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Field Reports

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Field Report: Birch Aquarium at Scripps Institution of Oceanography October 16th, 2026

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Field Report:

Birch Aquarium at Scripps Institution of Oceanography

October 16th, 2026



La Jolla, California, USA

Kelp Forest habitat, Living Seas gallery

Field Report prepared October 17th, 2026

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Expedition Overview:

This report details a Gaussian splat documentation campaign at Birch Aquarium at Scripps Institution of Oceanography (SIO), UC San Diego, on the morning of October 16th, 2026.

Birch Aquarium is the public exploration center for SIO, set on a bluff above La Jolla Shores and the Pacific Ocean. Its roots trace to 1903, when the Marine Biological Association of San Diego, the predecessor of SIO, established a public aquarium. A dedicated aquarium building opened on the Scripps campus in 1915, followed by the Thomas Wayland Vaughan Aquarium in 1951. The current building, designed by JCJ Architecture and launched with a gift from the Stephen and Mary Birch Foundation, opened in 1992. The forty-foot bronze whale sculptures at the entrance, "The Legacy," were unveiled in 1996. Today the aquarium welcomes more than 500,000 guests and 40,000 pre-K to 12 students each year.

The Living Seas gallery recently underwent a major renovation, the largest capital improvement since the building opened. Construction began in August 2024, and the Adam R. Scripps Living Seas Gallery reopened in May 2025. It now includes new Giant Pacific Octopus, Scripps Pier, Open Ocean, Tropical Pacific Coral and mangrove habitats alongside the 70,000 gallon Kelp Forest habitat. The renovation also brought new pumps and cooling systems, digital projections, UV-responsive wallpaper and a programmable day-to-night lighting shift.

Scott McAvoy previously scanned the Kelp Forest habitat in 2022, covering only the tank itself from the guest viewing area and from the roof. Those scans predate the renovation and are viewable at pointcloud.ucsd.edu/SIO/Birch_Kelp_Tank.html.

The goal of this campaign was twofold: to create 3D references of the renovated public spaces using Gaussian splats, and to test how this kind of reconstruction performs in an aquarium. Photogrammetry is traditionally difficult here, since the acrylic windows and the water behind them refract and reflect light, breaking the assumptions of standard camera models. One long, site-wide scan was captured with the cleaning lights on, brightening the whole space. A second, shorter scan of Living Seas was captured with the lights off again, as guests experience it. All work was completed between 8:00 and 9:00 am, before the aquarium opened to the public.

A full listing of datasets is provided in the appendix.

Please contact Scott McAvoy (smcavoy@ucsd.edu) for any questions regarding access to this data.

Special thanks to Birch Aquarium staff Megan Dickerson and Brian Gibson for helping to coordinate this work.

Expedition Team

Scott McAvoy* (UC San Diego), smcavoy@ucsd.edu
Alessio Martino (Politecnico di Torino)
Aviral Agarwal (UC San Diego)
Jordan Pierce (UC San Diego)

Data Acquisition - 10/16/2026

The team arrived before opening and worked between 8:00 and 9:00 am, while the galleries were empty of guests. Capture was carried out in two passes with the XGRIDS PortalCam, supplemented by test images from the DepthCam app on an iPhone 17 Pro.

1. **Site-wide scan, cleaning lights on.** One long, continuous walk through the key public areas with the aquarium's cleaning lights on, brightening the whole space for maximum image detail.
2. **Living Seas scan, lights off.** A shorter pass through the Living Seas gallery with the cleaning lights off again, recording the gallery under its exhibit lighting as guests experience it.

