PIT Tag Information System
Columbia Basin

Newsletter

A Fisheries Data Project of the Pacific States Marine Fisheries Commission

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Separation by Code in the Columbia Basin

NICOLE TANCRETO (PTAGIS Portland Office)

Separation by Code in the Columbia Basin

The PIT tag separation by Code (SbyC) program allows researchers to target specific PIT-tagged fish to be separated and diverted to specific locations within a facility. It also allows a default action to target any PIT-tagged fish to be routed one way or another in a facility. This is the case at juvenile bypass systems on the Snake River where fish transportation occurs. At Lower Monumental, Little Goose, and Lower Granite dams, a default action is in place that automatically diverts all PIT-tagged fish to be returned to the river, while untagged fish are collected for transportation. Through the SbyC program, researchers can target a group of fish to override that default action and keep a target group of PIT-tagged fish with the untagged fish population.

Other uses for SbyC include diverting fish toward sample tanks for additional hands-on sampling, diverting adult fish into a trap for sampling, or illuminating a light when a PIT-tagged fish is approaching, allowing a facility operator to take a manual action on that fish. SbyC actions can be applied to an entire group of tagged fish, a proportion of that population (e.g. divert 1 of 5 fish in the target group), or a predefined number of individuals. Both daily and seasonal collection quotas can be set to limit the number of fish diverted. Each SbyC action can be scheduled for a specified number of hours or days, or a specified pattern of days. Multiple populations can be identified and segregated at a given site, with unique SbyC actions assigned to each group at that site.

Researchers who wish to use the PTAGIS SbyC system must complete an online request form to be reviewed by the Fish Passage Advisory Committee (FPAC). If the SbyC project will involve diverting fish to a sample tank, the researcher will need to coordinate with USACE site biologists and the fish facility monitoring program personnel. For more information about what is possible with SbyC and how to request to use it, please contact us.

Facility	Default Action	Possible Actions
Bonneville Dam Juvenile Bypass	None	Divert target fish into one of two available sample tanks.
Bonneville Dam Adult Fish Facility	None	Trigger light when target tag detected, allowing operator to divert to or away from a sample tank.
John Day Dam Juvenile Bypass	None	Divert target fish into one of two available sample tanks.
McNary Dam Juvenile Bypass	None	Divert target fish into one of two available sample tanks.
Lower Monumental Dam Juvenile Bypass	Return PIT-tagged fish to river.	Override default action and treat target fish like untagged fish.
Little Goose Dam Juvenile Bypass	Return PIT-tagged fish to river.	Divert target fish into one of two available sample tanks. Override default action and treat target fish like untagged fish.
Lower Granite Dam Juvenile Bypass	Return PIT-tagged fish to river.	Divert target fish into one of three available sample tanks. Override default action and treat target fish like untagged fish.
Lower Granite Dam Adult Fish Trap	None	Divert target fish into adult fish trap.

Table 1. List of facilities where SbyC is available and the type of actions possible at those facilities.

Upgrades to Interrogation Data Collection Platforms and Software

NICOLE TANCRETO (PTAGIS Portland Office)

On September 15, 2021, PTAGIS Portland staff upgraded the interrogation data processing system to accept production data in the new M5 file format. On that same date, PTAGIS Kennewick staff upgraded the data collection platforms at two interrogation sites to begin collecting and submitting data using M5.

The data collection platform upgrades include:

- Replacement of consumer-grade PCs with industrial PCs running Windows 10 Enterprise LTSC

- Replacement of serial communications equipment with Ethernet-based counterparts

- Replacement of lead-acid UPS systems with SCADA-ready lithium battery models

- SCADA real-time monitoring

- Replacement of obsolete PLCs

Kennewick staff will continue to roll out these upgrades across the 30 PTAGIS-managed interrogation sites over the 2021-2022 winter, apart from those sites where Separation by Code (SbyC) takes place. As of November 16, 2021, seventeen sites have been upgraded and are now collection and submitting interrogation data using M5.

The first SbyC site to be upgraded will be Lower Monumental Juvenile (LMJ). While the smolt monitoring facility is dewatered for the winter, Kennewick staff are working on platform hardware and PLC programming upgrades. Lower Monumental SbyC will be operated by M5 during 2022 and closely monitored to ensure M5 and the new PLC programming are performing to standard.

Figure 1. Replacement PLC ready to be installed at Lower Monumental dam.

