

Compiling PIT Tag Interrogation Data from Dispersed Locations within the Methow River Basin to a Single “MRB” Super-Site

Dave Marvin
PTAGIS Systems Analyst

May 22, 2006



PIT Tag Information System
Columbia Basin | ptagis.org

Introduction

Since 2004, researchers from the U.S. Geological Survey (USGS) have installed up to 20 PIT tag detectors at 10 “sites” located on three small tributaries in the lower Methow River Basin, between the towns of Carlton and Twisp, Washington. These detectors record automated interrogation data not only for the resident, adfluvial, and anadromous fish stocks that are the focus of the USGS research, but also for the occasional PIT-tagged adult salmon or steelhead that returns or strays into one of these streams. The USGS researchers also believe that out-migrating salmon and steelhead smolts, PIT-tagged by other researchers further upstream in the Methow River Basin, may briefly utilize the lower sections of these monitored streams, generating incidental detections at the antennas located there. The USGS researchers would like to upload their detection data to PTAGIS in order to take advantage of the data management, reduction, and summary processes provided through the PTAGIS database, and to share any data from the detection of tagged fish from other studies with the researchers responsible for the initial tagging of those animals. In order to simplify the data file creation and maintenance process for the USGS researchers, and to simplify the implementation and maintenance of the location and configuration meta-data for these detection data by PTAGIS staff, I recommend that the data for all the transceivers in the three tributaries be reported to PTAGIS under the umbrella of a “Methow River Basin” (MRB) super-site definition.

Overview

Beaver Creek, Libby Creek, and Gold Creek and its tributaries are all located in the Methow River Basin in north central Washington. USGS, in a project directed by Kyle Martens, has placed PIT tag detectors on these three streams to support studies of the life histories of resident stocks of cutthroat and brook trout and adfluvial bull trout. Kyle and his staff have also tagged a few coho, a few hundred Chinook, and about 6000 steelhead since 2004, to study the early life history and stream utilization of these anadromous species. Kyle has placed PIT tag antennas in these streams to monitor the movement of these tagged fish. Most of the antennas are connected to FS-2001F-ISO (FS2001) transceivers. They have simple square “pass-through” geometries, are constructed of PVC pipe, and are generally located in the thalweg of the stream. During minimum summer flows, these antennas sample close to 100% of the stream width. During other times of the year, and especially during the spring freshet, these antennas sample only a fraction of the cross-sectional area of the stream, and any tagged fish hugging the stream banks as they pass the installation likely avoid detection. These antennas are situated individually at each location; there is no redundant or complementary detection.

Additionally, there are two locations, one each on Gold and Beaver creeks, where up to six antennas are arranged in a complementary and redundant array. Each of these arrays is powered by a FS-1001M multiplexing (MUX) transceiver. The antenna arrays consist of a combination of pass-over and hinged-hybrid (pass-over/pass-through) geometries. Pairs of antennas covering most of the stream’s width are arrayed in three redundant courses upstream to downstream. Due to Kyle’s strategic placement of the

Compiling Methow River Basin Detection Data

antennas in the stream bed, these arrays interrogate most of the cross-sectional area of the stream at all times of the year, and the hinged-hybrid antennas provide coverage of the upper section of the water column even when the water level above the pass-over antennas exceeds their detection range.