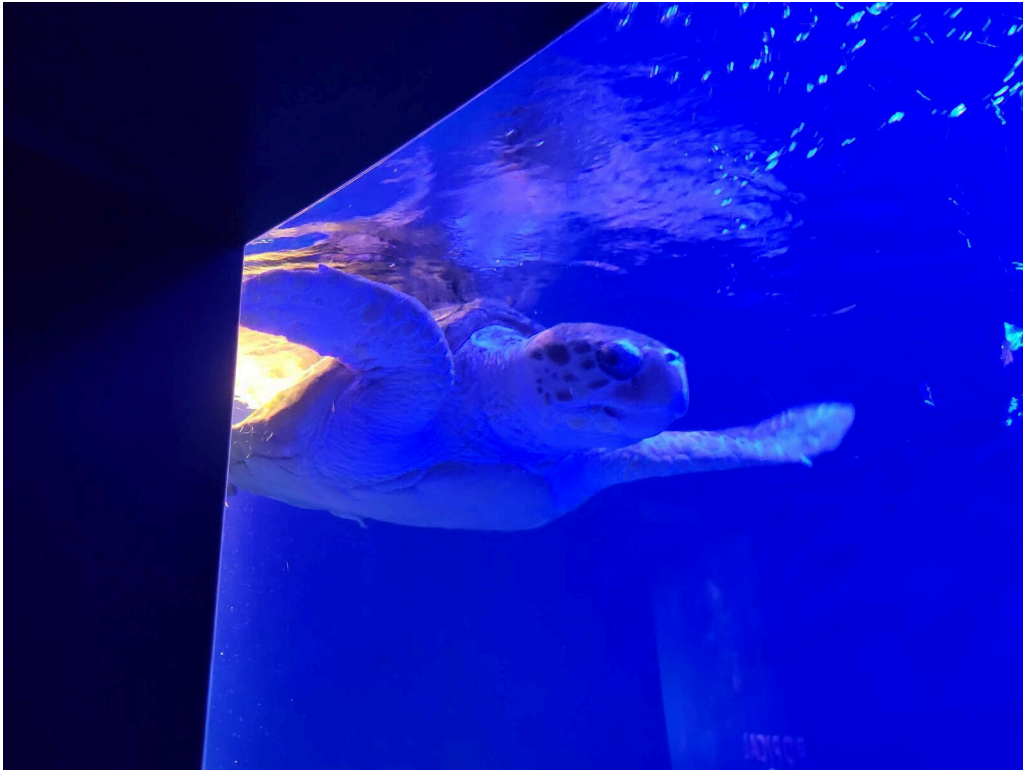
The scans covered the following public areas, named as they appear on the aquarium's visitor map:

- The Legacy whale sculptures, in front of the aquarium
- Main Entrance
- Davis Galleria
- Living Seas gallery, including the Kelp Forest and Open Ocean habitats
- Tide Pool Plaza (exterior)
- Imagine Wild exhibition space
- Seahorses and Seadragons
- Beyster Family Little Blue Penguins habitat

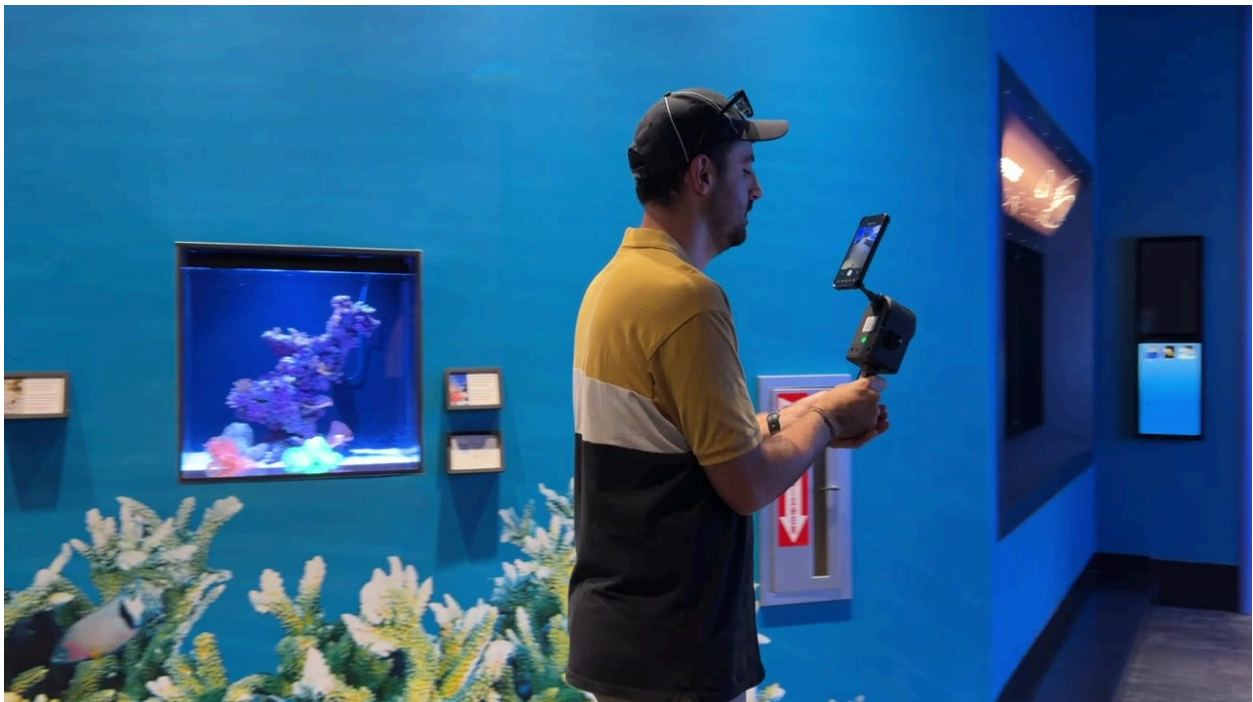
The education classrooms and the Sharks & Rays area to the south were not captured.



