

HOW TO CROCHET HYPERBOLIC CORALS

BY THE INSTITUTE FOR FIGURING



Ladies Silurian Atoll. Photo © the IFF.

The Hyperbolic Crochet Coral Reef is a celebration of the intersection of geometry and handicraft and a testimony to the disappearing wonders of the marine world. Launched as a response to the devastation of living reefs from global warming and ocean acidification, the Crochet Reef resides equally in the realms of art, science, mathematics and environmentalism.

HYPERBOLIC CROCHET CORAL REEF

A project by the Institute For Figuring

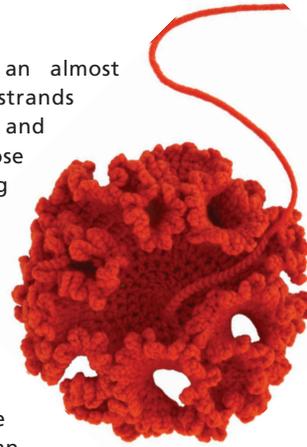
created and curated by
Margaret and Christine Wertheim

www.crochetcoralreef.org

fig.

HYPERBOLIC WONDERS

In coral reefs we witness an almost endless diversity: wavy strands of kelp, crenellated corals and curlicued sponges. Even those who have never seen a living reef immediately recognize the Crochet Reef's distinctive forms for this woolly wonder takes its cue from nature. In both cases the ruffled shapes are variations on a mathematical structure known as hyperbolic geometry. Nature loves these forms, for this is an ideal way to maximize surface area, allowing filter feeding organisms such as corals to enhance nutrient intake.



Hyperbolic Crochet
Sea Anemone

For humans, the best way to make models of hyperbolic geometry is with crochet, a discovery made in 1997 by Dr. Daina Taimina at Cornell University. Nature, however, does not stick to mathematical perfection and just as there is nothing in nature that is perfectly spherical, so there is nothing in nature that is perfectly hyperbolic. Living forms result from deviation and imperfection.



Christine Wertheim installing The People's Reef in Scottsdale AZ. Photo © the IFF.

In 2005, Margaret and Christine Wertheim at the Institute For Figuring, in Los Angeles, began to develop a taxonomy of reef-like forms by building on Dr Taimina's techniques. Instead of adhering to a mathematically pure pattern, they began to use more freeform techniques which give the models a natural and organic look. Tightly bunched mounds of brain coral, towered spires of pillar coral, blooms of carnation coral, and forests of kelp can all be mimicked.

Just as the diversity of living species on earth result from variations in an underlying DNA code, so a huge range of woolen 'species' may be brought into being through modifications in the underlying crochet code. As in nature, organic looking structures are the result of variation and experimentation. Anyone who takes up these techniques may begin to explore what is possible here. There is, as it were, an endlessly diverse, ever-evolving crochet 'tree of life.'

In addition to the "Core Collection" of Crochet Reef's created by the Institute, since 2006 the IFF has been working with cities and communities around the globe to create local "Satellite Reefs". As of 2010, Satellite Reefs have been made across the USA, and in the UK, Australia, Latvia, Ireland, and South Africa.

For more information about the Hyperbolic Crochet Coral Reef project visit: www.crochetcoralreef.org.

To learn more about hyperbolic crochet see the book that shows you how:

A Field Guide to Hyperbolic Space
By Margaret Wertheim (Institute For Figuring Press)

Books may be purchased online:
www.theiff.org/publications

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HYPERBOLIC CROCHET BASICS

Here we present a taxonomy of basic hyperbolic crochet models. To crochet a hyperbolic structure one simply increases stitches at a regular rate in every row. The more often you increase, the more quickly the model will ruffle up.



Model by Daina Taimina

Hyperbolic Plane: **Step 1.** To crochet a basic hyperbolic plane, begin with a line of chain stitches. (We recommend 15 or 20 stitches for your first try.) **Step 2.** After the line of chains, begin the first row by crocheting 5 stitches then increasing in the sixth stitch. (You may use single, half double, or double crochet as you choose.) Keep on repeating this pattern - crochet 5 stitches, increase 1; crochet 5 stitches, increase one - until the end of the row. **Step 3.** Turn around and repeat the pattern in the next row and all subsequent rows.



More Curly Hyperbolic Plane: In our first model the rate of increase is one in every 6 stitches. To make a more ruffled model, increase more rapidly. In our next model the rate of increase is one in every 4 stitches. **Step 1.** Begin with a line of chain stitches. **Step 2.** After the line of chains, begin the first row by crocheting 3 stitches then increasing in the fourth stitch. Keep repeating the pattern: Crochet 3 stitches, increase 1; crochet 3 stitches, increase one.

Crafters are encouraged to try out different rates of increase. Different types of yarn behave in different ways. To make a structurally rigid model like a coral, use synthetic yarn and a small hook. For a floppy kelp-like model, use soft wools and a larger hook.



Pseudosphere: In this model one does hyperbolic crochet round a circle. **Step 1.** Begin with a line of chains. **Step 2.** After a dozen stitches, you need to turn the line into a circle. To do this, crochet three stitches into the last chain and then join this group of stitches into a tiny cone. **Step 3.** Begin to crochet around the edge of the cone increasing at a regular rate. Here the rate of increase is one in every 3 stitches.



Another pseudosphere: Here the rate of increase is one in every 2 stitches, so the model ruffles up faster. If you increase at a regular rate you always achieve a mathematically perfect shape. This form is the hyperbolic equivalent of a cone - its tip extends to infinity.



Making a perfect pseudosphere is not necessary if you want to crochet corals. Instead, you may start with a circle of chains and do hyperbolic crochet round this loop. **Step 1.** Crochet 4 chains. **Step 2.** Join chains into a circle. **Step 3.** Begin to crochet around the loop increasing at a regular rate as you spiral out. Here we increase in every stitch.



Double Hyperbolic Plane: Here one does hyperbolic crochet around both *sides* of a line, working in a racetrack pattern. **Step 1.** Begin with a line of chains. **Step 2.** Crochet along one side of the chain increasing at a regular rate. (In this model we increase one in every 2 stitches.) **Step 3.** At the end of the row, increase 5 stitches in the last chain, then turn around and come back along the other side, continuing to increase at the same rate. **Step 4.** Continue hyperbolic crochet around the racetrack in all following rows. This kelp-like form is two hyperbolic planes joined together.



Seed-Pod Model: **Step 1.** To get this pretty form begin with a line of 15 chains. **Step 2.** In the first row crochet around the chain on both sides, increasing in every stitch. **Step 3.** In the second row, increase in two out of three stitches. **Step 4.** In the third row increase in every second stitch. **Step 5.** In the fourth row, increase in every third stitch. And so on. There are seed-pods with this structure.



Model by Spring Pace

Living organisms are always irregular. In order to achieve natural looking corals, you need to vary the rate of increase within the model. We encourage crafters to experiment for themselves.

All models by the Institute For Figuring, unless stated.