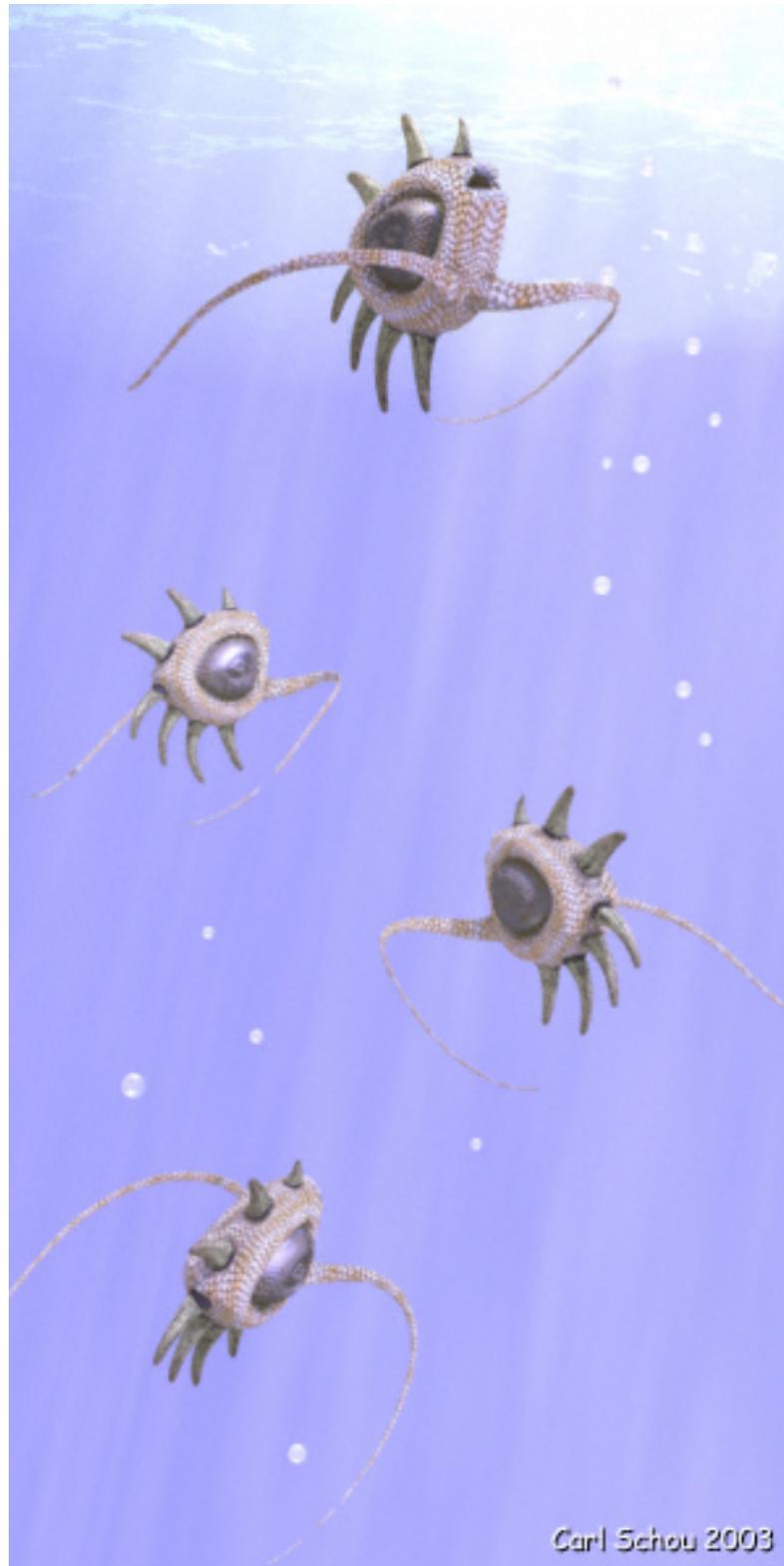


Carrara Tutorial:

Undersea Effects with Light Cones and Gels in Carrara

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MorningStar Ascension

There are many different ways to get underwater effects in computer graphics. For this month's foray into the digital domain, we will look at how this can be done using gels and light cones in Carrara.

The image above and the one at the end of this tutorial were done in Carrara Studio 3, though the ability to use gels and light cones was available in earlier versions of Carrara. The gels were created using PhotoShop and the Caustics Generator program.

An alternative method to produce underwater lighting would be to apply a transparent water texture with waves in the bump channel to a plane or a terrain placed in between the light source and the scene and to render with caustics turned on. However, if you want to have visible beams of light in your image, it's hard to beat the results you can get using a light cone with a gel and 3D Shadows activated.

The two full sized Carrara screenshots and the screenshot from the Caustic Generator program used in this tutorial are fairly large. To speed up download times, smaller versions of these images are provided in the main body of the tutorial. Clicking on one of these smaller images will open the full sized version in another window. If this larger image doesn't appear at full size, then let your mouse hover over the image and click on the magnification button that appears.

