

# Range Estimation Techniques

## 1. Determining range using reticules in binoculars

These calculations are assuming that you have 7 x 50 binoculars and that each division in the reticules are 5 mils (check your instructions that came with your binoculars). This is equivalent to an object of height 5m being viewed at a distance of 1000m



The following formula is used to determine your range scales for your reticules.

$$\text{Distance (m)} = (\text{height (m)} \times 1000) / \text{no. of mils}$$

So assuming your binoculars are the same:

If you want to work out the number of mils for a distance of 500m you will need to rearrange the formula at your eye level height above sea level

$$\text{No. of mils} = (\text{height (m)} \times 1000) / \text{distance}$$

For example if your eye level height is 15m above the sea level and you want to work out how many mils down from the horizon 500m would be then do the following:

$$\text{No. of mils} = (15 \times 1000) / 500$$

$$\text{No of mils} = 30$$

Remember that each division is 5 mils so in this case 6 divisions down from the horizon will be 500m i.e. place the top line on the horizon and count down six divisions.

You may want to do it another way – say - what distance will 5 mils, 10 mils or 15 mils be at a certain height (say 15m again)?

Then you use the original formula as it stands.  
Distance (m) = (height (m) x 1000)/no. of mils

Distance (m) = (15x1000)/5  
Distance = 3000m

Distance (m) = (15x1000)/10  
Distance = 1500m

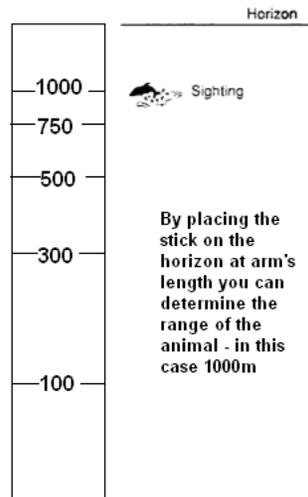
Make a list of all the possible ranges so that you can check this immediately when you have a sighting. You could alternatively write down the number of mils that the animal was ranged to from the horizon and calculate distances later.

For example you spot an animal observing from a height of 15m. When you view this animal through your binoculars placing the top division in the reticule scale on the horizon you note that the animal surfaced 30 mils down from the horizon – write 30 mils on the form in the distance field and then later work out the distance of the animal from the vessel using the formula

Distance (m) = (height (m) x 1000)/no. of mils  
Distance (m) = (15x1000)/30  
Distance = 500m

## 2. Determining range using range sticks

Simple range sticks can be made based on a methodology used in bird surveying (Heinmann, 1981). This is based on holding a stick in your hand and stretching your arm out so that it is straight. You then place the top of the stick on the horizon. On this stick you have marked lines to relate to various ranges. When an animal is sighted – you can line up the place where it surfaced to a corresponding line on the stick to determine range.

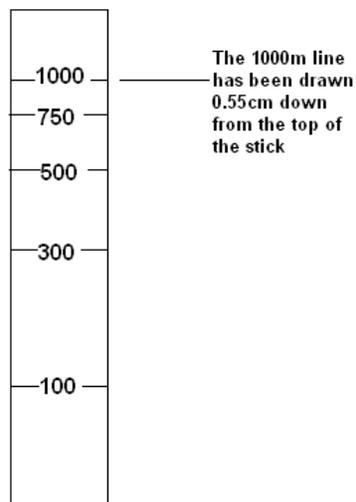


To determine where on the stick you are to draw lines to represent different ranges you must use a small program (using an incorporated formula from the fore mentioned publication). This has been written in an excel file that will be forwarded to the vessel for you to make some simple calculations. When you open the excel file you will see the following table.

Height of Eye (m)	Range of interest (m)	Arm's length (m)	Stick scaling (cm)
10	100	0.6	5.9501
10	200	0.6	2.9504
10	300	0.6	1.9505
10	400	0.6	1.4505
10	500	0.6	1.1505
10	750	0.6	0.7506
10	1000	0.6	0.5506
10	1500	0.6	0.3506
10	2000	0.6	0.2506
10	2500	0.6	0.1906
10	3000	0.6	0.1506
10	3500	0.6	0.1220
10	4000	0.6	0.1006

- Height of Eye = height of your eye above sea level in metres
- Range of interest = ranges that you are interested in being able to determine
- Arm's length = distance of your eye to the stick in your hand with your arm stretched out straight in front of you.
- Stick Scaling = this is the distance in centimetres down from the top of the stick that you must draw a line to represent what you have entered in the "Range of Interest " column

You must change the values in yellow according to your height above sea level and arm's length when stretched out in front of you. The above table represents a person whose eye is 10m above sea level when conducting surveys and who has an arm's length from the eye of 0.6 metres.



Range sticks can be easily made from a ruler covered with paper to enable you to draw lines on it.

Reference: Heinmann, D. 1981. A range finder for pelagic birds censusing. *Journal of Wildlife Management* 45(2): 489-493.