Evolution and Design of PIT-Tag Antenna Efficiency Testing Techniques

Matthew S. Morris[1], Robert J. Magie[1], Richard D. Ledgerwood[2], and Amy L. Cook[1]

[1]Pacific States Marine Fisheries Commission. Point Adams Research Station.
520 Heceta Place, Hammond, Oregon 97121.

[2]National Marine Fisheries Service, Fish Ecology Division
2725 Montlake Boulevard East, Seattle, Washington, 98112-2097

Since 1995, technologies developed to detect PIT-tagged fish passing hydroelectric dams in the Columbia River basin have been modified for a towed application behind a surface pair-trawl in the estuary. Dams commonly use tagged fish or surrogate "stick fish" (wooden dowels implanted with PIT-tags) to troubleshoot PIT-tag equipment and assess antenna efficiency. Our trawl detection system is mobile, and is not conducive to these traditional release/read testing techniques designed for fixed plumbing systems. Since fish released into the trawl might escape, we began, in 2001, an in-situ method to accurately test trawl antenna performance using techniques not requiring test fish. PIT tags were attached to a vinyl coated tape measure at known spacing intervals and orientations and passed back and forth through the center of each antenna coil. For the early style cylindrical antennas, this was done weekly to assess electronic tune, the effects of radio frequency interference (noise), and to evaluate the antennas ability to read tags at specific spacing intervals and orientations. This method was further adapted when the magnitude larger matrix antenna (2.6 by 3.0 m) was developed in 2007. In 2009, the design of the test tape was modified to better understand the ability of the matrix antenna to read tags with shorter spacing intervals (30, 60, and 90 cm apart) and at suboptimal orientations (45° to the detection field). Two variations of this test tape (one with shorter ranged "ST" model tags and the other with longer ranged "SST" model tags) were made to understand the effects of tag type on antenna performance. This improved design immediately demonstrated a problem with tag code collision at the 30 and 60 cm spacing intervals for both tag types. It also showed a marked improvement in reading suboptimal orientations of SSTs compared to STs. We successfully use this testing methodology to verify antenna performance through time and to evaluate potential design changes for improved read efficiency.