Later this winter M5 will be released to the general PTAGIS community along with new utility software, called I5. I5 allows users to connect directly to transceivers (via serial or Ethernet), download stored tag detections, format the records as an M5 file and submit that file to PTAGIS for processing. It also includes features to filter out already submitted data from a buffer download, and edit values such as Antenna IDs or timestamps in case of equipment reset or other issue.

The PTAGIS Data Specification has been updated to include specifications for the M5 file, with information on how to construct an M5 file and submit it to PTAGIS using the Web API. ◉
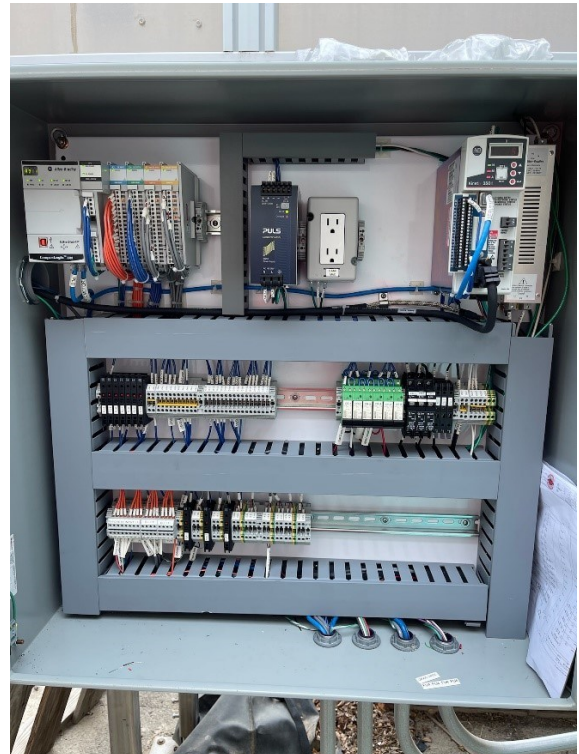
M5 and I5 Interrogation Software Coming Soon

NICOLE TANCRETO (PTAGIS Portland Office)

PTAGIS will release the next generation interrogation software to the community this winter. It is already deployed for production data collection at about half of the PTAGIS-managed interrogation sites in the Columbia basin. Staff are working to finish documentation and polishing up the user interface before the software is released for general use.

M5 can be used as a direct replacement for both M4 and MiniMon. It has been developed as two separate application executables: the M5 Host Service and the M5 Control Panel. The M5 Host Service runs as a background service running continuously to collect data and submit it to PTAGIS. The M5 Control Panel is the GUI application that allows users to interact with the host service. The M5 Control Panel can connect to the M5 Host Service from any computer accessible from the same network.
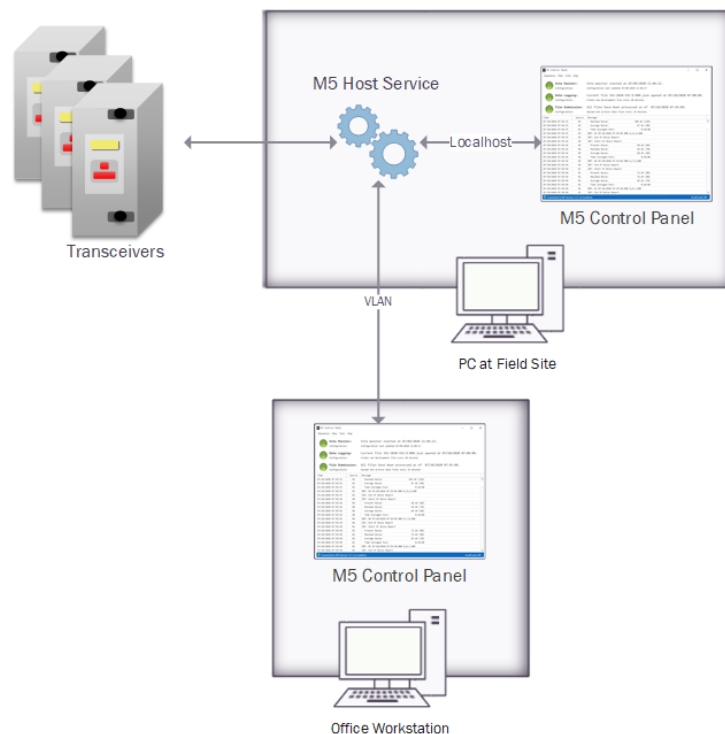
Figure 2. Conceptual diagram for M5 Host Service and M5 Control panel applications.

