Columbia Basin PIT Tag Information System (1990-080-00)

2018 Annual Report

BPA Project # 1990-080-00

Report covers work performed under BPA contract #(s) 78040 REL 1

Report completed under BPA contract #(s) 78040 REL 12

1/1/2018 - 12/31/2018

John Tenney, Don Warf, Nicole Tancreto

Pacific States Marine Fisheries Commission, Portland, OR, 97202

Report Created September 2019

Table of Contents

Executive Summary

The **Columbia Basin PIT Tag Information System (PTAGIS)** is a coordination and data management project of the Pacific States Marine Fisheries Commission (PSMFC). PTAGIS develops and maintains software used to collect and contribute Passive Integrated Transponder (PIT) tag data; manages and makes those data available for download and reporting via the PTAGIS website; and operates and maintains large scale PIT tag detection sites throughout the Columbia Basin. This project is an important prerequisite component of all PIT tag research conducted for the Bonneville Power Administration (BPA) Fish and Wildlife Program.

PTAGIS develops and maintains software for entering/collecting both tagging and detection data. Tagging data is collected when fish are first marked with PIT tags or recaptured after having been previously PIT-tagged. Detection data is collected when PIT-tagged fish pass through automated antenna systems, called interrogation sites, installed in facilities or streams. Four new updates to the P4 tagging software were released in 2018, and the legacy P3 tagging software was retired at the end of the year. Scoping and planning for the next-generation interrogation field software began in 2018, along with an effort to enhance and expand interrogation site metadata.

Researchers from 34 organizations contributed just over 2 million fish marked with a PIT tag to the PTAGIS database in 2018 with a cumulative total of over 47 million records since 1987. The 298 interrogation sites contributing data to PTAGIS detected 897 thousand uniquely tagged fish this year. One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites; 16.8 million detections were reported to PTAGIS in 2018 totaling 231 million detections since 1987. To give additional scope to the overall data management efforts in 2018, PTAGIS processed 544 thousand data files with 146 million database rows updated or inserted; 556 users executed 510 thousand queries resulting in 8.8 billion rows of data returned.

PTAGIS Operations and Maintenance (O&M) staff, based out of Kennewick, WA, provide direct O&M of 29 large scale interrogation sites throughout the Columbia Basin, primarily at main stem dam locations. This involves daily monitoring and regular onsite visits to maintain the detection equipment that provides the majority of 231 million observation events available in the database system. PTAGIS also maintains the Separation by Code systems at nine locations, which can be used by researchers to selectively segregate individual PIT-tagged fish from other tagged and non-tagged fish. The detection and diversion efficiencies at these sites remained very high throughout the year.

PTAGIS O&M staff participate in the design, planning, and installation of new interrogation sites and detection technology. Installation of the communications equipment at John Day Dam was completed in early 2018, and near real-time data collection and automated data file submissions began in February 2018. Three antennas were installed on the newly constructed full flow pipe at Lower Granite Dam (*Figure 1*) and were operational prior to water up for the season. Antennas were installed in the lamprey passage structures at Bonneville Dam and integrated into existing interrogation sites (*Figure 2*).

Figure 1. Installation of three antenna systems on new full-flow bypass at Lower Granite Dam

Figure 2. Additional antennas added for a lamprey bypass system at Bradford Island Ladder of Bonneville Dam

Staff once again participated in the Lower Granite Spillway Detection Project. Installation was postponed until fall/winter 2019, but weekly design and coordination meetings continued throughout the year to finalize technical details. Staff actively participates in these meetings, providing technical expertise and guidance along with conceptual drawings (*Figure 3)* for aspects of the PIT tag portion of the project.
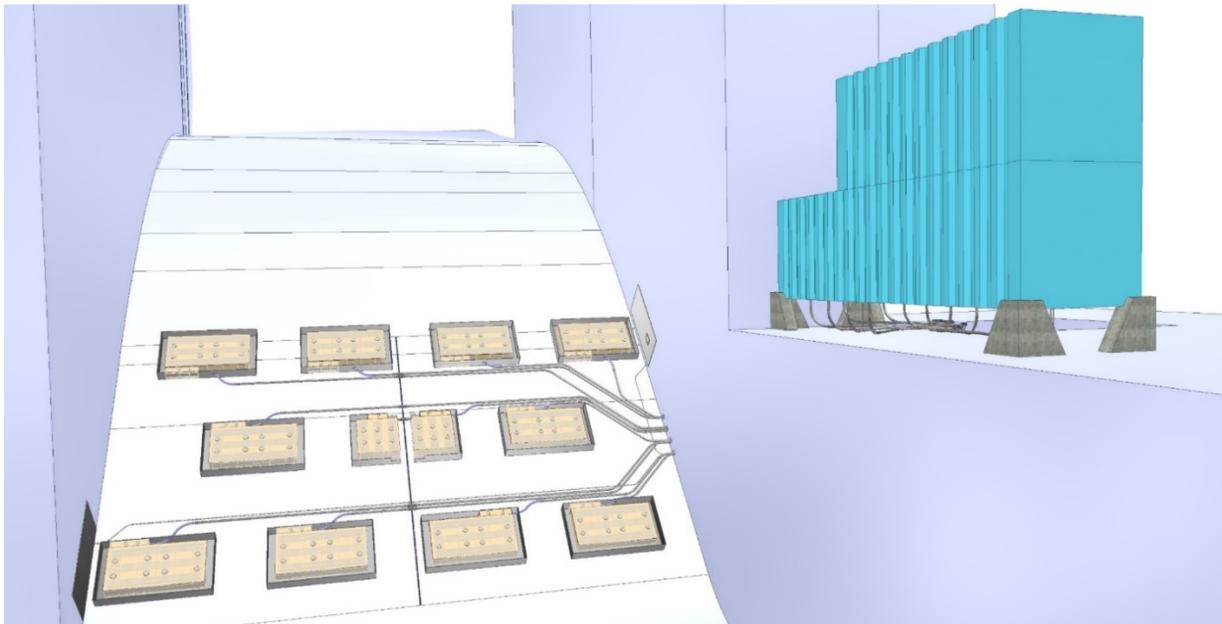
Figure 3. Conceptual drawing of antenna layout and containers for electronic equipment at the spillway of Lower Granite Dam

