

The Quest to Keep Coral Alive

A Tokyo startup is using AI and IoT to raise coral in an urban environment.

by **Tim Hornyak**



In one corner of an office above a beer hall in the Toranomom business district, clownfish, blue tangs, and blue-green chromis dart about in a tank. But look closer and you will see something more remarkable: the aquarium is full of colorful coral that is actually alive.

“More than 50 kinds of organisms are living together in this tank,” says Takakura Yota, CEO of Innoqua Inc., a startup business that grew out of the University of Tokyo. “What makes Innoqua different is our ability to create an artificial ecosystem in which coral can survive.”

Behind the tank is a blueprint, laid out like a circuit board, which shows the relationships between all the living things in the aquarium. The startup has managed to get corals raised by aquaculture farmers in Okinawa Prefecture, in southern Japan, and cultivate them in a carefully controlled environment in the heart of Tokyo. It is very difficult to raise coral because its native ecosystem must be copied in terms of water quality, temperature, and wave characteristics as well as microorganisms and other living creatures.

With the proliferation of sensors and Internet of Things (IoT) devices, however, top aquarists have gathered enormous volumes of data on the ideal artificial conditions for coral to grow. Innoqua uses this crowd-sourced data, which is stored in the cloud, and an artificial intelligence system to carefully regulate its ecosystem. This includes ultraviolet lighting systems to simulate sunlight and moonlight, artificial saltwater, and water temperature precisely tuned in increments of 0.01 degree to mimic the Okinawan sea. The company calls this environmental transfer technology.



Living coral brighten this aquarium in the office of Innoqua, Inc. Even in this small space, a near-perfect marine ecosystem can be created.

Takakura’s vision is to be “a doctor for the Earth.” His first objective is to engineer the artificial spawning of coral—the release of millions of eggs and sperm in a spectacular underwater blizzard. He believes this will prove Innoqua’s artificial ecosystem to be sound. Like raising coral, it is extremely difficult to reproduce the precise environmental conditions for spawning. His efforts may raise awareness in Japan about the problem of coral bleaching, in which an absence of phytoplankton and nutrition can lead to coral death.

“There are over 800 species of coral in the world, and about 400 of them are found in Okinawa,” says Takakura. “We want to bring the magic of these organisms to many people so everyone can realize how precious they are.”

The 26-year-old Takakura grew up in a family that enjoyed marine activities, especially diving and snorkeling, and he

became interested in tropical fish in middle school. After studying AI at the University of Tokyo, he decided to establish Innoqua in 2019 with the goal of “delivering the value of nature to people.” It already has about 10 staff and ties with major organizations in Japan.

Takakura and colleagues established a coral aquarium attraction in a shopping mall that lets children learn hands-on about conserving marine resources while communicating with experts from the company. It is also working with the Japan Aerospace Exploration Agency (JAXA) to adapt its environmental transfer technology for space exploration, specifically the challenge of growing food for a large group of people living in a moon base in the 2040s.

That is a remote goal, and for the meantime, the startup is focused on achieving the perfect conditions for coral spawning. While it managed to simulate the environmental conditions that prompt spawning, actual reproduction remains elusive. But Takakura is certain he can accomplish it—even in an office in Tokyo.

“I was lucky enough to witness coral spawning in Okinawa,” says Takakura. “It’s the most dramatic spectacle and it’s what I would most like to show people to convey the value of these precious creatures.”