M5 files use the JSON file format, which is commonly used for transferring information between different computer systems but is also human-readable. The PTAGIS Data Specification has been updated with the M5 file specifications. M5 submits these files through the PTAGIS Web API, using a RESTful service, instead of the less-secure FTP that is used by MiniMon and M4.

M5 and I5 Interrogation Software Coming Soon

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M5 is currently Windows-only, but there is potential for the M5 Host Service to run on alternative low-cost, low-power platforms such as Linux on Raspberry Pi. We will evaluate this potential before the public release next year. Please contact us if you have suggestions for additional types of platforms to run M5.

Figure 3. M5 Control Panel connected to remote M5 Host Service.

For sites where a dedicated computer cannot be operated, PTAGIS is releasing new utility software called I5. I5 is a replacement for PIFF and PIFF2 and allows users to connect directly to transceivers or controllers, download observation data, review and edit the data, and then submit it to PTAGIS.

I5 supports connecting to devices using serial and Ethernet. If a remote interrogation site has networked communications available, I5 can be used to remotely connect to it and download stored observation records.

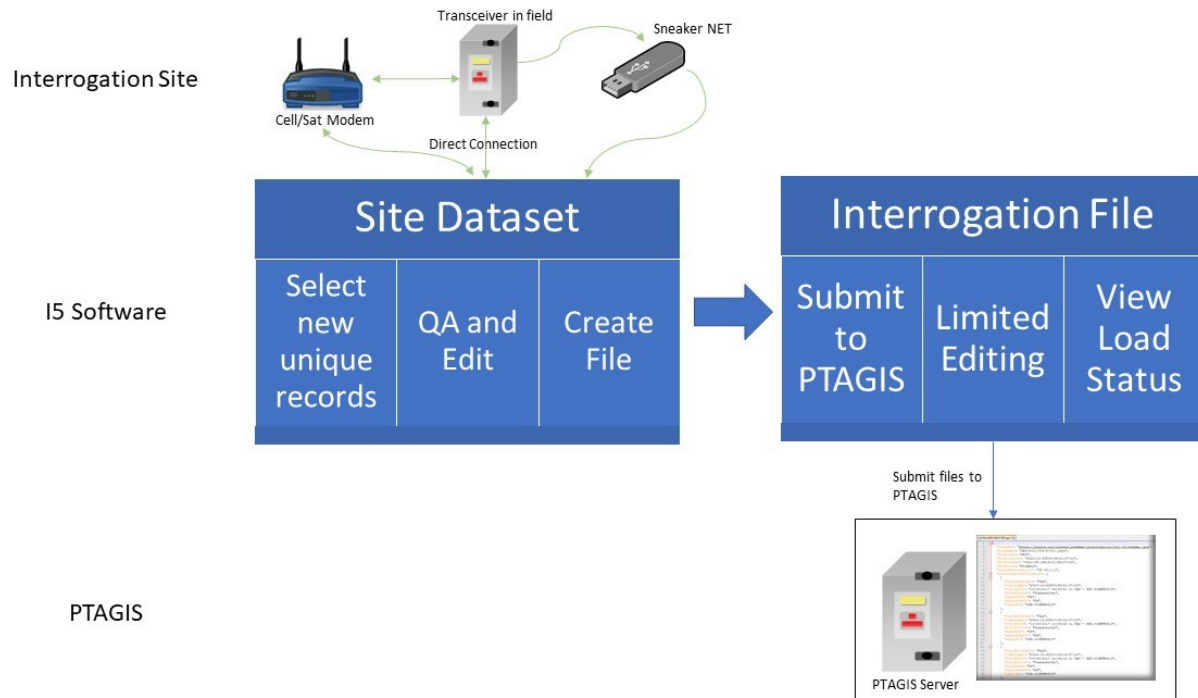# M5 and I5 Interrogation Software Coming Soon

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Figure 4. Conceptual diagram showing data flow from interrogation sites to I5 to PTAGIS.

I5 is organized around a Site Dataset, which is a container for data downloaded from one interrogation site. The Site Dataset screens out duplicate detection records and keeps track of records that have been used in previous interrogation files. This allows data stewards to download data multiple times over a satellite modem connection to make sure that all records have been received. I5 will automatically filter out duplicate records from the multiple downloads and ensure that only unique records are written to the interrogation file. It also allows data stewards to download buffers without clearing them, as I5 will keep track of previously used records and duplicate records, ensuring that only observations recorded since the previous download are used in the new file.