Imagine Wild exhibit



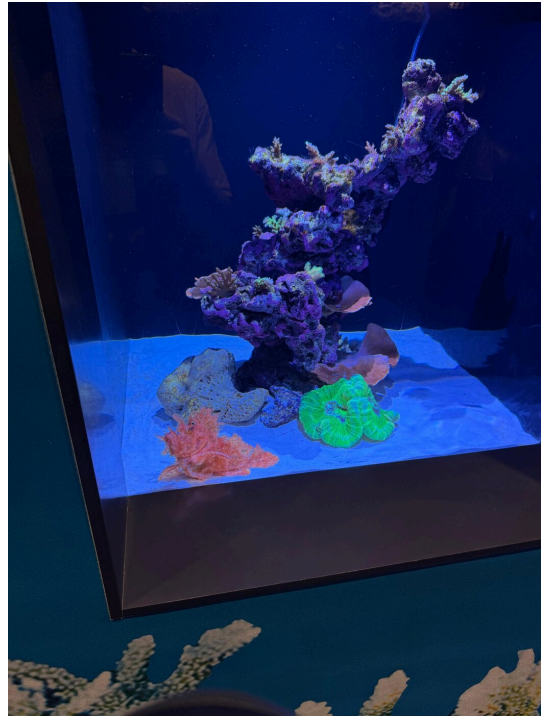
Rescued Loggerhead Sea Turtle in the Open Ocean habitat, Living Seas, exhibit lighting



Scanning the Tropical Pacific Coral area of Living Seas with the XGRIDS PortalCam



Lionfish, Living Seas



Coral display, Living Seas



Beyster Family Little Blue Penguins habitat



Exhibit signage

Imaging Equipment

Handheld Gaussian Splat Scanner - XGRIDS PortalCam



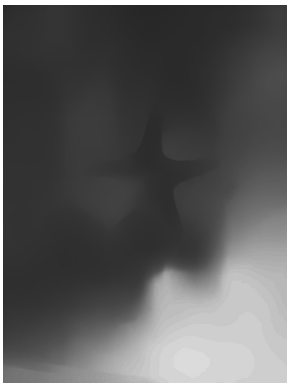
A handheld spatial capture device built for Gaussian splatting. It pairs four 12 MP cameras (two forward-facing, two fisheye) with a LiDAR sensor capturing 856,000 points per second at up to 60 m range, in a unit under 900 g.

