Case Study: Michigan Fish Hatcheries

Hatcheries Use Windemuller-designed Distributed Opto 22 SNAP Systems for Replenishing Fish Populations Throughout the State

Fish hatcheries are facilities where fish eggs are cultivated under artificial conditions for breeding, repopulation, and other purposes. Typically, hatchery workers release the female fish's eggs (a process known as "stripping") and then add the male fish's sperm (aka milting.) The fertilized eggs are incubated in a controlled environment free from disease, predators, and other risks. The hatched fish are then moved to raceways (artificial canals) where they mature and are sold for food, sent to aquariums or pet stores, or used for restocking.

"Michigan hatcheries release all their fish into our local rivers, lakes, and tributaries to support commercial and recreational fishing and to supplement the natural population of various species," explains Chris Klage from the state of Michigan's Department of Natural Resources.

Oden State Fish Hatchery—Main Hatchery Building

Monitoring and Control Systems

Klage oversees six hatcheries in the state of Michigan, including the Wolf Lake, Harrietta, Platte River, Oden, Thompson, and Marquette State fish hatcheries. These facilities produce several varieties of salmon, sturgeon, pike, trout, splake, and other species. Klage's main area of responsibility is maintaining the hatcheries' numerous process control and alarm systems, which utilize Opto 22 SNAP Ethernet hardware as their central components.

Opto systems manage tank water temperatures, water flow and oxygenation, and equipment status

The Opto 22 systems interface with flow meters, float level sensors, variable frequency drives, and the hatcheries' other POW-related equipment. (POW is the acronym used by hatchery personnel to describe anything power, oxygen, or water related.) Numerous other devices and systems manage a variety of conditions such as tank water temperatures, water flow, and oxygenation, as well as the on/off status of equipment. For example, at the Oden State Fish Hatchery, a breeding facility for brown and rainbow trout, Opto 22 SNAP controllers are used in the different hatchery buildings to automate, manage, and monitor equipment used during every stage of the fish rearing process.

One of three outdoor raceway buildings at the Oden State Fish Hatchery

"First and foremost, we have Opto systems monitor for the presence of three-phase power to ensure that the building systems are up and running," says Greg Dekker, Project Manager at Windemuller, a provider of electrical, automation, communication, and IT services to companies throughout Michigan. "We also monitor all of the hatchery tanks' water levels, specifically the low water marks."

The hatcheries' Windemuller-designed control and monitoring systems utilize Gems-brand float level switches that work in similar fashion to the ballcock assembly in most home flush toilets. The float device is connected to Opto 22 digital input modules, and as the water levels change, the float rises up and down, triggering internal switches that send a signal to the module, which then communicates the readings to a SNAP-LCM4 (or SNAP-LCSX-Plus) controller.

Alarming features have also been added so hatchery personnel receive

A central controller and Ethernet connectivity allow biologists and technicians to monitor water and equipment conditions on any networked PC

notification if the preset high water or, more importantly, if the low water mark is reached, as too little water means not enough oxygen to sustain the fish. The hatcheries also utilize the Opto 22 systems' alarming features to warn if too little or too much water is being supplied to any given tank at any given time.

"We have the systems configured for high alarms around the 6000 gpm mark and low alarms in the 2500 gpm range depending on the facility and also the time of year," says Klage. The Opto hardware receives an alarm condition and triggers local audible horns and visual strobe lights to warn on-site hatchery personnel. When alarm conditions arise after working hours, Opto 22 equipment closes

various contacts for remote pagers and also activates a phone dialer for remote notification and quick response by on-call personnel.

Both Klage and Dekker are impressed with the Opto 22 hardware—specifically its simplicity, easy configurability, and tremendous flexibility. For instance, although all the hatcheries' Opto 22 hardware communicates using Ethernet as the transport protocol, the physical layer over which this communication takes place varies by location. Some hatcheries use a serial interface from the controller to the field I/O (and an Ethernet interface for programming and to deliver hatchery data from the controllers back to a database.) Other hatcheries, however, utilize fiber optic cable as the physical media. Future plans call for standardization of all the hatcheries on fiber optic cabling.

Distributed Architectures

"The distributed nature of the Opto 22 platform is particularly important for us because each hatchery spreads out over 10 to 75 acres," says Dekker, who worked with FishPro (a professional services firm specializing in fishery and aquatic resource engineering) to design and install the specific architecture at each hatchery that offered the best performance, simplicity, and aesthetics.

FISHPRO

As Klage explains: "At each hatchery site, there are many different buildings—raceways, clarifiers, well houses, cold storage buildings, a visitor's center—so we have cable running underground to all these different locations. But instead of a separate controller at each location, we have an independent I/O processor talking to the local I/O and then communicating to the central Opto controller."

