



Automation Streamlines High-Tech Shrimp Facility

Indoor, inland operation sets sights on worldwide growth for fresh shrimp.

NaturalShrimp International’s Pacific white shrimp (*Litopenaeus vannamei*) are a long way from the Pacific – and they’re on their way to a premium position in markets around the world. Reared in the semi-arid outskirts of San Antonio, Texas near the U.S. border with Mexico, the shrimp in NaturalShrimp’s first production facility are miles away from the viruses and bacterial diseases that plague ocean-reared shrimp, and live in climate-controlled comfort all year long. That makes every day a perfect day to grow and thrive.

“As far as the shrimp are concerned, it’s summer all the time,” notes Doug Ernst, NaturalShrimp’s vice president of science and technology. “We’re pushing for good growth every day of the year.”

That makes every week harvest week. As the shrimp reach 20 per pound (23 grams), they travel from tank to chiller, layered on ice in totes just minutes after being removed from the grow-out tank. The company harvests 6,000 pounds of shrimp per week, marketing it on its freshness, its lack of antibiotics and treatment chemicals, and its week-long shelf life.

“If we try to sell frozen shrimp, we’re competing with a world commodity,” Ernst explains. “Instead, we can sell a premium product, fresh – never frozen – shrimp.” The local San Antonio market is home to 1.2 million people, and other major cities – Austin, Dallas and Fort Worth – put millions more customers within a few hours’ drive.

“By being inland and not depending on the resources of the coastal zones, we can put these facilities near the markets,” says Ernst. “We’re trying to design a facility that could pretty much go anywhere and function in any climate.” Proving the point, NaturalShrimp has teamed up with joint-venture partners to establish production facilities in Spain, Turkey and Mexico.

Project Focus

The NaturalShrimp production facility is a closed system, which sets the stage for outstanding biosecurity and precludes the need for medications and water treatment chemicals. The San Antonio operation started by drawing 1 million gallons (37.8 million liters) of county water, de-chlorinating it, and adding sea salt to create a brine with half the salinity of seawater. Other than some evaporation, there is minimal loss of water from the system, which makes it attractive to conservation-minded permitting authorities around the world. Solid waste and nutrients are digested in a water reclamation system,

and the cleaned water is recirculated back to nursery systems and grow-out tanks.

NaturalShrimp brings in eyelash-sized post-larvae and rears them in post-larvae nursery tanks measuring 20x25x5-feet (7.6x6x1.5 meters). As they grow, they are transferred to 120x20x5-foot



NaturalShrimp’s product shown immediately after chilling.

(36.5x7.6x1.5-meter) grow-out tanks. Each of the 20 tanks is equipped with a YSI 5200 multiparameter continuous monitoring and control system, linked to a central computer that runs YSI’s AquaManager® software. Automatic wipers keep dissolved oxygen (DO) sensors on the 5200s free of biofouling, Ernst points out, which can be a challenge in murky shrimp tanks. The result is low-maintenance automation – and high efficiency.

In addition to keeping the DO probes clean, the spinning-brush on the YSI 5567 DO wiper also provides sufficient movement of the shrimp tank water around the probe to maintain accurate readings.

Automation is a vital part of keeping NaturalShrimp running smoothly and profitably. Backed by the suite of 5200s, just 10 employees working a single shift keep the operation running smoothly. Without automation, the company would have to expand to round-the-clock staffing to handle manual monitoring and control for water temperature and DO, as well as continuous 24/7 feeding, notes Ernst. “If a problem happens in the middle of the night, depending on severity, workers may or may not respond

(continued)

to it he says. “The 5200s are there every minute of the day, keeping the set points in range and notifying us if they are not.”

Each 5200 controls oxygen, temperature and feed. Ernst’s team inputs shrimp biomass (kg), specific feed rate (% body weight per day), food conversion ratio (FCR), feed dispenser calibration (kg feed per minute), and daily feeding times into the AquaManager program. The program then computes and applies precise feed quantities per



One of 20 wall-mounted 5200's on a grow-out tank.

feeding event, on a 24-hour basis, with built-in 5200 panel relays directly controlling feed dispensers. Based on FCR values, the program increases shrimp biomass levels on a daily basis, so that feeding rates are increased incrementally to keep up with the growing shrimp. Water temperature and DO are controlled according to user-inputs for set-points and alarms. Ernst points out that the 5200 can actually monitor even more water quality parameters – including conductivity (salinity), pH and oxidation reduction potential (ORP) – but he designed the system to focus on the variables that require quick response and can be handled automatically for their needs.

“Those three functions – oxygen, temperature and feed – are the ones you really want to automate,” he explains. “For the rest, you have to ask yourself, ‘is it important and is there an automated response that you can do for that variable that would rationalize continually monitoring it?’”

Ernst points out that temperature tends to drop steadily over time, so using the 5200 to signal in-tank heat exchangers to come on whenever the water gets too cool makes sense. Similarly, oxygen can get depleted quickly – any time of day or night – so continually monitoring dissolved oxygen and injecting pure oxygen as needed is economical, as well as vital at high shrimp biomass densities.

The risks – and the safeguards – came into sharp focus one night. When an oxygen injector malfunctioned in one of the tanks, the 5200 detected the decline in dissolved oxygen, sounded an alarm to alert the facility managers, and immediately stopped the feed

dispensers to avoid creating further oxygen demand. That quick action allowed NaturalShrimp to fix the situation before losing a tank full of valuable shrimp.

Ernst points out that the YSI AquaManager software supports the ability for managers to stay on top of production facilities around the world. “An important selling point of the 5200 is that it uses a Microsoft Access database, not some proprietary programming hidden from our eyes,” says Ernst, who earned his Ph.D. creating automated systems and computer simulation models for aquaculture operations (see www.AquaFarm.com). “We can write software that allows us to look at those databases remotely, via the Internet. We can have an expert somewhere looking into a problem at any of our locations.”

He adds that his experience with YSI equipment gives him confidence in its performance. “Years ago, when I worked for a salmon ranching operation on the graveyard shift, one of my most trusted friends was a YSI DO meter,” he recalls. “My aquaculture career has grown up with this equipment, I’ve had experience with YSI’s products, I appreciate the product quality, and I am very happy with their customer support. Intensive shrimp production systems are rigorous environments for equipment in general, whether it’s aeration, heating, filtration, or automated monitoring and control systems.”

Ernst notes that YSI’s Darrin Honious went on-site to provide technical support, fine-tuning the automatic probe wiping systems and helping with networking challenges to link the 5200s with the central database. Honious says Ernst and the NaturalShrimp team have designed their automation system to make excellent use of the monitoring and control capabilities of their equipment.

“They’re very detail-oriented,” says Honious. “They studied the product beforehand, so they knew what they were doing. They’ve been very quick in learning the process, and they’re willing to get dirty, get in there, and get things done.”

The system has worked swimmingly, and NaturalShrimp is ready to go worldwide. “We’re comfortable with the technology,” Ernst says, “so we’re starting to put together design and operational manuals and work on our technology transfer to joint-venture partners.”

There’s no telling where NaturalShrimp’s shrimp may find new homes – close to premium markets, but miles from the sea.

For water quality and additional data from NaturalShrimp, please visit:

www.naturalshrimpinternational.com