Data can be downloaded manually using the I5 terminal, or semi-automatically using a download script. A download script is configured by the user to connect to one or more transceivers/controllers at a site and send a series of commands to download buffers, generate noise or status reports, or set the date and time. Though I5 is not developed to run unattended, it can minimize the interaction needed to download from multiple transceivers. The resulting observation records must be reviewed and submitted manually by a person.

M5 and I5 Interrogation Software Coming Soon

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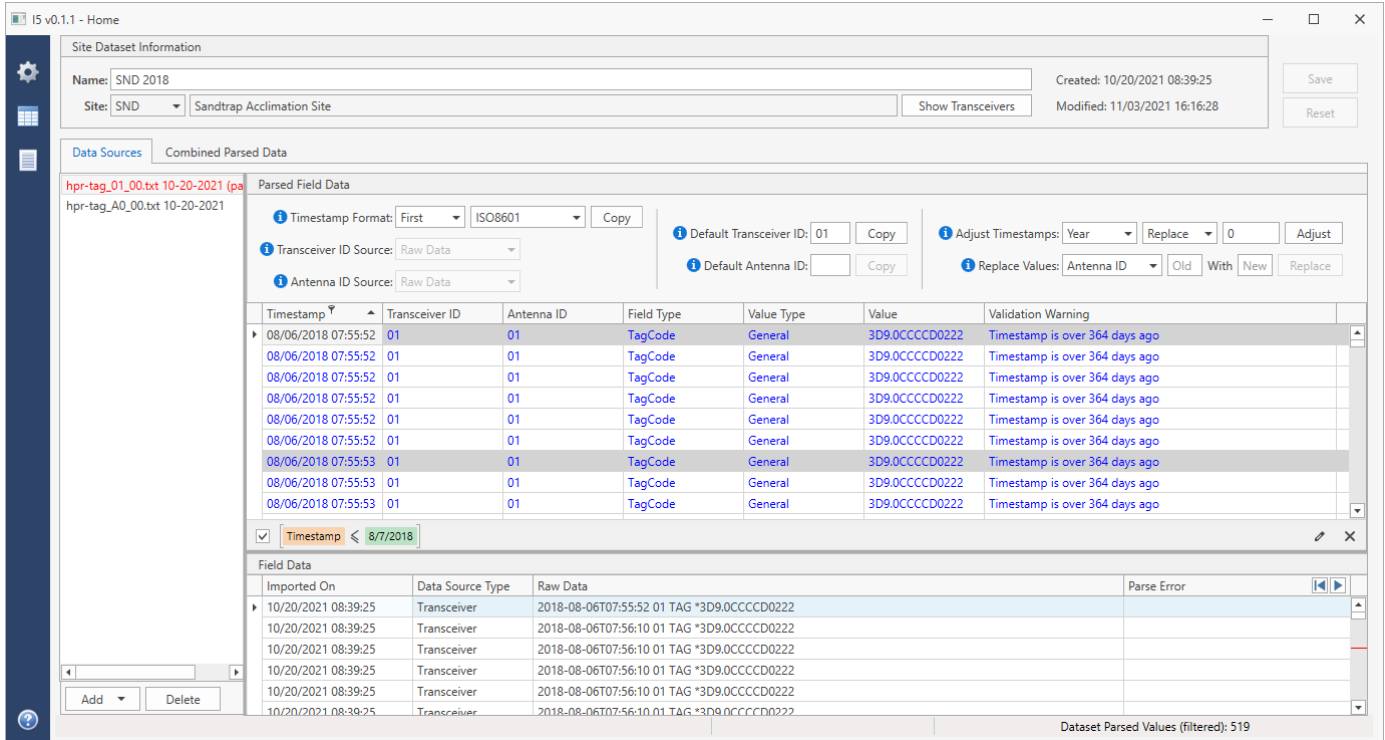
Figure 5. I5 Site Dataset view.

Interrogation Site Location Changes

NICOLE TANCRETO (PTAGIS Portland Office)

We have made changes to how interrogation site location is reported to better accommodate when interrogation sites are moved to a new location.

A small percentage of instream interrogation sites have been moved to new locations that provide better detection opportunities or protection against damage from high flows. Interrogation sites are only allowed to move within the same stream. If a site moves to a different stream, the original site is decommissioned and a new interrogation site is added for the new stream location. If a site moves less than 1 kilometer, the latitude and longitude coordinates change, but the River Kilometer (RKM) stays the same.

In the past we have treated interrogation site location as a *type 1 slowly changing dimension*, meaning that the old location value was replaced with the new location. This resulted in the new location being reported for all observation records at that site, even those that were detected at the old location.