We will begin with some background about caustics and gels, then outline the approach used for this project before we dive into creating underwater scenery. The main focus will be on the lighting effects for the image at the top of tutorial, MorningStar Ascension.

Background on Caustics and Gels

Caustics refers to the manner in which light reacts when it passes through a refractive medium like water or glass. The Index of Refraction is a measure of how much the path of a light beam bends when it passes from one medium (such as air) to another (such as water). When the refracting surface is not completely flat, the light passing through it will focus and defocus to form alternating bright and dim areas. This effect is familiar to anyone who has ever looked at the light patterns on the bottom of a swimming pool on a sunny day.

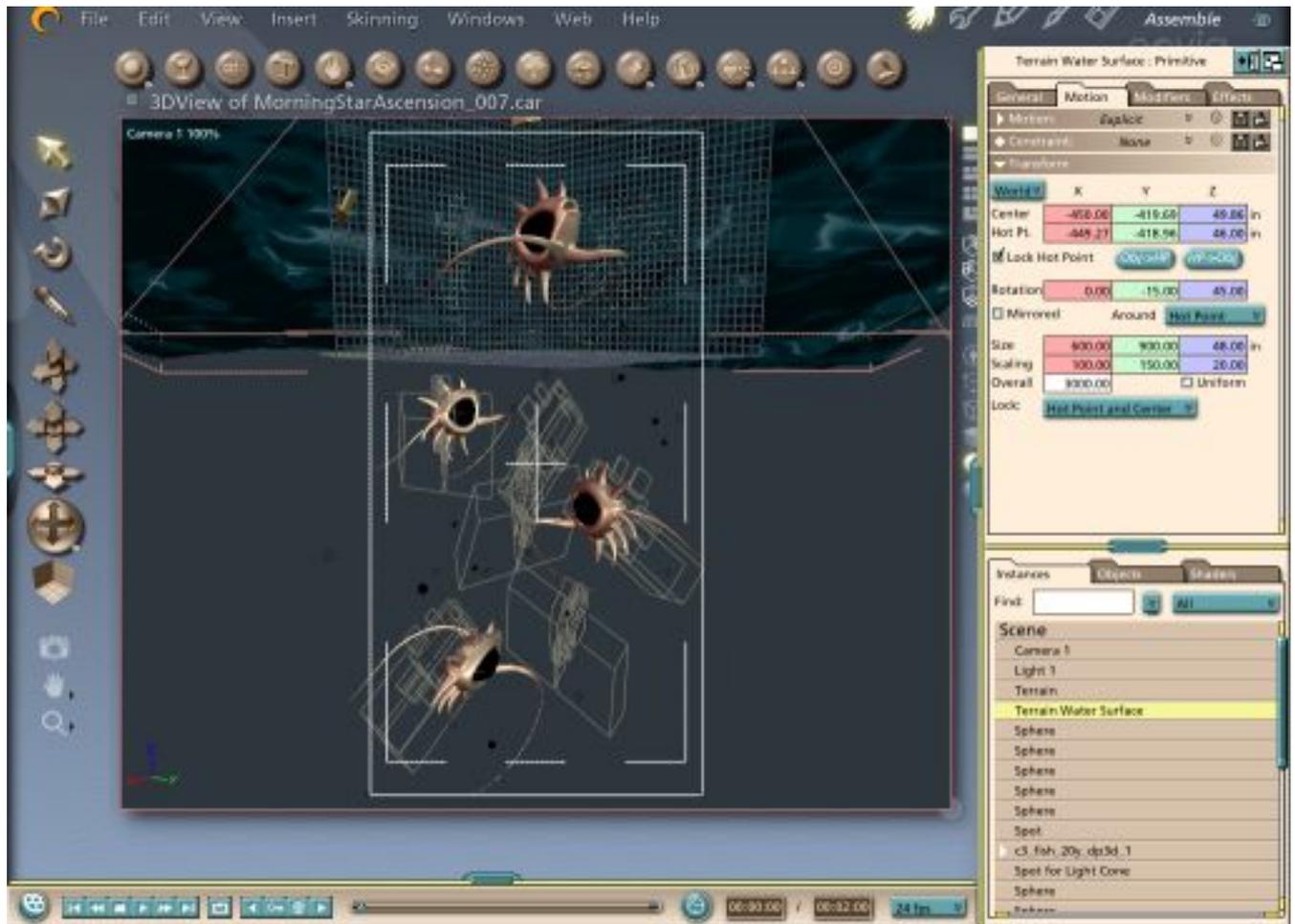
A gel is an image applied to a light, turning the light into a sort of slide projector for that image. In the early days of electric lighting, gelatin filters were used to color stage lighting. As brighter (and hotter) lights came into use, the materials used to make the filters changed, but the original name stuck and got carried over into the terminology of computer graphics lighting.