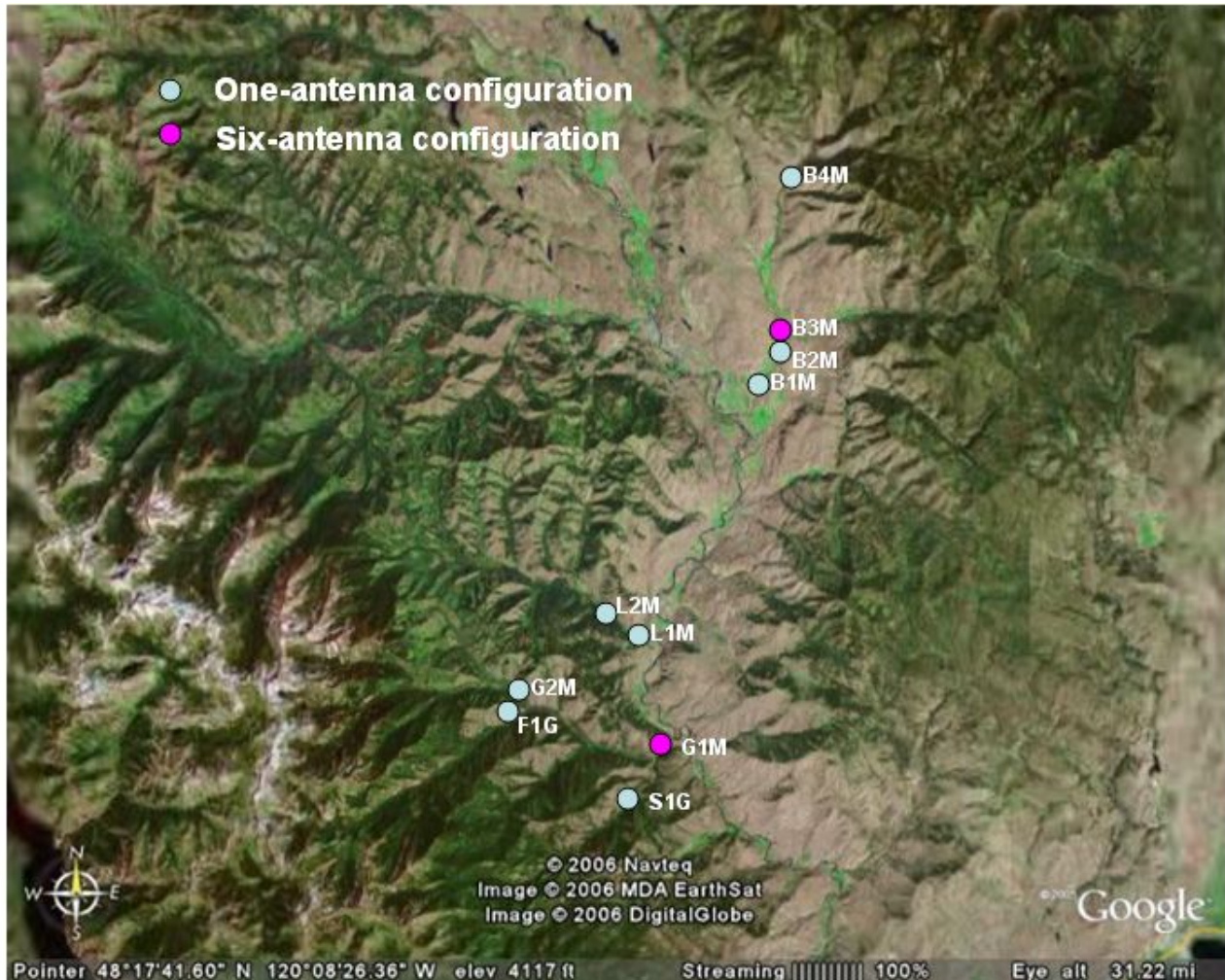


Fig. 1. PIT tag antennas deployed by USGS to tributaries in the lower Methow River Basin.

PIT Tag Interrogation Data Collection

Even though many of these PIT tag antennas are located on private property, most of them operate on DC current. Of the six transceivers I saw, only the muxed array at the lower Gold Creek site had access to AC power, which was then transformed and rectified to 12VDC. The MUX transceivers on Gold and Beaver creeks are backed up by PDAs running MobileMon, to avoid detection data loss in the event of a buffer overrun. There is no PDA or laptop backup of the data from any of the FS2001 transceivers. There is no remote communication with the transceivers. The data from each of the transceivers are downloaded either directly from the transceiver or from MobileMon approximately twice per week. When downloading the buffer from an FS2001 transceiver, the data are normally imported directly into a MiniMon file. Kyle

Compiling Methow River Basin Detection Data

and his staff are very concerned, obviously, with being able to distinguish detection data from one transceiver with data from any other transceiver. Prior to my visit, the USGS crew was not aware that they could assign a specific Coil ID to each transceiver when they downloaded an FS2001 buffer. They instead accepted the “default Xcvt ID” assigned to the single FS2001 device in their MiniMon configuration and, after selecting a “site” identifier prefix and suffix from a defined domain of codes, downloaded the data into separate MiniMon files. To date, they’ve archived all their data this way, with each transceiver download stored to a separate file, and using a filename that identifies the transceiver. These data files are then taken back to the USGS office in Twisp, where the USGS staff has Internet access. From here the detection data can be reviewed, vetted, and transmitted to PTAGIS.



