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Quinault River Automated Salmon Counter is First of its Kind

BioSonics Takes Small Step for Sockeye, Giant Leap for Hydroacoustics

Seattle – Fisheries managers at the Quinault Indian Nation (QIN) have a long history working with BioSonics on management of the salmon resources of the Quinault River. Since the early 1980's, BioSonics has assisted tribal biologists in developing systems and procedures to enumerate adult salmon in Lake Quinault.

Sockeye salmon *(Onchorynchus nerka)*

Salmon are a main staple of income and subsistence for the Quinaults. While the river supports several viable runs, the blueback sockeye, a highly prized delicacy, represent the most culturally significant salmon run in the river. Accurate and timely measure of salmon escapement is foundational to a successful sockeye harvest management strategy. Historically, sockeye escapement has been estimated by counting adult salmon in Lake Quinault using a BioSonics mobile scientific echosounder. Tribal harvest managers have expressed concerns about using estimates from lake surveys because of an apparent relationship between distribution (depth) of the fish and precision of the estimates, the potential for overestimation due to resident fish, and due to lag between the time fish enter the river and the time they enter the sampled population in Lake Quinault. QIN harvest managers therefore sought a more timely and precise index of salmon counts to properly manage their fisheries resources. It was widely believed that such an index would most likely be obtained from sampling in the lower river.

The Need for Timely Estimates of Escapement

The need for accurate estimates of salmon escapement has long been recognized. The QIN membership realized that wise stewardship of their salmon runs and achieving the maximum sustainable yield was dependent on access to the number of fish entering the river as soon as possible. In 2009 BioSonics completed an evaluation study to determine if a suitable site exists for counting salmon with sonar. Several candidate sites were evaluated by personnel from the QIN and BioSonics and an ideal site was identified. In 2010 QIN contracted with BioSonics, Inc. to study the feasibility of establishing an automated, real-time fish counting station in the lower river.

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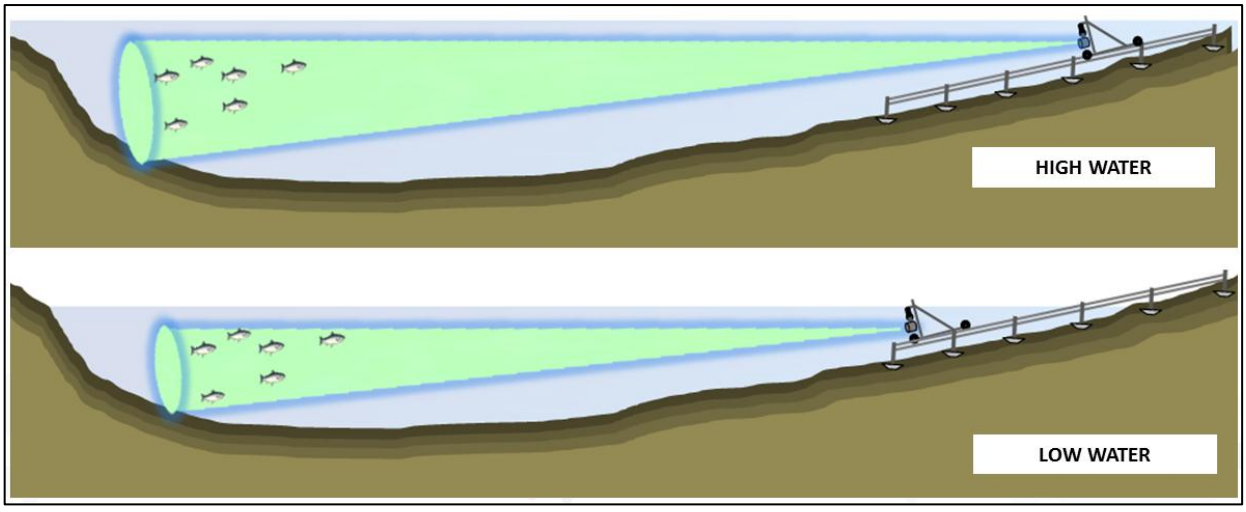
Defining the Vision of an Automated Salmon Counting System

Existing methods for counting salmon in rivers vary widely in complexity and scale. Counting salmon via visual observation, weirs, fish traps, and conventional sonar systems are all relatively common. Such operations can be labor intensive however, and are often manned 24/7 or require frequent visits for maintenance, analyzing data, and reporting of results. BioSonics and QIN envisioned an automated acoustic system that could collect and analyze data in real time, with a communications network that received daily fish counts from a remote station on the river and published results to a web page "dashboard". BioSonics scientists believed such a system with a high degree of automation would provide data to the most people in the shortest amount of time, and have the highest degree of scientific and legal defensibility.