Strategy for Light\Water Interaction

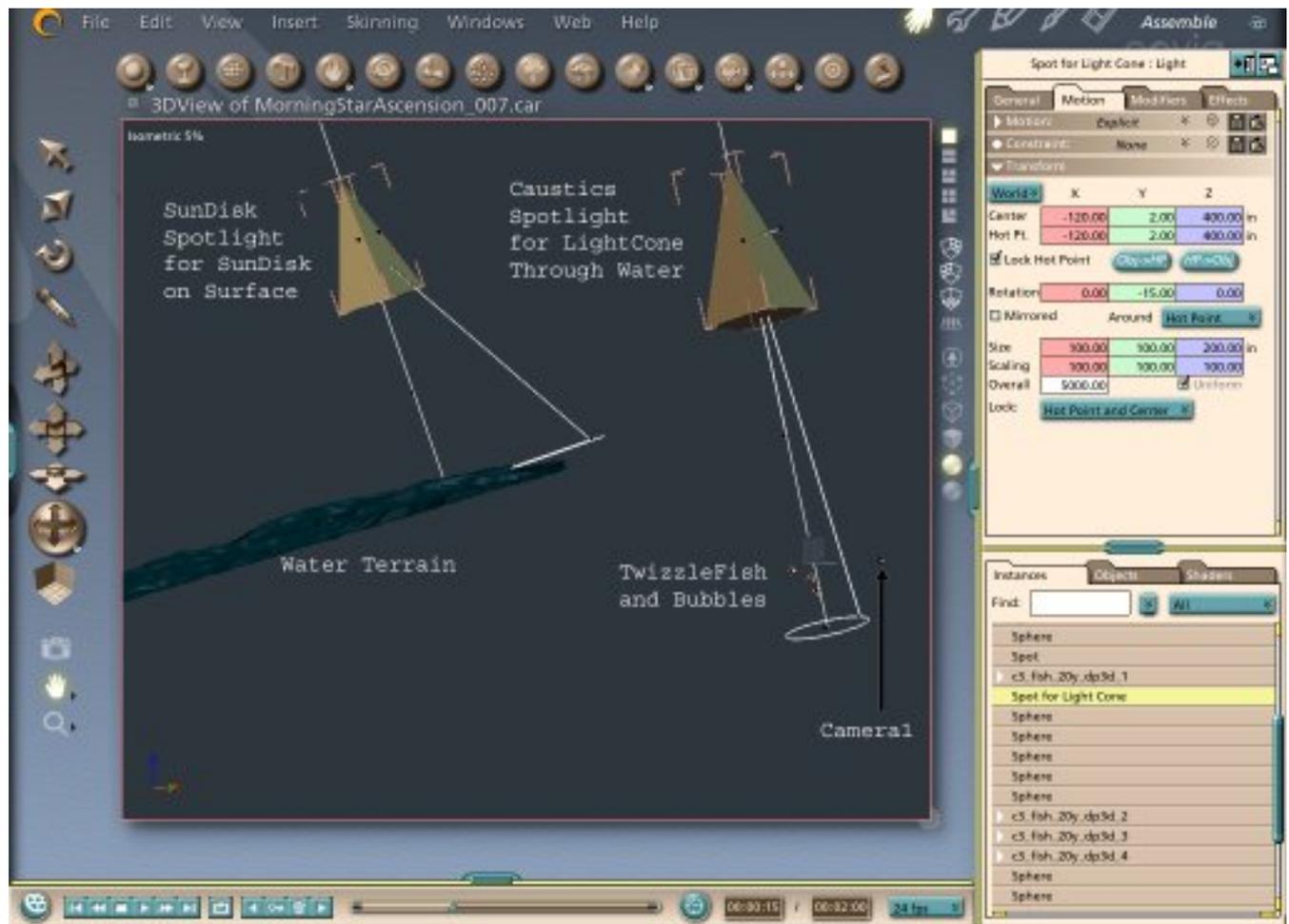
- (1) Open a pre-existing scene, or create a new scene where you want to apply the lighting effects.
- (2) To get the effect of limited visibility produced by the murkiness of the water, add distance fog to the scene.
- (3) To get the effect of light passing through water and illuminating the bottom, make a gel with a caustic light pattern and apply it to a spot light with the Light Cone enabled. This will be called the Caustics Spotlight.
- (4) To get the effect of the sun's disk seen through the surface of the water, make a gel of the distorted disk and apply it to a spot light positioned over the transparent surface of the water. This will be called the SunDisk Spotlight.

Setting the Scene

This scene was based on some rather surrealistic fish models I had built in Carrara for an earlier project. I wanted to show the fish swimming up toward the sunlight at the surface and to capture the effects of the light passing down through the water. The view from the rendering camera is shown in the Assembly Room screenshot below. Click on the image for a full sized 1024 by 737 pixel version.