Fig. 2. Location of the Methow River Basin in north-central Washington.

Compiling Methow River Basin Detection Data

After learning that they could explicitly assign a specific transceiver (and antenna) ID to each detection record from each of the FS2001 transceivers, and could maintain this specificity even while they appended multiple downloads from separate transceivers into a common MiniMon file, Kyle's crew was much more receptive to the prospect of recording and reporting all of their interrogation data under a common "MRB" super-site ID. They recognize the potential simplification in file and data management from the use of a single site ID, but they perceive that the potential benefits are offset to some degree by the current difficulties they encounter in configuring the MiniMon software to download the contents of each transceiver's buffer. However, capturing the data in separate transceiver "site" files has its own drawbacks, and Kyle and his crew perceive the compilation and reporting of the data from a single "MRB" site to be a net benefit.

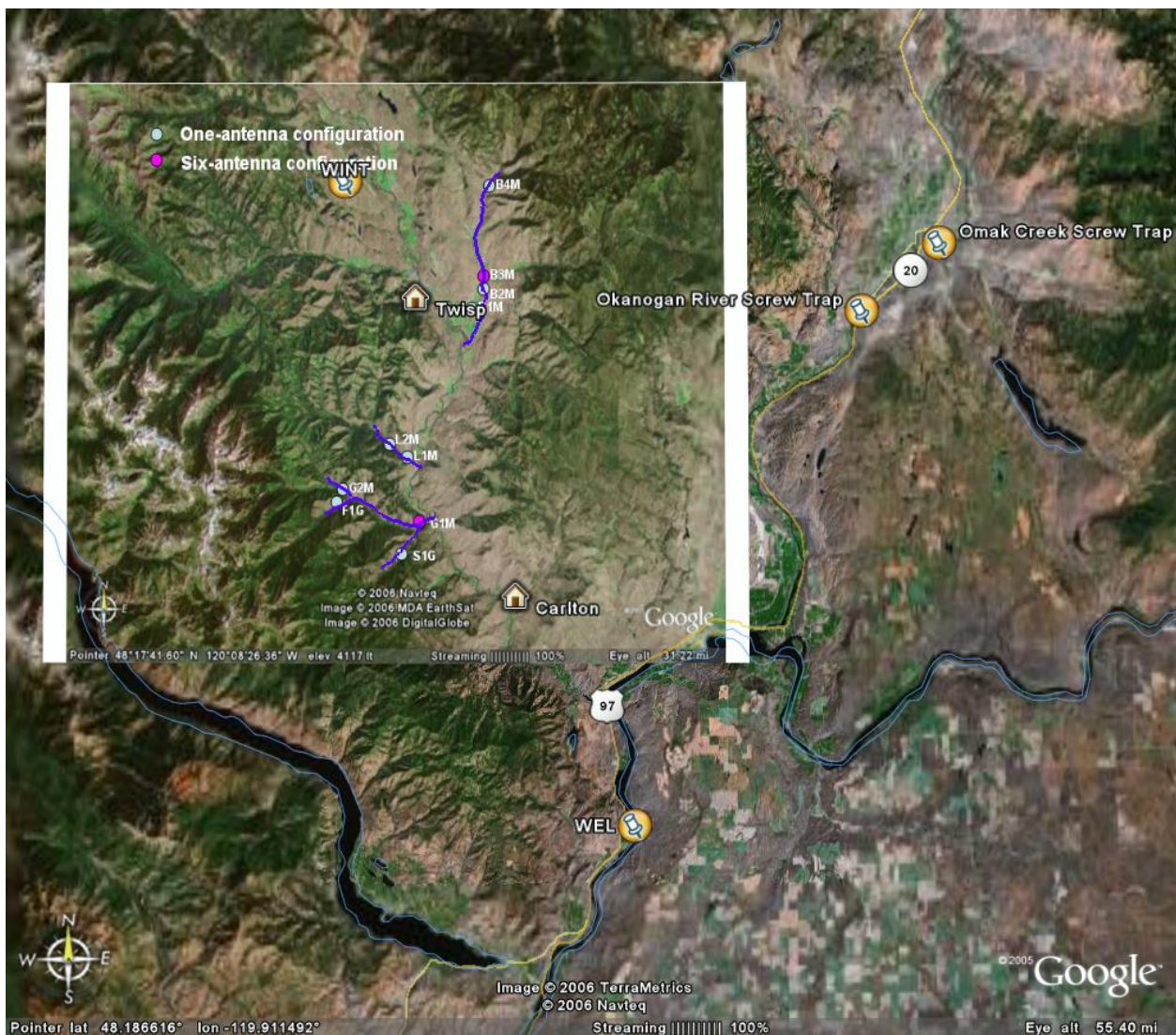


