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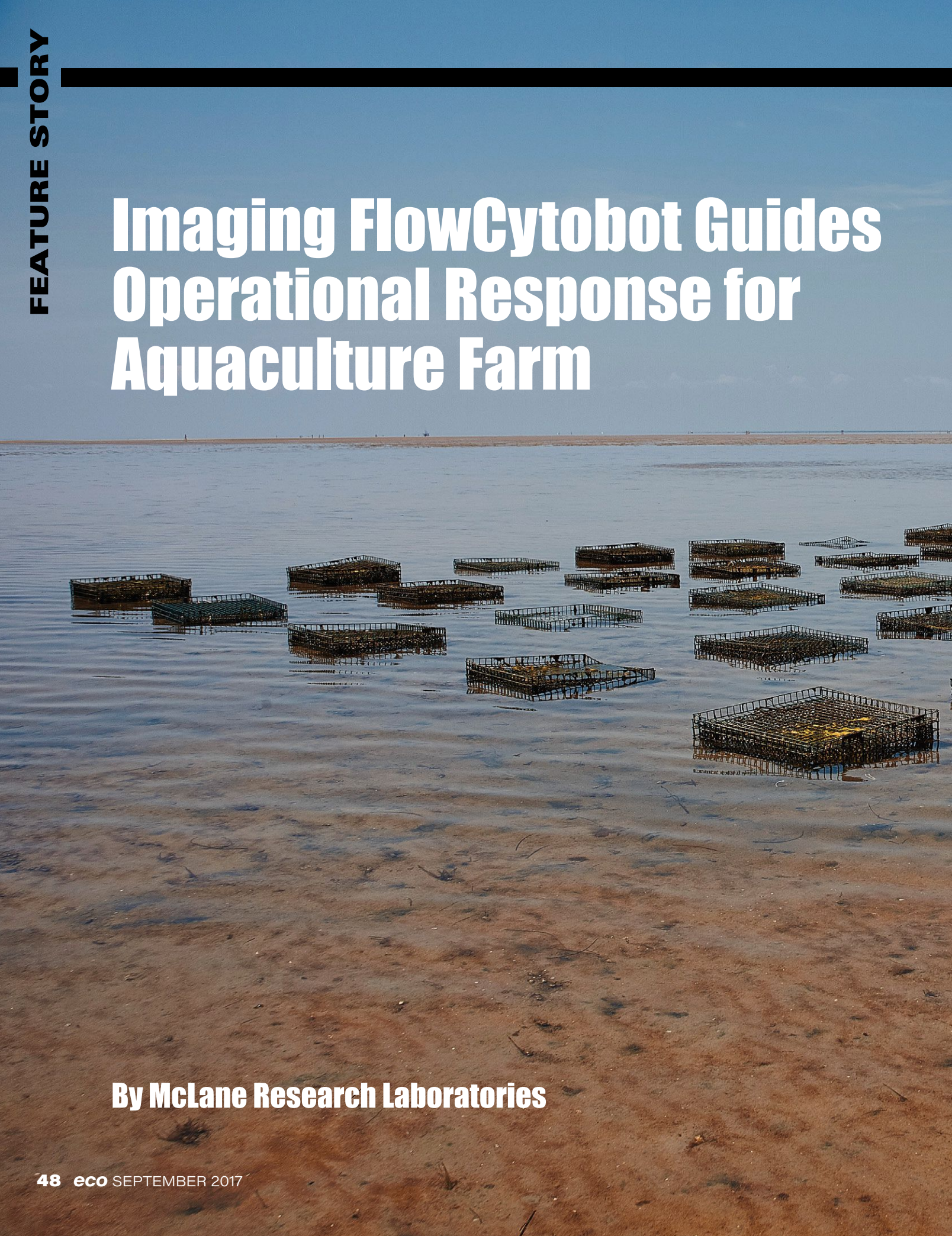
Imaging FlowCytobot Guides Operational Response for Aquaculture Farm



By McLane Research Laboratories

Oyster traps in Cape Cod, MA.

For aquaculturists, water resource managers, and oceanographers, forewarned is forearmed. Robotic instruments such as the McLane Imaging FlowCytobot (IFCB) are helping shift plankton detection and identification to continuous, in-situ methodologies. In-situ laboratories such as IFCB are changing detection protocols with continuous, real-time imaging available 24/7 via a smart phone, computer, or tablet. Such early information allows critical decision makers to adjust protocols and make fast operational responses.

Consider the experience of Dr. Dan Ward, owner of Ward Aquafarms, a Cape Cod (Massachusetts) based business that farms oysters, quahogs, scallops, and kelp. Ward had been concerned about large *Cochlodinium polykrikoides* blooms on his oyster grant, which had damaged his juvenile shellfish in previous years.