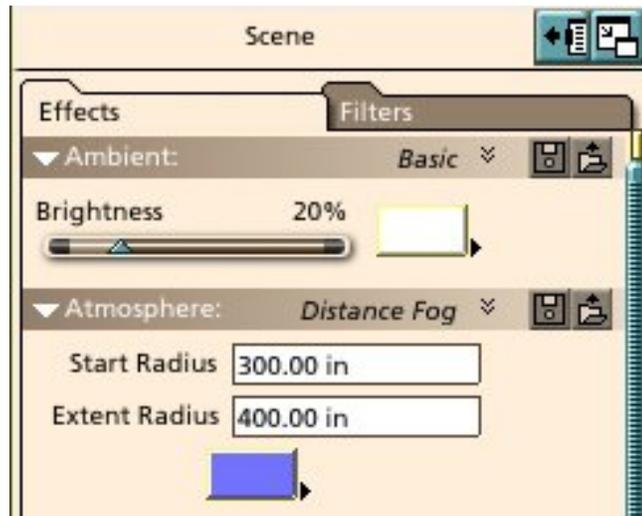


In the screenshot below, we have switched to an isometric side view and pulled back a great distance to show the relative positions and sizes of the different parts of the scene. To give a sense of scale, the height from the lowest fish to the highest fish is about 50 inches in Carrara units. The Caustics Spotlight is about 400 inches over the fish, with a narrow half angle to force the light beams to be nearly parallel rather than fanning out in a cone shape. The terrain used for the water's surface is about 400 inches behind the fish, and the SunDisk Spotlight projects the sun's image onto the water's surface from a height of about 300 inches. Click on the image for a full sized 1024 by 738 pixel version.



Haze up the Water with Distance Fog

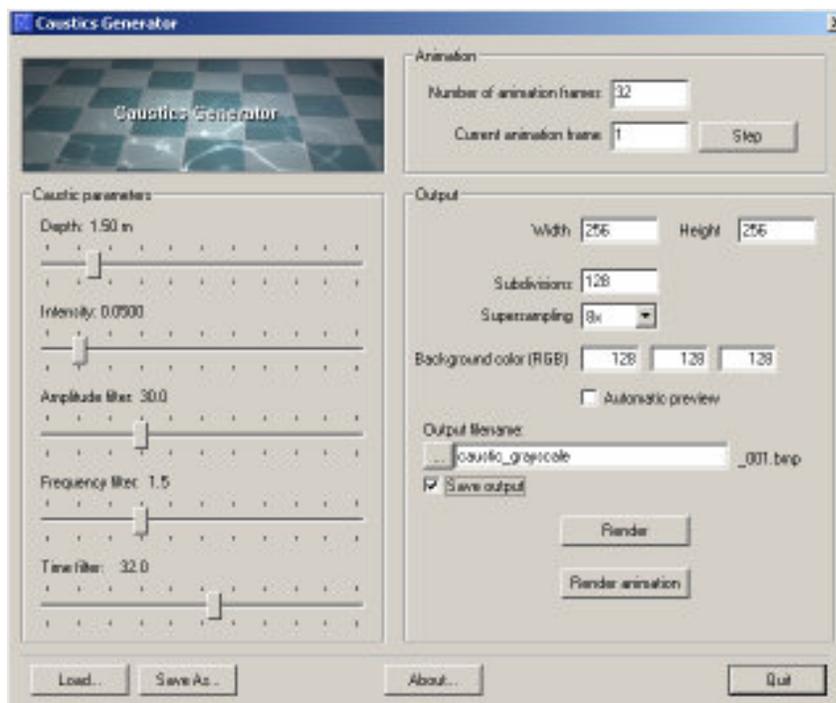
To keep our water from appearing too clear, we are going to add in Distance Fog. Select the Scene and adjust the settings for Distance Fog as shown below. The Start Radius is the distance from the camera that the fog begins, and the Extent Radius is the distance at which the fog becomes completely opaque. Remember that the values shown are what were needed for the scene I set up and that any other scene will probably need different settings. The values were chosen to keep the water clear in the foreground, slightly hazy at the surface overhead, and completely hazy at the surface in the rear. This causes the farther portions of the surface to fade out into the blue background haze of the water.