Fig. 3. Relationship of USGS PIT tag detection arrays in the lower Methow River Basin, relative to the surrounding area in the mid-Columbia region of north-central Washington.

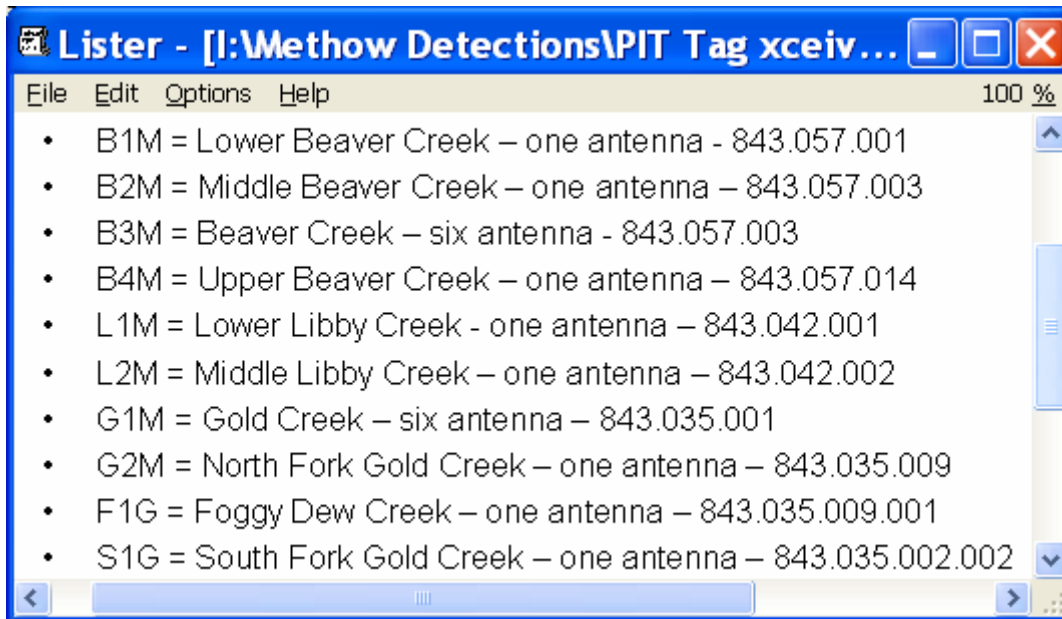


Fig. 4. "Site" codes used in MiniMon file prefixes and suffixes to identify distinct transceiver data.

Site Topology

Each of the USGS single- or muxed-antenna transceiver arrays in the Methow River Basin operates essentially independently. Depending on the time of year, and how far up in a given drainage juvenile anadromous salmonids are PIT-tagged and released, it's likely that some tagged fish will be seen on multiple transceivers in that drainage. In that same drainage, it is unlikely that resident or adfluvial fish stocks will be detected on more than one transceiver unless those transceivers are essentially adjacent, as with the two Beaver Creek installations within 120 meters of each other at RKM 3. Even in this case, the installations are separated by three double-drop A-weirs deployed below an irrigation diversion intake, and these weirs may impede free movement of fish between the two PIT tag detectors. Thus, each transceiver array (or "monitor", in the current PTAGIS site configuration parlance) is a "river exit".