Interrogation Site Location Changes

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As of July 27, 2021, interrogation site location will be maintained as a *type 2 slowly changing dimension*, meaning that the location of the site at the time the observation was recorded will be reported with that observation.

For example, the interrogation site on the lower Methow River (LMR) moved from its original location on August 18, 2017. The original location had an RKM of 843.003 and the new location is about 5 kilometers upstream of that, giving it an RKM of 843.008. Now that interrogation site location is being maintained as a type 2 dimension, the Site Latitude, Site Longitude and Site RKM values report the original location for all observations made before 08/17/2017 (highlighted in yellow in Figure 2) and the new location for all observations made after that date (highlighted in blue in Figure 2).

The PTAGIS sites map and interrogation site metadata page will still show the most current location, but the site description will provide general information about when and how far the site moved from its original location.

Site Code	Tag	Obs Time	Site Latitude	Site Longitude	Site RKM	Site Info Start Date	Site Info End Date
LMR	3DD.003BE1295B	5/6/2017 6:40:20 AM	48.054608	-119.928121	843.003	3/1/2009	8/18/2017
LMR	3DD.003BE1295B	5/6/2017 6:40:24 AM	48.054608	-119.928121	843.003	3/1/2009	8/18/2017
LMR	384.3B23A67794	5/6/2017 6:19:57 PM	48.054608	-119.928121	843.003	3/1/2009	8/18/2017
LMR	3DD.007796E4F5	8/18/2017 7:47:27 PM	48.074923	-119.956143	843.008	8/18/2017	
LMR	3DD.003BB8F4FD	8/18/2017 8:58:14 PM	48.074923	-119.956143	843.008	8/18/2017	
LMR	3DD.0077967917	8/18/2017 9:05:38 PM	48.074923	-119.956143	843.008	8/18/2017	

Figure 6. PTAGIS report showing interrogation site location changes for LMR. ↻

P4 Tutorial Video Series

NICOLE TANCRETO (PTAGIS Portland Office)

Over the past few years we have worked on a series of video tutorials covering P4, the tagging software developed by PTAGIS. The series is made up of seventeen separate videos, ranging in length from 4 to 17 minutes and totaling over two hours of running time.

When you first load the P4 tutorials page, the videos are sorted in the recommended viewing order if you are brand new to the software and want to start at the beginning. Each video in the list includes a brief description and video duration in minutes and seconds. All videos include closed captions, which are enabled by default.

P4 Tutorial Video Series

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These video tutorials are intended to provide information to help those new to P4 get started with configuring and operating the software. P4 also includes an integrated help system which provides more details about how certain features work. If there are any topics that you would like to see covered in a tutorial video, please let us know.

Figure 7. Screenshot of the P4 Overview tutorial video.

PTAGIS Field Operations & Maintenance Summary for 2021

Scott Livingston (PTAGIS Kennewick Office)

Figure 8. Bonneville Dam Powerhouse 1.

O&M Summary

The PSMFC PTAGIS Kennewick office is responsible for ensuring the PIT tag detection systems in mainstem juvenile fish bypass facilities and adult fish ladders are functioning at peak performance while those passage systems are in operation. The Kennewick office also monitors and cooperatively maintains *Separation by Code (SbyC)* hardware at nine of those facilities, allowing researchers to selectively separate PIT-tagged fish as they move through passage facilities. The Kennewick staff continues to provide technical assistance for multiple other projects involving the installation or development of new detection systems, such as the new spillway system at Lower Granite dam.

Juvenile fish bypass facilities (JFF) on the Snake and Columbia Rivers began operating in March and April. Detection efficiency rates for 2021 were maintained at or above previous year's detection efficiency rates of greater than 99%. The single antenna in the Bonneville Corner Collector (BCC) is the exception to this with an estimated efficiency rate in the seventies based on NOAA live fish testing using 12mm tags.

PTAGIS Field Operations & Maintenance Summary for 2021

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BCC detected 98,230 PIT tags during 2021. *SbyC diversion gate efficiency rates* remained high for 2021 with all diversion gates running above 97%. *Adult ladder detection efficiency (ALE)* also remained high in dam-to-dam comparisons with all sites maintaining an approximate 98 to 99% detection efficiency over a 12-month rolling report period.

Slide Gate and SbyC Upgrade at Lower Monumental

With support of the USACE site biologists and site maintenance personnel at three of the Snake River dams, PTAGIS Kennewick staff began research and development to replace the legacy pneumatic cylinders currently used to actuate the slide diversion gates with a more reliable and consistent actuator. PTAGIS proposed the use of an electric motor and actuator which is digitally controlled by a Programmable Logic Controller (PLC). This allows for precise positioning and control of the slide gates and will drastically reduce the daily and annual maintenance required by the current pneumatic cylinders.