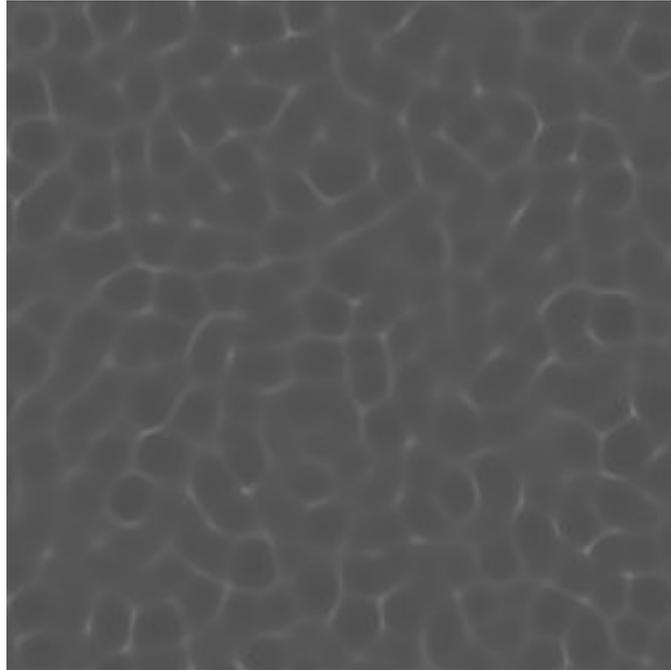
The Light Through the Water - Making the Caustics Gel

To produce the beams of light passing through the water, we are going to build a Caustics Spotlight by attaching gel of a caustics pattern to a spotlight and project it down into the scene with the light cone effect turned on.

To create the gel of the caustic pattern, we are going to use a free program called Caustics Generator which can be downloaded through the web address supplied in the Related Links section at the end of this tutorial. The control panel from the Caustics Generator is shown in the image below. Click on the image to see a larger 644 by 536 pixel version.

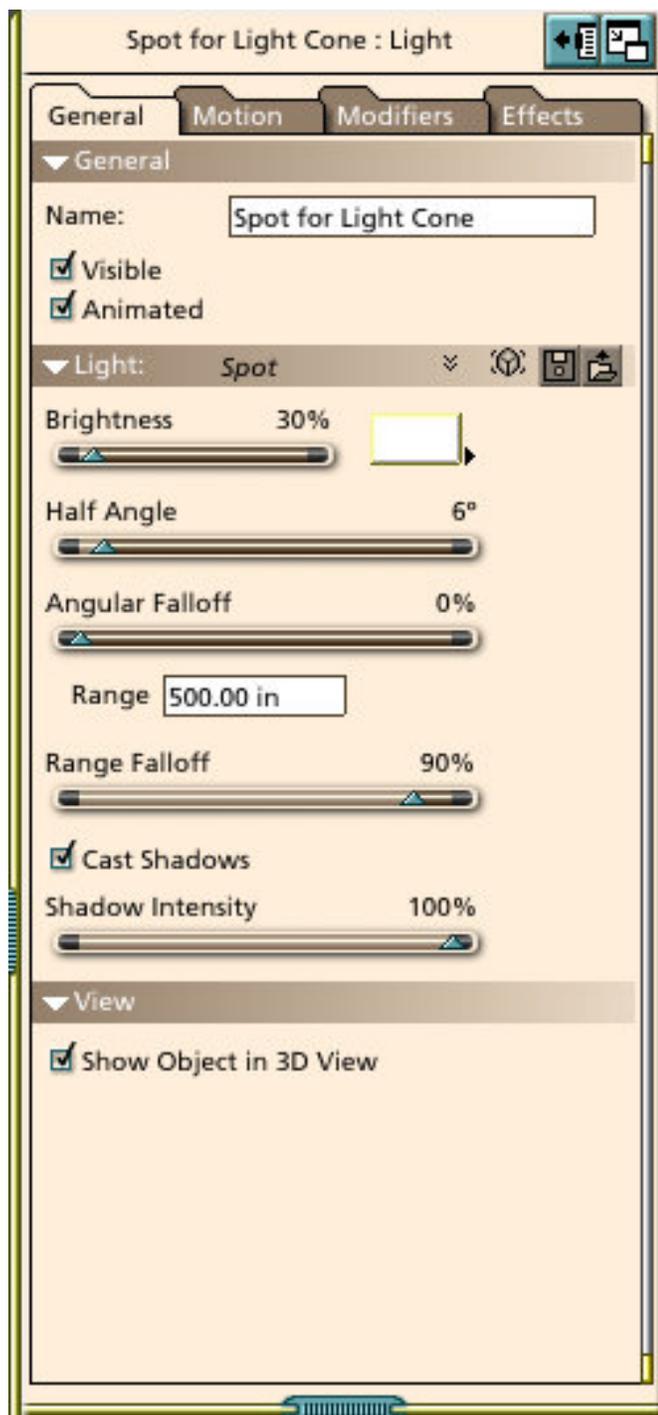


The Caustics Generator program was run with the settings show above. The caustic render was saved as a BMP file. The contrast of the image was decreased a bit in Photoshop since a subtle caustic effect was all that was wanted for this project. The finished image that was used as a gel is shown below.



The Light Through the Water - Making the Caustics Spotlight

If you have not already added a spotlight to your scene for projecting a caustics gel, do so now. Select the spotlight and adjust the parameters as shown below for the General and Effects tabs of the Properties tray at the right side of your screen. Note that you will be adding the Caustics gel image to the spotlight using the browser under the Effects tab.