In recent years, BioSonics has pioneered the advancement of Automated Hydroacoustic Monitoring Systems centered around their digital DT-X split beam technology which allows for the detection, sizing, and 3-D tracking of targets at ranges in excess of 200 meters. BioSonics software systems provide watchdog functionality that monitor and communicate system status parameters to project managers in real-time. BioSonics data processing software uses advanced algorithms to automatically generate fish tracks and create fish count reports. The QIN's desire for a remote, riverine fish counting system was an ideal opportunity to leverage BioSonics latest technology and create a completely autonomous fish counting system that operates 24 hours a day with minimal manpower and transmits fish count information in real time.



Conceptual drawing of transducer/rotator assembly on adjustable track mount for variable water levels

Innovation to Overcome Challenges

Once an ideal location was selected, engineering of the automated counting system began in earnest and several logistic issues were quickly identified. First of all, the location for installing the salmon counting station is on a remote stretch of the river with no available power source or communication link. This meant that a reliable autonomous power source would be needed. Custom power modules were engineered to provide continuous electricity. Two heavy duty trailers were configured each with a

bank of deep cycle batteries and an integrated inverter/charger. By rotating the trailers every 3-4 days for recharging, the system could be continuously powered with relatively little effort and at low cost. The entire system had to be extremely robust to withstand river flow and long term exposure to the elements, yet also be easily removable to avoid extreme high flows in the fall and winter when water levels rise and inundate the entire location. Therefore, all surface electronics and components were housed on trailers for quick and easy demobilization. Lastly, an adjustable mount for the transducer was necessary to accommodate water levels in the river that fluctuate several feet depending on precipitation and runoff rates. To facilitate transducer positioning, a track and trolley system was designed to allow for adjustment of the split beam transducer. A mechanical rotator was integrated to provide additional fine adjustment capability and ensure accurate transducer aiming.

Successful Trial Deployment

In May 2011, the automated salmon counting system utilizing BioSonics scientific sonar was deployed in a remote stretch of the Quinault River in Grays Harbor County, Washington. The system consists of 120 kHz split beam transducer and ROS PT 25 rotator mounted to an adjustable track trolley system custom fabricated from anodized aluminum. The track was gravity mounted with cement pier blocks for minimal bank disturbance and easy demobilization. A DT-X echosounder and control computer were housed in a mobile office trailer with a satellite modem for communication. The system operated for several months during which time, data was collected and processed for algorithm refinement and tuning for site-specific conditions. By the end of the deployment phase, the system was automatically transmitting daily salmon count reports to project managers. BioSonics President Tim Acker expressed the significance of the project; “This pilot stage deployment was monumental. To our knowledge, there is nothing else like this in the world. Completely autonomous, completely automatic fish counting represents a shift in the way fisheries managers work. Imagine sitting at your desk and receiving a fish count report from an unmanned monitoring station twenty miles away.”

About the Quinault Indian Nation

The Quinault Indian Nation (QIN) consists of the Quinault and Queets tribes and descendants of five other affiliated tribes: Quileute, Hoh, Chehalis, Chinook, and Cowlitz. The QIN is a sovereign nation with the inherent right to govern itself and deal with other tribes and nations on a government-to-government basis. Tribal operations include: Administration, Natural Resources, Community Services, Health and Social Services and several commercial enterprises. The QIN Reservation is located on the southwestern corner of the Olympic

Transducer/rotator assembly

Aluminum track installed in river

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Peninsula in Washington State and encompasses over 208,150 acres, including some of the most productive conifer forest lands in the United States, and 37 kilometers of unspoiled Pacific coastline. Nearly 700 people are employed by QIN and its enterprises, making it one of the largest employers in Grays Harbor County.

About BioSonics

BioSonics is a manufacturing, consulting, and engineering firm specializing in the application of hydroacoustic (sonar) technology for monitoring and assessment of aquatic biological resources. For over thirty years, BioSonics scientific echosounders have been used for accurate assessment of fish abundance, distribution and behavior. Versatile and rugged design allow for installation in every aquatic environment imaginable. BioSonics offers a range of technical services including survey design, installation, data collection, environmental monitoring, data processing, analysis and reporting.

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