The electric actuators operating the Lower Monumental JFF A and B diversion gates continue to be maintenance free. There were no reported instances of failure or inefficient operation during the 2021 out-migration period. After the fish facility was de-watered, the PLC control panel was completely re-wired and the legacy PLC was permanently removed from service. This PLC was replaced with the latest Allen-Bradley Compact Logics series PLC which is 10 times faster than the previous. Another component of this upgrade included the replacement of the Sample and Diversion gate control HMI's. These HMI's have higher resolution screens and are more compatible with the new control system PLC.

Figure 9. New electric cylinder at LJM A-B side gate.

PTAGIS Field Operations & Maintenance Summary for 2021
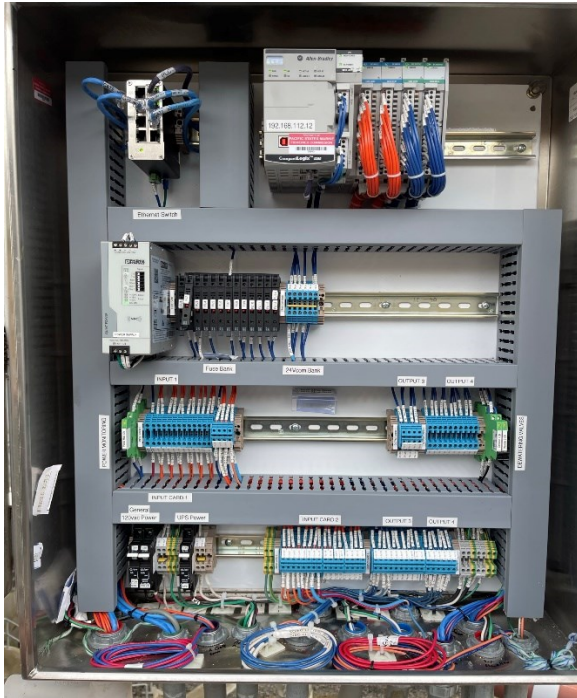
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Figure 10. LMJ upgraded PLC controls.

Figure 11. LMJ separator booth high resolution HMI.

Lower Granite Spillway Project

On April 3, 2021, the spill gates were opened just after midnight operating under the Flex Spill pattern schedule. The GRS PIT tag detection system continues to detect PIT tags at an exceptional rate. All 11 antennas exceeded detection rate expectations throughout the duration of the spill. The spill season ended on September 1st, although the spillway is periodically opened and closed for various reasons. As of November 11, 2021, the GRS interrogation site has detected nearly 252,000 PIT tags.

After the annual spill concluded on November 15, 2021, the entire GRS transceiver system was upgraded to a new synchronization schema. In the event of transceiver failure, the new design will allow a transceiver to be replaced without disrupting the operation of other transceivers. This will allow for continuous operation and PIT tag detection if one of the transceivers fails and needs to be replaced.

A work barge access platform was designed by USACE to provide safe and secure access to the OGEE surface for inspection and maintenance of the GRS antennas embedded in the surface. All or most of the platform components have been procured and are awaiting assembly. The platform should be ready by the end of the 2022 spill season.

Kennewick staff continue to provide daily monitoring of the GRS PIT tag system performance and supporting infrastructure.

PTAGIS Field Operations & Maintenance Summary for 2021

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Bonneville Dam Cascade Island Fish Ladder (BO2)

Kennewick staff installed two antennas earlier this year to monitor the upstream migrant tunnel (UMT) and two antennas at the counting window of the Cascade Island Fish Ladder. These antennas will replace the original weir orifice antennas in the lower part of the ladder as BO2 next year. Staff monitored the performance of the new antennas and compared detections to the original antennas to ensure that coverage will be maintained when the new antennas and data collection platform is finalized early next year. Bonneville project personnel completed their scope of the project in August and PTAGIS staff will complete the installation and bring the new BO2 online no later than March 1, 2022.

Internet Upgrades

A new internet service provider was sourced to replace the unreliable and expensive DLS internet service at the Snake River interrogation sites. The microwave internet service can meet the high availability requirements of PTAGIS at a lower cost than the previous DSL service. Internet service for interrogation sites at Lower Granite Dam (GRA, GRJ and GRS), Lower Monumental Dam (LMJ) and Little Goose (GOJ) are now provided by the microwave internet service. It is also in consideration for other PTAGIS sites.