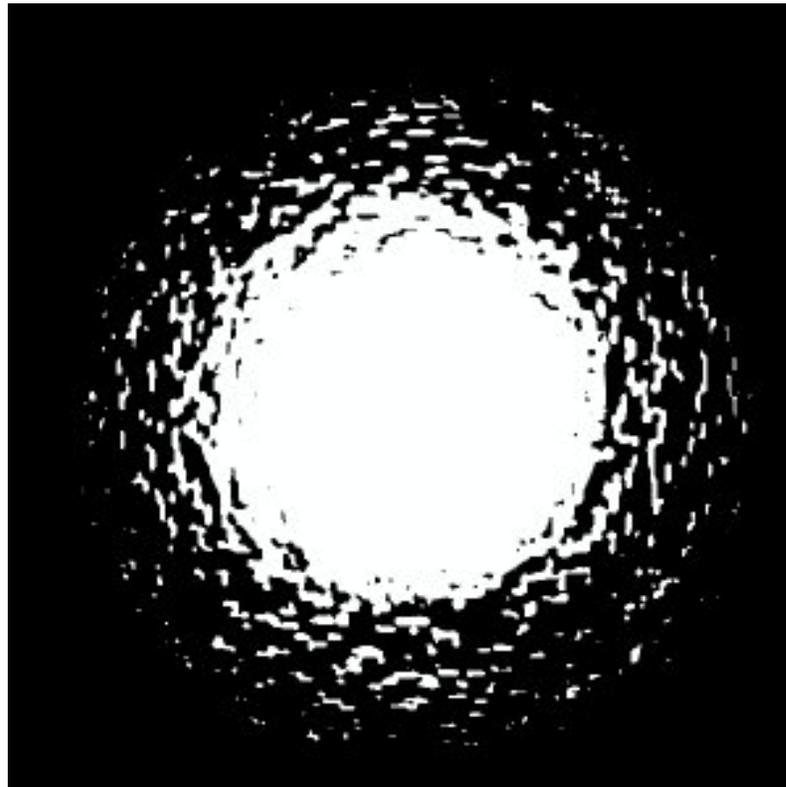


In the Light Cone section under the Effects tab, click the Edit button, then adjust the settings in the pop-up window to match the screenshot below. Note that you may need to increase the Shadow Buffer Size or the Gel Buffer Size, to prevent the appearance of any artifacts in the light cone. Increasing these parameters will increase render times, so it's recommended to do a few quick test renders to see if you can get by with the minimum Buffer sizes of 64. In addition, it is recommended that you leave the Animate Turbulence box unchecked as shown, unless you are making an animation, since that will also increase render times.



