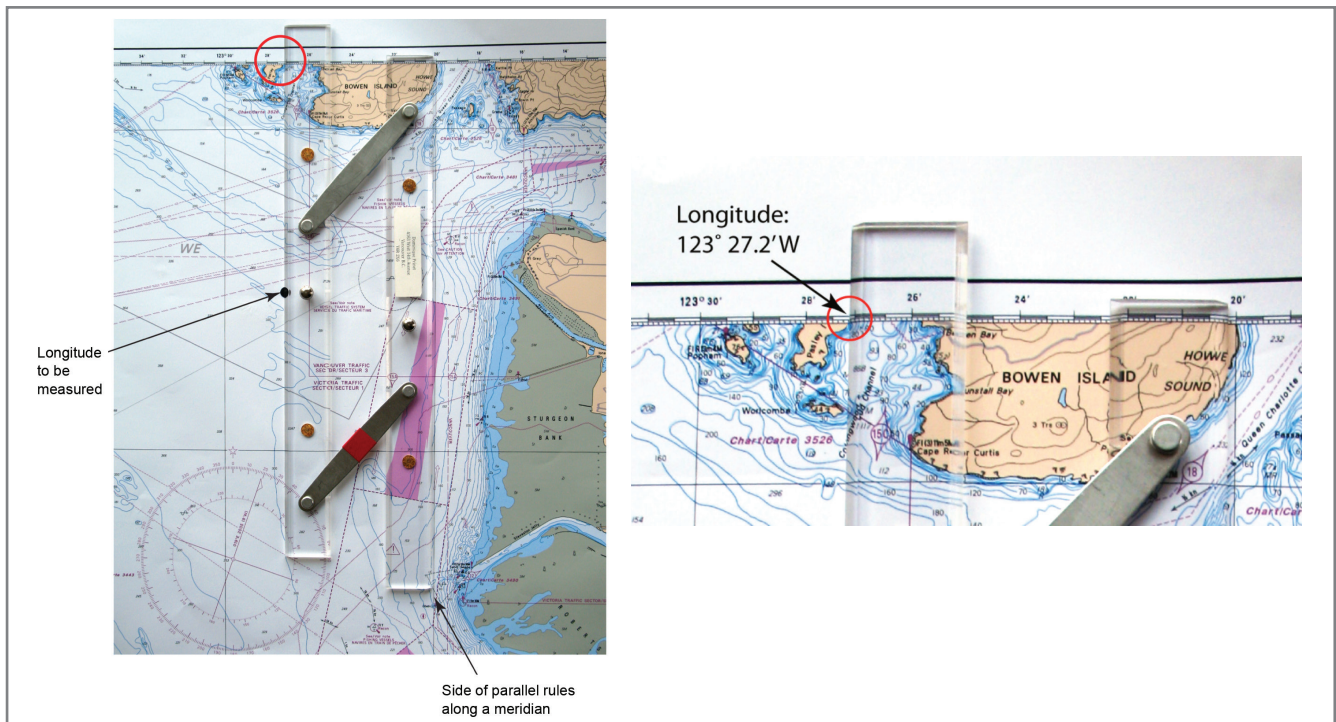


Fig. 5.4 Longitudes are measured off the longitude scale, at the top or bottom of the chart, using parallel rulers.

Latitudes are measured with the dividers, which capture the distance, along the parallel rulers, between the point on the chart and the nearest parallel. The dividers are then moved to the scales of latitudes along the **left** or **right** sides of the chart to measure the exact latitude.

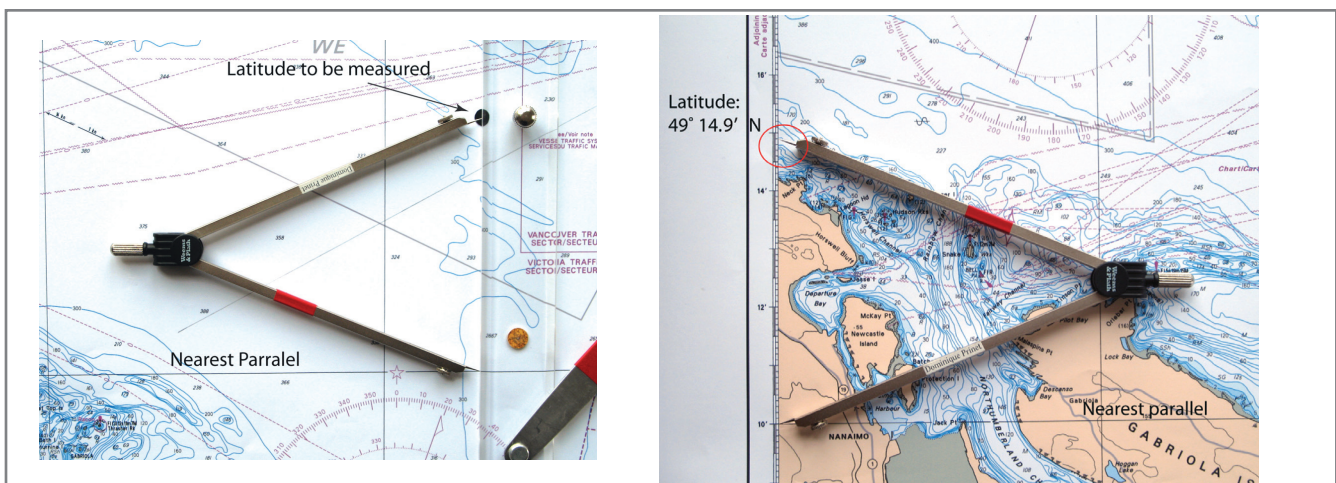


Fig. 5.5 Latitudes are measured from distances captured along the edge of the parallel rulers, and measured along the latitude scale, at the right or left of the chart, using dividers.