Some of the more remote PTAGIS-managed sites have been converted to cellular data internet connectivity. Cellular data has provided reliable internet access at a fraction of the cost of the previous DSL and wireless services. Sites converted to cellular data include the Yakama Nation acclimation sites (CFJ and ESJ) and Roza Dam (ROZ), with Prosser Dam (PRO) coming soon. ◎

Acoustic+PIT Tagged Steelhead Coming Again to Your Basin in 2022!

JEFF FRYER (CRITFC), IAN TATTAM (ODFW) AND LOGAN BRESHEARS (Oregon State University)

In 2020, ODFW, in cooperation with CRITFC, OWEB, and BPA, conducted an adult steelhead acoustic tagging project at Bonneville Dam using Vemco V13 acoustic tags with another tagging project to be conducted in 2022. The goal was to monitor adult overshoot at the mouth of the John Day River by focusing tagging efforts on individuals previously PIT tagged as juveniles in the John Day basin. However, the Bonneville Dam Adult Fish Facility location and facility procedures meant that only about 2% of returning adults from such a program can be trapped using the PTAGIS sort by code system. Therefore, ODFW was forced to acoustic tag steelhead with similar run timing as well as other physical characteristics typical of John Day steelhead in previous migration years. Targeted adults were A-run (<78 cm), tall dorsal, non-ad clipped steelhead migrating between mid-July and early September. A total of 200 steelhead were acoustic tagged via gastric implant, with the acoustic tags set at a one-year lifespan. Fifty of these steelhead had acoustic tags that included temperature plus depth sensors. All steelhead were PIT tagged and genetically sampled so stock could be determined post-season.

Acoustic+PIT Tagged Steelhead Coming Again to Your Basin in 2022!

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Acoustic receivers were primarily deployed around the mouth of the John Day River, with additional receivers being deployed in the mainstem Columbia River between Bonneville and Priest Rapids Dams (including the mouths of major tributaries and cold-water refuges on both the Oregon and Washington shores). A small set of receivers were also deployed further upstream in the John Day basin.

With the acoustic receiver network in the Mid-Columbia area, we found that most John Day spawning steelhead which overshot the John Day River did not enter the river on the first pass upstream, instead displaying a nomadic 'wandering' migration very distinct from the linear migrations they exhibited in Bonneville and The Dalles pools. Wandering behavior, for some John Day spawning steelhead included several trips up and downstream through the entire John Day pool. This occurred well after peak stream temperatures and doesn't appear to represent behavioral thermoregulation. For steelhead that did enter the John Day during summer, migration downstream to the Deschutes River for thermal refuge appeared more prevalent than migration upstream. For instance, one tagged steelhead overshot the John Day mouth on its initial upstream migration, turned around near Arlington (between John Day and McNary Dams), and then entered the John Day River for a couple days mid-summer, prior to leaving for a 74 day stint in the Deschutes, and then returning to the John Day in fall. Overall, summer usage of the Deschutes River appeared to be more prevalent among John Day spawning steelhead than the tagged population at large.

As was expected, numerous acoustic tagged steelhead have been detected in other locations throughout the Columbia River basin other than the John Day Basin (Figure and Table). Based on PIT tag detections from 198 steelhead, 22.8% were last detected at Bonneville, The Dalles, or John Day Dam (all of which are enroute to the John Day River) or in the John Day River. Those last detected in the Snake Basin comprised 40.4% of the PIT-tagged steelhead compared to 7.1% last detected in the Yakima, and 9.6% last detected above Priest Rapids Dam. A total of 11.6% were last detected by PIT tag arrays installed in juvenile bypass systems, suggesting that these are kelt moving downstream. This estimated percentage of kelt increases to at least 21.5% if acoustic data indicating downstream movement in Bonneville-McNary pools is included.

These stray steelhead offer the opportunity for researchers in other basins to deploy VR2Ws to learn more about steelhead in their respective basin. Chelan PUD and Douglas PUD, who maintain VR2W receiver networks between Rock Island and Wells dams, have tracked these fish between Rock Island and Chief Joseph dams.

If you are interested in learning more about acoustic tagged steelhead and the VR2W settings to detect them, please contact Logan Breshears (logan.breshears@oregonstate.edu), Ian Tattam (Ian.A.Tattam@odfw.oregon.gov), or Jeff Fryer (fryj@critfc.org). Also, as mentioned earlier, we will be conducting another ODFW steelhead study in 2022 with the goal of tagging $\geq$250 wild A steelhead at Bonneville; as well as, funding permitting, a sockeye acoustic tagging study. If there are other agencies and researchers interested in participating with tags, funding, or unused VR2W receivers, please get in touch with us.