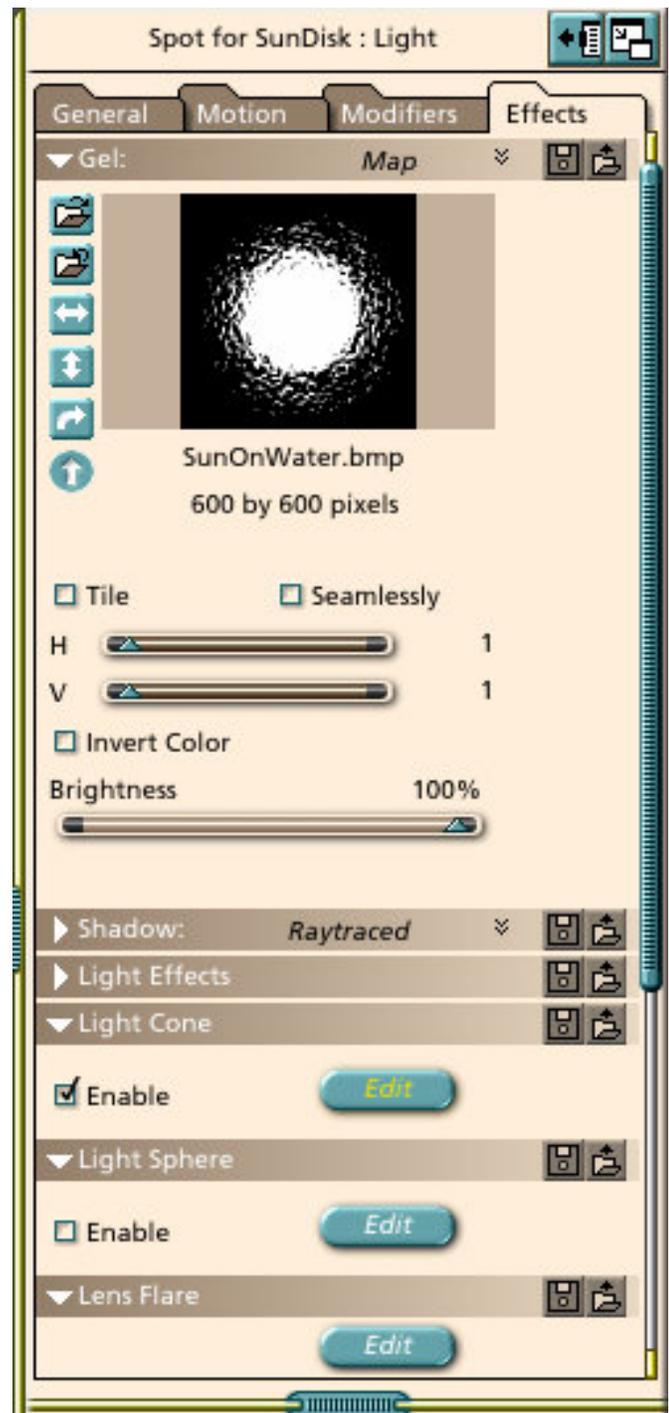
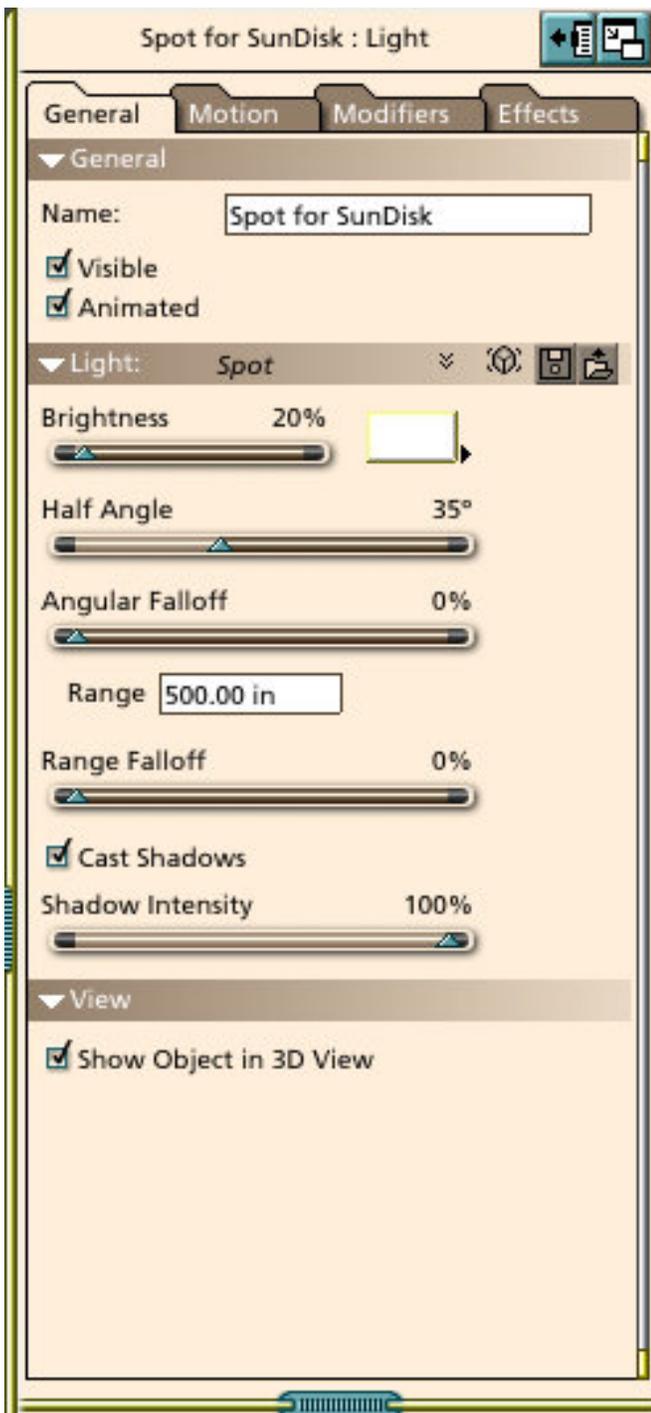
The Light on the Water - Making the SunDisk Gel

To make the light visible on the surface of the water, we are going to use PhotoShop to make an image that will be used as a gel. Create a new image in Photoshop with same length sides. I used 600 by 600 pixels, but the exact size doesn't matter as long as it is large enough to have sufficient resolution. Create a circular selection in the center of this image by activating the Elliptical marquee tool and dragging out from the center of the image while holding down the Shift and Alt keys. Invert the selection to select the area outside of the circle and use the paint bucket tool to fill that area with black. Apply the Ocean Ripple filter from the Distort section and adjust the Ripple Size and Magnitude to get something like the image below.



The Light on the Water - Making the SunDisk Spotlight

If you haven't created the SunDisk Spotlight yet, do so now. Repeat the process you went through for the other spotlight by applying the SunDisk gel to the light and adjusting the parameters under the General and Effects tabs to match the values shown in the screenshots below.