Similarly, the hierarchical ordering of the transceivers is arbitrary. Within a single drainage, Kyle plans to use a common "series" of antenna IDs ("Ax", "Bx", "Cx", etc.) and number the antennas sequentially, upstream to downstream, left to right looking downstream. (Due to the constraints of MUX antenna addressing, this sequence is not possible in the Beaver Creek drainage, where the MUX is downstream of an FS2001 antenna that would otherwise be identified as "A1".) Kyle also plans to extend this antenna naming convention to each of the three drainages; Beaver Creek drains into the Methow River above the other two creeks and so will be assigned the "A" series, while Gold Creek drains to the Methow below both Beaver Creek and Libby Creek and will be assigned the "C" series. It's highly unlikely that any fish detected on any of the "B" arrays will be detected at any of either the "A" or "C" arrays, and vice versa; that is, detections in the individual drainages are probably mutually exclusive. Therefore, the

Compiling Methow River Basin Detection Data

series codes of the transceivers do not imply any “path” of fish movement outside of a single monitored drainage.

Each transceiver array (monitor) should have a name that explicitly describes its location in its respective drainage, as well as its configuration; e.g., “Beaver Creek RKM 3.2 (MUX)” or “Beaver Creek RKM 3.1 (FS-2001)”. This will benefit Kyle and his staff, of course, but will be of greater importance to other researchers whose tagged fish may stray into these waterways and be detected on the USGS equipment.

Implementation

I have already offered to assist Kyle and his staff with the compilation of the detection data they have collected from these various transceivers since 2004; the data from each transceiver (or muxed antenna) will be mapped to match the site configuration schema we will define in the PTAGIS database. I also recommend that the data files be segregated by year, at least, when they are processed into the PTAGIS database.

At some point in the near future, all of the data from the FS-1001M and FS-2001F-ISO transceivers (and individual antennas) will be explicitly and uniquely identified before, or as, the data are captured in MobileMon or MiniMon records. To do so efficiently and effectively will require assistance from the PTAGIS software engineers. I recommend that John and/or Nadia work with Kyle and his staff to improve their knowledge of the existing capabilities of the MiniMon and MobileMon software, and perhaps expand these capabilities and/or develop new functionality in the software to improve and expedite the manual importing and consolidation of data from multiple and disparate PIT tag transceivers.

After the detection data have been retrieved from the transceivers and transferred to the office in Twisp, Kyle or his staff will compile and format the data into standard PTAGIS interrogation files. USGS will then upload these consolidated data files directly to PTAGIS for inclusion in the database.

Conclusion

Aggregating the PIT tag interrogation data to a common “MRB” site from the various transceivers deployed in the Methow Basin by USGS will be advantageous to all parties. It will simplify data management for the USGS staff. It will minimize the effort needed to create and maintain meta-data definitions by PTAGIS staff, especially if USGS adds antenna arrays on other Methow River tributaries. It will allow Kyle and his staff to easily review all of the detection data for the entirety of their research area. It will likely benefit other researchers whose fish are detected within the Lower Methow, especially if the monitor names tell them the exact locations of the detections.

In the future, other interrogation sites may benefit from similar data consolidation, especially if the data are manually downloaded and compiled from multiple transceivers. For example, if dispersed adult salmon detection arrays are deployed in the lower Deschutes River, their data could be reported as a single site. Similarly, the three existing detection sites on the Chinook River, in the lower Columbia Estuary, are

Compiling Methow River Basin Detection Data

essentially a closed system driven by a single research project; data management for all parties would be simplified if these Chinook River data were reported under a common site umbrella.

I recommend that we proceed with the configuration and deployment of a common "MRB" site in support of Kyle Marten's research, and consider similar PIT tag interrogation array consolidations for certain other existing and future detection arrays.