Acoustic+PIT Tagged Steelhead Coming Again to Your Basin in 2022!

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Given the VR2W network we hope to have deployed in 2022 and the personnel already doing the work, we could inexpensively expand the reach of this acoustic project. Like participating in PTAGIS does with PIT tags, we could all work together on building a bigger VR2W network for 2022 and increase acoustic tagging to learn more about migrating adult salmon and steelhead.

Site of Last Detection	N	Percentage
Bonneville Dam	20	10.1%
Clearwater Basin	3	1.5%
Deschutes Basin	5	2.5%
Entiat Basin	5	2.5%
Grande Ronde Basin	12	6.1%
Hood Basin	7	3.5%
Ice Harbor Dam	2	1.0%
Imnaha Basin	5	2.5%
John Day Dam	4	2.0%
John Day River Basin	9	4.5%
Klickitat Basin	4	2.0%
Lemhi Basin	2	1.0%
Little Goose Dam	2	1.0%
Lochsa Basin	3	1.5%
Lower Granite Dam	40	20.2%
Lower Monumental Dam	1	0.5%
McNary Dam	17	8.6%
Methow Basin	6	3.0%
Okanogan Basin	2	1.0%
Salmon Basin	4	2.0%
Selway Basin	2	1.0%
Tucannon Basin	4	2.0%
Umatilla Basin	6	3.0%
Walla Walla Basin	6	3.0%
Wallowa Basin	4	2.0%
Wells Dam Basin	5	2.5%
Wenatchee Basin	3	1.5%
Wind Basin	1	0.5%
Yakima Basin	14	7.1%

Table 2.   Number and percentage of acoustic tagged steelhead by site of last PIT tag detection site as of November 1, 2021 for steelhead tagged at Bonneville Dam by ODFW in 2020. ◉

In-Stream Monitoring PIT Tag System Improves Detection Probability of Chinook Salmon in Valley Creek, Idaho

HEIDEN BLISS (Biomark Inc.)

A three-decade decline in stocks of salmon and steelhead in the Columbia River basin led to listing these fish under the Endangered Species Act in the late 1990's and prompted regional fish and wildlife programs to develop strategies to reverse the trend.
(source: https://www.webapps.nwfsc.noaa.gov/assets/4/726_04062016_125108_Achord.et.al.2011-AFS-Symp-76.pdf, pg.1.)

As a result, in the early 2000's Northwest Fisheries Science Center, National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service collaborated on an in-stream PIT-tag monitoring system to improve data quality for better recovery planning of wild spring/summer Chinook salmon (*Oncorhynchus tshawytscha*).

Figure 12. PIT Tag Antennas from first install on trailer (right), on ground (left) new PIT Tag Antennas.

This year, 19 years after the initial install, Biomark, a Merck Animal Health company, worked in collaboration with Bonneville Power Administration (BPA), NOAA Fisheries, Idaho Department of Fish and Game (IDFG) and the Nez Perce Tribe to update the existing system.

In-Stream Monitoring PIT Tag System Improves Detection Probability of Chinook Salmon in Valley Creek, Idaho

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The team at Biomark replaced the initial antenna monitoring systems at Valley Creek and upgraded the existing FS1001M-MUX with a limited 9" read-range, to the Biomark IS1001 Multiplexing Transceiver System (MTS) with an estimated 27"-32" read-range.

Figure 13. Aerial view of new PIT tag antennas on opposite sides of the bridge.

The IS1001 MTS consists of an IS1001 Master Controller and up to 12 IS1001 readers. The Master Controller acts as the command, control and data collection center for the PIT-tag monitoring system. It directs each IS1001 to activate its antenna and send stored tag IDs and diagnostic information. Power and communication transfers between IS1001 and Master Controller are completed through a Controller Area Network (CAN) bus cable. At Valley Creek, there are six antennas connected to the IS1001 MTS.

Valley Creek is one of the furthest upstream PIT-tag antenna array from saltwater in the Salmon and Snake river basins, which is 950 miles from the Pacific Ocean. Adult salmon detected have traveled through four dams in the Columbia River and four dams in the Snake River on their migration to their natal stream. The latest upgrade is projected to improve adult detection probability, while significantly improving juvenile detections, so that agencies can have better data to further help in the recovery of Chinook salmon.

Figure 14. Aerial view of IS1001 MTS Enclosure.