Trawl-tech: Chasing the Future of Fisheries Research

www.Thyboron-Trawldoor.dk

Thyboron brand steel trawl doors provide the hydrodynamic lift required to expand the dimensions of a trawl net being pulled through the ocean.

By Greg Hinks, Principal Biologist

The Tackle Box

New Jersey Division of Fish and Wildlife's Ocean Stock Assessment Survey samples fish in near-shore ocean waters from Sandy Hook to Cape May. Sampling is conducted with a 30-meter wide bottom otter-trawl, a net designed to drag along the seabed. An otter-trawl includes components referred to as *doors*.

Historically, an otter door was merely a slab of wood held in a steel frame. At nearly 1,200 pounds of dead weight per door, they were essential for the trawl net to function. Two otter doors maintain the trawl net opening by providing resistance against water as they are pulled by the vessel.

Today, this equipment has been transformed by applying the science of hydrodynamics—which utilizes the forces of fluids, like seawater—to achieve the same result as the old doors, but at half the weight.

The functioning of these advanced-style otter trawl doors resembles an airplane wing by using the redirection of water as it flows over the gear to provide lift. Not only do modern trawl doors weigh significantly less—making them more fuel-efficient because of the decreased mass—they are made entirely of steel resulting in sturdier equipment.

Like a fisherman's hook in the water, trawl nets are nearly invisible once deployed. In the past, knowledge of how a net was performing was based entirely on the experience of the captain behind the wheel. Deployment complications could result in an incomplete opening of the net or perhaps the weighted "footrope" intended to dredge the ocean floor might not be making contact.

Scientists now use wireless net-monitoring systems to reveal how a net is performing in the water. Special sensors attached to the fishing gear relay information back to the boat via a hydrophone, providing virtually any imaginable measurement one may desire to know about the net. Wingspan (the distance from one side of the net to the other) is constantly monitored, informing the captain if the net is fully open, while a bottom-contact sensor

Marine biologists use rugged, waterproof, dustproof handheld computers like Juniper Systems' Allegro 2, below, that perform under rough and wet conditions during trawl surveys.

Jamie Darrow/NJ Div. Fish and Wildlife

Technological advances in the field of fisheries research continually enhance and improve the way data is collected, making it faster, easier and more efficient to count fish. While these advancements may come with a hefty price tag, the payoff is immense, often resulting in new data that was previously unobtainable.

Allegro 3, courtesy of JuniperSys.com

indicates whether the footrope is on the ground as it should be. Additional data, such as temperature and depth, are constantly recorded—information that was previously difficult to monitor over the course of a 20-minute sampling tow.

The Thermometer

Since its first launch in 1989, the New Jersey Stock Assessment Survey has always monitored water quality parameters such as dissolved oxygen and salinity, but the measurement techniques have changed dramatically. Traditionally, fisheries scientists would collect water samples from various ocean depths and transport them back to their laboratory. Hours would be spent performing Winkler titrations—a chemically-based analysis to determine the amount of oxygen contained in a water sample. Although tried and true, the method required glass laboratory components, chemicals and a skilled scientist familiar with this methodology along with the ability to interpret the results. And this analysis only determines the water's dissolved oxygen level! Numerous additional complex tests would be required to obtain other water quality parameters important to evaluating the conditions from where the fish were sampled.

Fisheries scientists now use electronic devices to obtain this data. A "SONDE" device (Shipboard Oceanographic Networked Data Environment) now records everything scientists need to know in one convenient unit. Think of it as an environmental Swiss Army knife. Multiparameter SONDEs, such as those used for the Stock Assessment Survey, are lowered to the ocean floor by a data cable connected to a hand-held display unit aboard the ship. Measurements of water depth, temperature, salinity, dissolved oxygen and pH are recorded every half-second during the device's voyage to the bottom of the sea and back. What used to take hours and resulted in one set of measurements each at the bottom and surface of the water column, now takes only minutes and provides a complete chemical profile of depths approaching 90 feet.

The Fishing Log

The bulk of the information gathered by the Ocean Stock Assessment Survey is biological data on the fish species sampled. Most of this data is length and weight collected from thousands of fish every year. Paper data-sheets used to be the only way to record the large amount of information obtained from each drag of the net. A biologist would record the weight of each basket loaded with a particular fish species, then measure the length of *every* fish in that basket. All this data could fill many double-sided data sheets. Once a survey was completed, each data sheet would be checked for errors, entered into a computer database and then verified to be error-free. Repeating this process for nearly 200 samples annually required several staff members numerous weeks to complete.

Miniaturization of electronic components has expanded and simplified fisheries data collection by means of hand-held computers, much like a smartphone. The former steps for data-recording, entry and error-checking are reduced to a single step of data-entry, followed by a quick check for erroneous or missing information. One person can handle updating the database in only a few days.

Advances in technology have proven invaluable to fisheries research scientists. It's difficult to imagine what might be the next big leap forward in marine fisheries research—but it is eagerly awaited.

Courtesy of Xylem.com

With a YSI/Xylem brand SONDE instrument, surveyors measure water quality parameters important for monitoring environmental trends.