McLane Research Laboratories, manufacturer of the IFCB, recently partnered with Ward, who evaluated the laboratory platform in a deployment at his aquaculture farm.

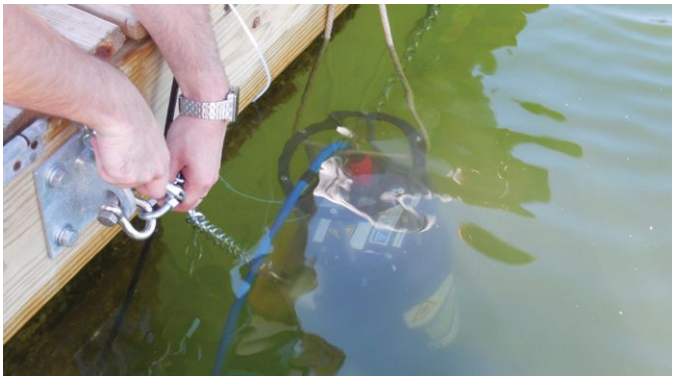
"I had high hopes, but I had never seen the IFCB in a real deployment, so I was unsure what to expect," Ward says. "I was hoping that [IFCB] would be able to pick up individual *Cochlodinium polykrikoides* cells, but I didn't know if it could. Turns out it is able to pick out individual *C. polykrikoides* cells, and it does a great job at focusing and imaging all different sizes and types of microalgae."

Within an hour of installing the IFCB at Ward's site, *C. polykrikoides* cells were imaged in great abundance and represented a large portion of the local population. McLane staff immediately notified Ward for confirmation.

"I checked the IFCB, and sure enough, there was *C. polykrikoides* at high densities, so we moved all of our seed oysters out into deeper water to get away from the bloom," said Ward. "If the IFCB wasn't deployed, I most likely wouldn't have known the bloom started, and most of the seed oysters in the nursery would have died."

Traditional monitoring to detect bloom-forming plankton species is an infrequent, costly, and labor-intensive process often enacted once fish kills or blooms have already occurred. Collection and species identification sometimes occurs too late to protect the valuable resources within the affected area. This delay makes shellfish growers particularly vulnerable to large economic losses.

Capturing continuous, in-situ plankton data also has applications for Catalina Sea Ranch, a 100-acre aquaculture farm located on the Los Angeles, California coastline. Catalina Sea Ranch is the first offshore aquaculture facility in U.S. federal waters. The site is currently equipped to grow Mediterranean mussels, giant kelp, giant rock scallops, Pacific oysters, and abalone. The facility has purchased an IFCB to evaluate the effects of offshore aquaculture impacts on phytoplankton communities, and help improve animal husbandry and protection efforts.



The Imaging FlowCytobot (IFCB) is an in-situ automated submersible imaging flow cytometer that generates images of particles in-flow taken from the aquatic environment.

In addition to harmful algal bloom (HABS) monitoring,

The IFCB is a fully submersible instrument with self-cleaning protocols to combat biofouling.

Catalina Sea Ranch will use the IFCB to track beneficial species for shellfish feeding, determine optimal spat distribution timing, and study phytoplankton community composition to meet regulatory requirements.

According to NOAA's Marine Aquaculture Strategic Plan, domestic aquaculture production by volume is forecasted to double within five years. As the domestic aquaculture industry experiences steady growth, next generation instruments like IFCB will help to sustain businesses with proactive, in-situ plankton identification.

"As a hardened, in-situ, real time, fully submersible instrument with self-cleaning protocols to combat biofouling, we believe that the IFCB makes a compelling business case for both aquaculture farmers and resource managers," comments Yuki Honjo, COO of McLane Research Laboratories.

Manufactured since 2013 by McLane Research Laboratories, IFCB is an automated submersible imaging flow cytometer that generates images of particles taken in flow from the aquatic environment. Automatic image classification and identification is used to characterize phytoplankton, invasive species, and other microorganisms.

In addition to aquaculture monitoring, IFCB has been deployed for phytoplankton ecology research, water quality characterization, and underway (shipboard) sampling in applications around the world.

IFCB has multiple triggering channels and is optimized to acquire images of particles in the range of sub-10 to 150 µm. Capable of maintain a continuous sampling rate of 15mL/hour, the IFCB may generate up to 30,000 high-quality (approximately 3.4 pixels per micron) images in one sampling hour.

In addition to advanced research platforms, McLane Research Laboratories also manufactures a range of oceanographic instrumentation in three product lines: profilers, samplers, and flotation.

Learn more about McLane at mclanelabs.com.

Learn more about the IFCB at mclanelabs.com/ifcb-videos/.

See a live data streaming IFCB dashboard as well as a 10-year time series at ifcb-data.whoi.edu/mvco/.