LiDAR and inertial data constrain the camera trajectory, which makes it well suited to long walking captures through mixed interior and exterior spaces. Data is processed in XGRIDS LCC into Gaussian splat models viewable in a web browser. ([specifications](#))

Mobile Depth Capture - iPhone 17 Pro with DepthCam

Test images were captured with the DepthCam app on an iPhone 17 Pro, recording RGB images paired with depth from the phone's LiDAR sensor. These serve as a lightweight comparison to the PortalCam in the refractive tank environment.

iPhone depth test (starfish)

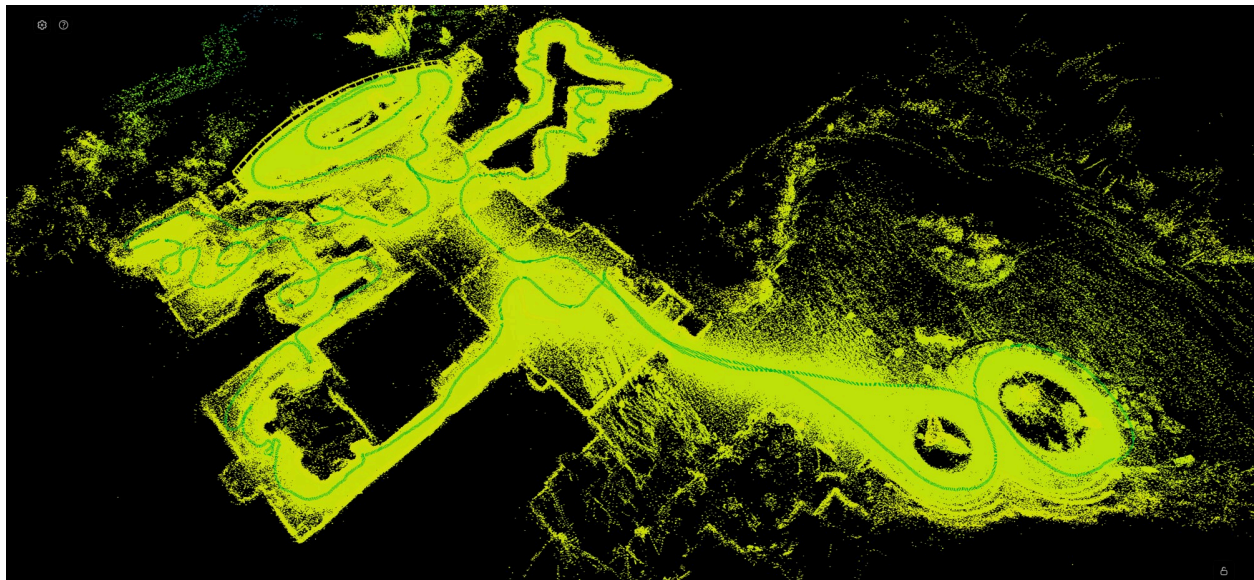
			
RGB	Depth unfiltered	Depth filtered (using RGB information)	Depth filtered + levels adjusted
Sensor: Rear LiDAR · Valid samples: 70,575 / 442,368 (~16%) · Min: 0.16 m · Max: 0.76 m			