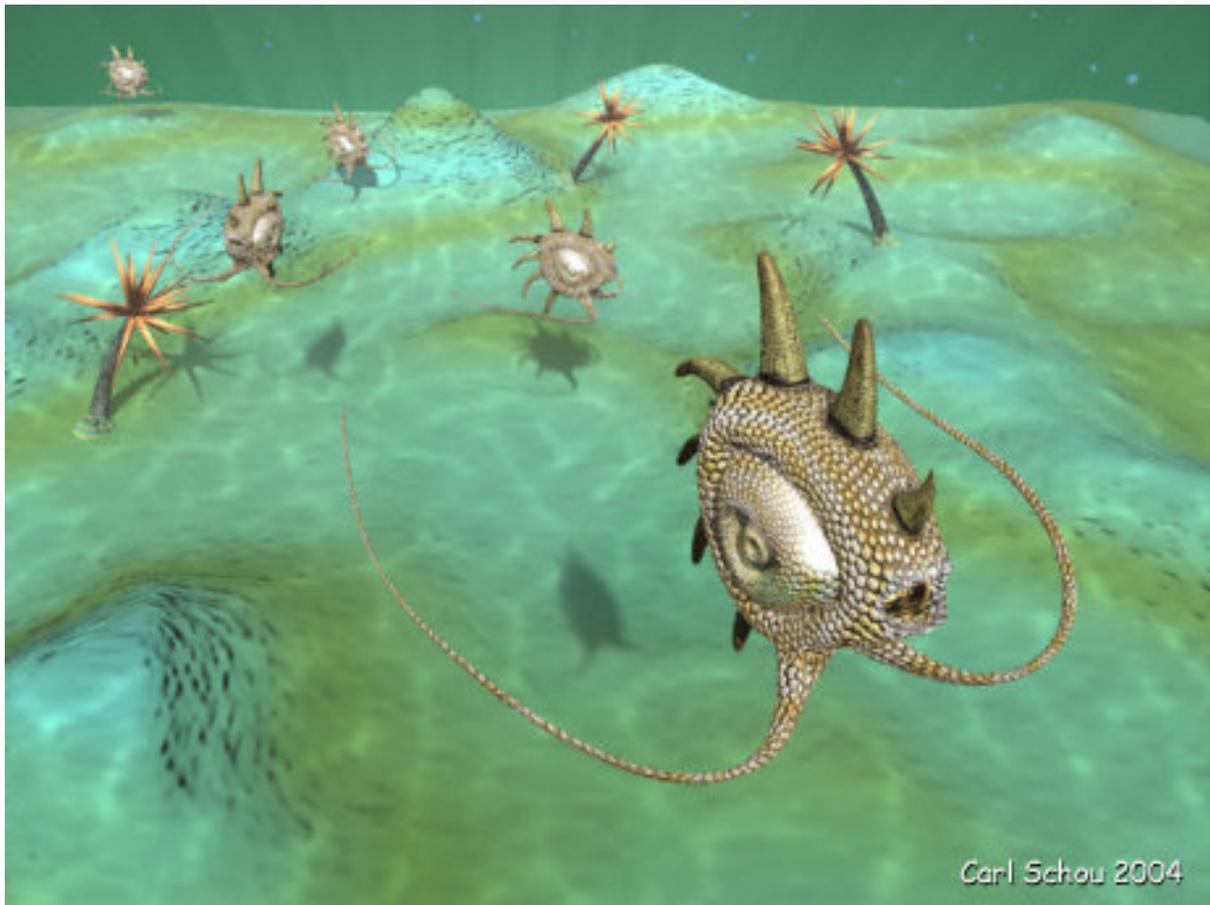


In the Light Cone section under the Effects tab, click the Edit button, then adjust the settings in the pop-up window to match the screenshot below. Note that the main differences between the light cones for the two different spotlights are in the Intensity and the Turbulence settings.



The Light on the Bottom

The same caustic spotlight and gel used to produce the effect of light passing through the water may also be used to create caustic light patterns on the bottom, as shown in the image below, The Reef of the MorningStars.



Other Options - Procedural Gels

Another option, which has just become available from Digital Carvers Guild, is a plug-in called ShaderGel that uses procedural shaders as the gel on the spotlight and light cone. The advantage to this approach is that the caustic spotlight can be constructed entirely inside of Carrara.

The Rest of the Picture(s)

The model of the TwizzleFish was built in Carrara 3 for an earlier project. The UV mapping was done in UnWrap3D and textures were applied in PhotoShop with some touchup in Deep Paint 3D. The image at the top of the tutorial, MorningStar Ascension, was rendered in Carrara using Global Illumination in Skylight mode with Caustics enabled. The plants in the image at the bottom of the tutorial, The Reef of the MorningStars, were produced by the new Plant Modeler and the image was rendered in Carrara.

Related Links

[Eovia, Home of Carrara](#)

[Caustics Generator](#)

[Digital Carvers Guild](#)

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