## BACK BOX

## How long is Australia's coastline?

At first blush the question seems eminently reasonable, but it is as open-ended as the classical 'how long is a piece of string?' The answer to both is the same: it all depends.

Dr Robert Galloway of the CSIRO Division of Land Use Research in Canberra was recently confronted with the question when compiling an inventory of Australia's coastal lands. Looking up published figures, he found the following answers:

Year Book of

Australia 36 735 km

Australian

Encyclopaedia 19 658 km

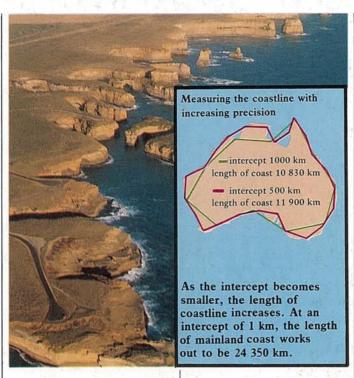
Australian

Handbook 19 320 km

The great disparity has to do with the precision with which the measurement is made. The larger and more detailed the map, and the more finely the measurement is made, the longer will be the coastline. Ultimately one could walk around the coast itself with a measuring stick, but the answer still depends on whether you use seven-league boots or a metre rule.

(It's a philosophical point whether the coastline tends to any limit as precision improves. Some say it does, others not.)

To settle on a reliable, repeatable figure, Dr Galloway got together 162 maps covering the Australian coast (Natmap's 1:250 000 series) and enlisted the help of Ms Margo Bahr of the Division.



A few points of methodology had to be agreed on before the exercise could begin.

How far up estuaries should the coastline be taken? It was decided that all inlets would be arbitrarily (but consistently) cut off whenever their mapped width was less than 1 km. Within Sydney Harbour, for example, Kirribilli Point was joined to Garden Island. Straits less than 1 km wide were ignored, treating the island as though it were part of the mainland.

Islands less than 12 ha were ignored. Measuring the coastline of the 2600 islands larger than that would be tedious in the extreme.

Instead, a 16% sample was taken and a graph of coast length against area drawn.

This plot gave a good correlation, allowing island coastlines to be derived simply from their area. However, the ten largest islands (including Tasmania) were, for accuracy, measured directly. (Macquarie Island and Lord Howe Island were not included.)

Mangroves were regarded as part of the land, with the coastline following their seaward fringe; channels between mangroves were treated as estuaries. All coral reefs were excluded.

Finally came the question, which tools to use: a pair of dividers, a map measuring wheel, or a length of string or fine wire? On a test run dividers gave consistent results only if the same starting point was used; the wheel was rapid but

inaccurate. Fine wire (not string) laid on the drawn coastline proved surprisingly consistent and accurate (as good as dividers set to a 0.7-km interval) and so was chosen for the task. Down to work

When the 162nd map was put aside, the total length of the mainland coast plus Tasmania worked out to be 30 270 km. Adding on the length of coast of all the islands greater than 12 ha, about 16 800 km, gave a grand total of 47 070 km.

As a matter of interest, and undeterred by their prior efforts, the two workers examined the effect of different divider lengths on the measured coastline length when using smaller 1:2 500 000 maps. As expected, the apparent length of the coast of the mainland diminished steadily as the divider length was increased, shrinking to 10 830 km at a 1000-km intercept.

A simple formula was derived that linked coast length to the length of the measuring intercept. Using this formula to extrapolate to a divider length of just 1 mm gave a length of about 132 000 km for the mainland coast of Australia, rather more than three times the circumference of the earth!

Andrew Bell

What is the length of the Australian coast? R.W. Galloway and M.E. Bahr. Australian Geographer, 1979, 14, 244-7.