Preliminary Results

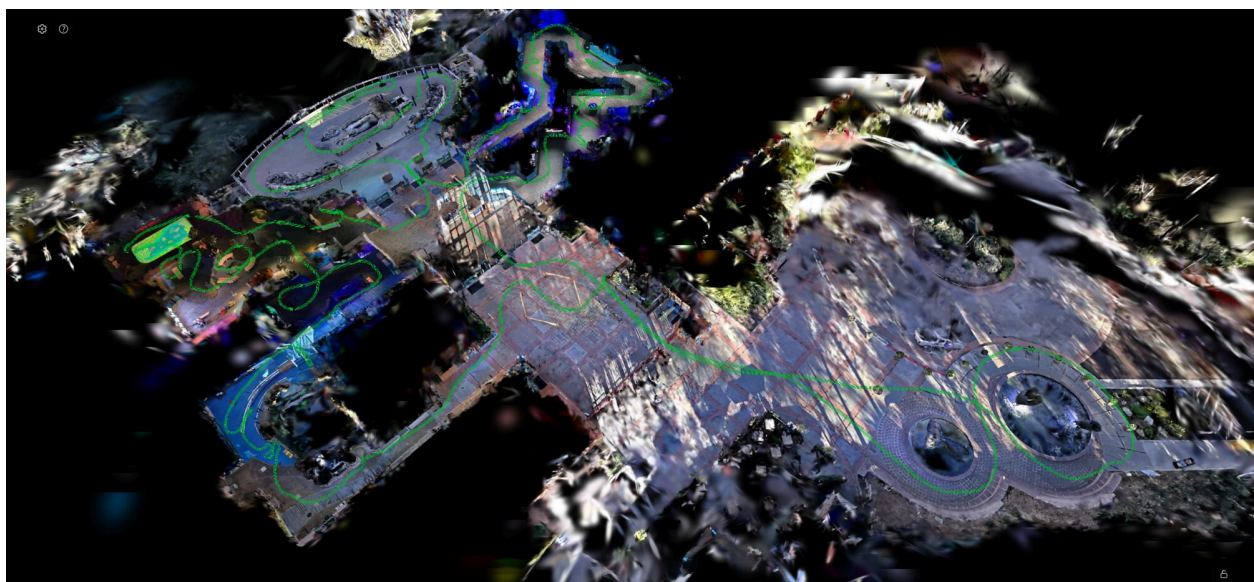
The PortalCam Gaussian splat reconstruction shows the aquarium's public spaces in stunning detail. Reconstruction quality closely followed the lighting:

- **Well-lit areas** reconstructed very well.
- **Low-light areas** were weaker, even with the cleaning lights turned on.
- **Tank interiors** did not resolve well, as refraction through the acrylic and water caused errors in the reconstruction.

Despite these limits, the model is a strong 3D reference of the aquarium's renovated public spaces.



LiDAR point cloud preview of the site-wide scan, capture path overlaid in green (XGRIDS LCC viewer)



Gaussian splat model of the site-wide scan, capture path overlaid in green (XGRIDS LCC viewer)

Videos



PortalCam results
video walkthrough
youtu.be/kK0jT7Xf_Z4



Kelp Forest habitat
with Halloween decoration
youtube.com/shorts/3JM2xHNYuK4

Data Quality and Availability

The data provided by this project is not certified by a licensed surveyor. Measurements provided are subject to error. Geometry seen through tank windows is additionally distorted by refraction and should not be used for measurement. If an application requires a particularly high level of accuracy or precision, please contact the authors of this report.

The data is published publicly as cited below.

Alessio Martino, Aviral Agarwal, Jordan Pierce, Scott McAvoy, Politecnico di Torino, Cultural Heritage Engineering Initiative (CHEI), UC San Diego 2026: Birch Aquarium - Interior Public Space - Photogrammetry - Terrestrial. Distributed by OpenOcean3D. <https://doi.org/10.34946/D6Q883>

Appendix - Data Inventory

Description	Area	Lighting	Sensor	Collector
Site-wide Gaussian splat scan	Whale sculptures, Main Entrance, Davis Galleria, Living Seas, Tide Pool Plaza, Imagine Wild, Seahorses and Seadragons, Little Blue Penguins	Cleaning lights on	XGRIDS PortalCam	Alessio Martino
Living Seas Gaussian splat scan	Living Seas gallery	Exhibit lighting (lights off)	XGRIDS PortalCam	Alessio Martino
DepthCam test images	Living Seas	Mixed	iPhone 17 Pro, DepthCam	Aviral Agarwal
Field photographs and video	Living Seas, Little Blue Penguins	Mixed	Phone cameras	Expedition team
Prior scans, 2022	Kelp Forest habitat, guest view and roof	n/a	Leica BLK 360	Scott McAvoy (viewer)

Sources

- [Birch Aquarium: Living Seas opening](#)
- [Birch Aquarium: Living Seas, Living Dreams, 2025 story](#)
- [Birch Aquarium visitor map, April 2025](#)
- [Birch Aquarium, Wikipedia](#)
- [Heliguy: XGRIDS PortalCam launch](#)