Once the data is received, the central controller's Ethernet connectivity allows information to be transmitted to any networked PC, so biologists and technicians can review and interpret the water and equipment conditions. If necessary, these same individuals can also review control strategies and make adjustments to any of the hatchery systems right there from the same PC. Additionally, when Klage is off site, he can use PC Anywhere to check conditions, change set points, and take control of various systems at any of the six hatcheries.

However, these types of remote control capabilities come secondary. The main consideration is keeping all of the systems that support the fish and their environment thriving. To help ensure this, many monitoring and alarming features have been implemented. In addition to the aforementioned high and low water notifications, various other alarms are configured. Every piece of electrical equipment that supplies water to eggs or fish is outfitted with power

OPTO 22

monitors, and the Opto 22 system interfaces with these and monitors closure of auxilary contacts, thereby providing a holistic view of all electrical equipment.

Standardizing on Opto 22

The Opto 22 systems were first specified for installation at the Michigan hatcheries just prior to the year 2000. The Department of Natural Resources had Y2K compliance worries about the myriad of control systems (from a mix of vendors) being used at the hatcheries and a decision was made to replace this hodge-podge and standardize on a single vendor—Opto 22.
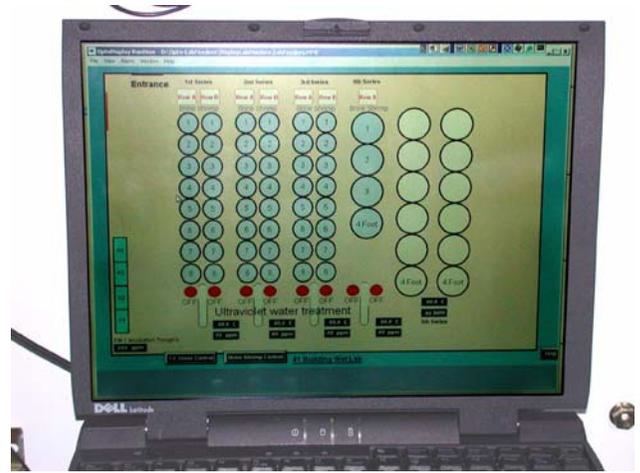

Free consultation with the Opto 22 presales team resulted in a powerful and affordable system for each hatchery

"When I came into the picture in 1999, almost every hatchery used a different hardware-software platform—Keithley Metrabyte hardware with ProScan software and many other combinations," Klage explains.

Working within its budget constraints, the department was able to confer with Opto 22's presales team (which provides free consultation and product selection services) and eventually specify a powerful and affordable system for each hatchery. Indeed, Klage was pleased to learn that besides having all of his functionality requirements met, he could have Windemuller integrate nearly all six systems with Opto 22 hardware for the price it was going to cost to do just one of these systems with components from competitor Allen Bradley.

In addition to affordability, the simplicity of the Opto systems and easy configurability of the programming software were major selling points.

For remote monitoring of the hatchery systems and equipment, Windemuller worked with the Department of Natural Resources and used the OptoDisplay software to create easy-to-understand HMI screeens.

"Opto flowcharting is easy to understand, especially compared to ladder logic," says Klage. "I also like that the I/O racks have fewer slot dependencies and that the modules are trouble-free and easy to swap out. With some of the other systems, we would have to darn near disassemble the whole rack to replace one board. That's a far cry from the Opto gear, which will even let me perform hot swaps, if necessary."

For the Department of Natural Resources' variety of biologists and maintenance personnel, the Opto 22 systems have been easy to maintain and very reliable. As with many state agencies, money is tight and the staff is limited in numbers, so having a product that's virtually trouble-free and also easy to modify is very important.

"Using Opto 22 has been very good for the department and also for the state of Michigan and the people who enjoy the great outdoors and the great fishing the state has to offer," says Klage.

About Opto 22

Opto 22 develops and manufactures hardware and software for applications involving industrial automation and control, remote monitoring, and data acquisition. Opto 22 products use standard, commercially available networking and computer technologies, and have an established reputation worldwide for simplicity, innovation, quality, and reliability. Opto 22 products are used by automation end-users, OEMs, and information technology and operations personnel. The company was founded in 1974 and is privately held in Temecula, California, USA. Opto 22 products are available through a worldwide network of distributors and system integrators. For more information, contact Opto 22 headquarters at 951-695-3000 or visit www.opto22.com.

About Windemuller

Windemuller was established in 1954 and is headquartered in Wayland, Michigan, with satellite offices in Big Rapids, Montague, Kalamazoo, Manistee, Petoskey and Traverse City.

The company provides electrical, automation, communications, outdoor utility, and information technology services for industrial, institutional, government, utility, commercial and municipal customers.

Windemuller employs over 200 employees (including approximately 42 master electricians) and maintains a better than 1 to 1 apprentice to electrician ratio. The company's current EMR safety rating is .58.

Striving to provide the best possible service to all of its customers, Windemuller expects honesty, trust, commitment, and accountability from all its employees and plans its continued success by providing quality service and maintaining an innovative edge in all it does.