The Automated PIT Tag Test System (APTTS), a custom system to test PIT tags purchased by BPA and distributed by PTAGIS before shipping them to researchers, was upgraded this year. To further increase tag testing efficiency, a new tag sorting system consisting of custom hardware and software was developed that allows up to 30 vials of 100 tags each to be combined and processed through the APTTS for QA testing. Upon completion, the system sorts the 3,000 combined tags back into their original vials.

PTAGIS O&M staff continued to work with lamprey researchers to provide alternatives to the use of full-duplex tags in systems that could be significantly impacted by a lamprey attaching to an antenna. After the successful test of dual-detection mode at the The Dalles Dam fish ladder in 2017, staff enabled dual-detection mode at all adult ladder interrogation sites managed by PTAGIS, except for John Day Dam. This will allow researchers planning to release lamprey below fish ladders to use half-duplex tags, which do not interfere with the full-duplex tags used in salmonids.

In June, a PTAGIS user experienced a safety issue with an older model portable PIT tag reader. PTAGIS issued an announcement to the community warning of the issue and worked with BPA to determine how many BPA-funded projects need to replace the old model readers. PTAGIS worked with the manufacturer to resolve outstanding performance issues before BPA procured and distributed replacements. PTAGIS also implemented a reader loan program that allows BPA-funded projects to borrow modern PIT tag reader models.

PTAGIS staff worked with the PIT Tag Steering Committee (PTSC) to publish the PTAGIS Data Specification. The specification provides data field definitions and requirements; detailed file descriptions; and a general introduction to PTAGIS data types and tools.

PTAGIS participated in the Independent Science Review Panel (ISRP) project review at the end of 2018, with final presentations to the panel being completed in January 2019. The ISRP indicated that PTAGIS meets the scientific review criteria.

In 2018, PTAGIS continued to provide high quality data collection, validation, management, and reporting of PIT tag data for the Columbia River basin. Hundreds of users from dozens of fisheries organizations utilized PTAGIS on a daily basis to collect, contribute, and retrieve PIT tag data for salmonid and other fish species of interest in the region.

Background

The Passive Integrated Transponder (PIT) tag is an electronic tag typically measuring 9 to 12 mm long and can be coded with one of 35 billion unique codes. The tag can be automatically detected and decoded in situ – eliminating the need to sacrifice, anesthetize, handle, or restrain fish during data retrieval. The PIT tag was developed in 1987 as a research and management tool for monitoring the movement of juvenile and adult salmonids in the Columbia River Basin. Detecting/recording devices strategically located within collection facilities at hydroelectric dams can automatically recognize fish injected with this tag.

When a fish is tagged, all related information about the tagging event and the individual fish is captured and entered into field software and uploaded to a central database by the organization responsible for the tagging. This information includes the unique PIT tag ID, tagging location, organization responsible for the tagging, species, run, rear type, weight, length, and condition. Once tagged, the fish is then released into the river system and can be identified and monitored indefinitely.

As the tagged fish migrates, it has the opportunity to pass through electronic interrogation antennas located in juvenile bypass facilities at many of the dams on the Columbia and Snake rivers as well as smaller instream detection sites in tributary locations. This electronic equipment automatically detects the PIT tag code, and records the time and location of detection. This information is automatically submitted to the central database where it is joined with the previously submitted tagging information.

When the tagged adult fish returns to the Columbia River system to spawn, the fish is again automatically detected at the permanent adult detection sites as it travels up-river. These data detections are associated with the previous information about that individual fish in the database and provides additional data on its history and migration.

The PIT tag Separation by Code (SbyC) process allows researchers to target individual tagged fish and separate them from the general population as they move through juvenile and adult fish passage facilities that are equipped with PIT tag actuated gates.

The Columbia Basin PIT Tag Information System (PTAGIS) was implemented in 1991 to manage the collection, correlation, and exchange of Columbia Basin PIT tag data. PTAGIS encompasses dedicated data collection software, a centralized relational database management system, and standardized data descriptions and reporting processes. In 2002, the scope of the Columbia Basin PTAGIS program expanded to include entries for resident and semi-anadromous stocks of rainbow and cutthroat trout, bull trout, and lamprey, sturgeon and other species.

Staff responsible for managing the data systems are located at the PSMFC headquarters in Portland, OR. A second field operations office is centrally located in Kennewick where staff designs, installs, and maintains the equipment and software needed for automated PIT tag detection and SbyC diversion. A PIT Tag Steering Committee (PTSC) provides program oversight, data standardization and technical coordination for the research community. Additional information about this program is available at www.ptagis.org.

Data Management

This section provides a summary of the program's overarching deliverable for 2018 and further describes work elements of the PTAGIS project related to collection, management and web delivery of all PTAGIS data.

Researchers contributed 2.09 million fish marked with a PIT tag to the PTAGIS database in 2018 with a cumulative 47 million records (*Figure 4.*). These records were collected and submitted to PTAGIS by 34 organizations as they marked and released fish at 378 site locations throughout the Columbia Basin. The composition of marked species was similar to previous years (*Figure 5.*).

Number of Fish Marked with PIT Tags
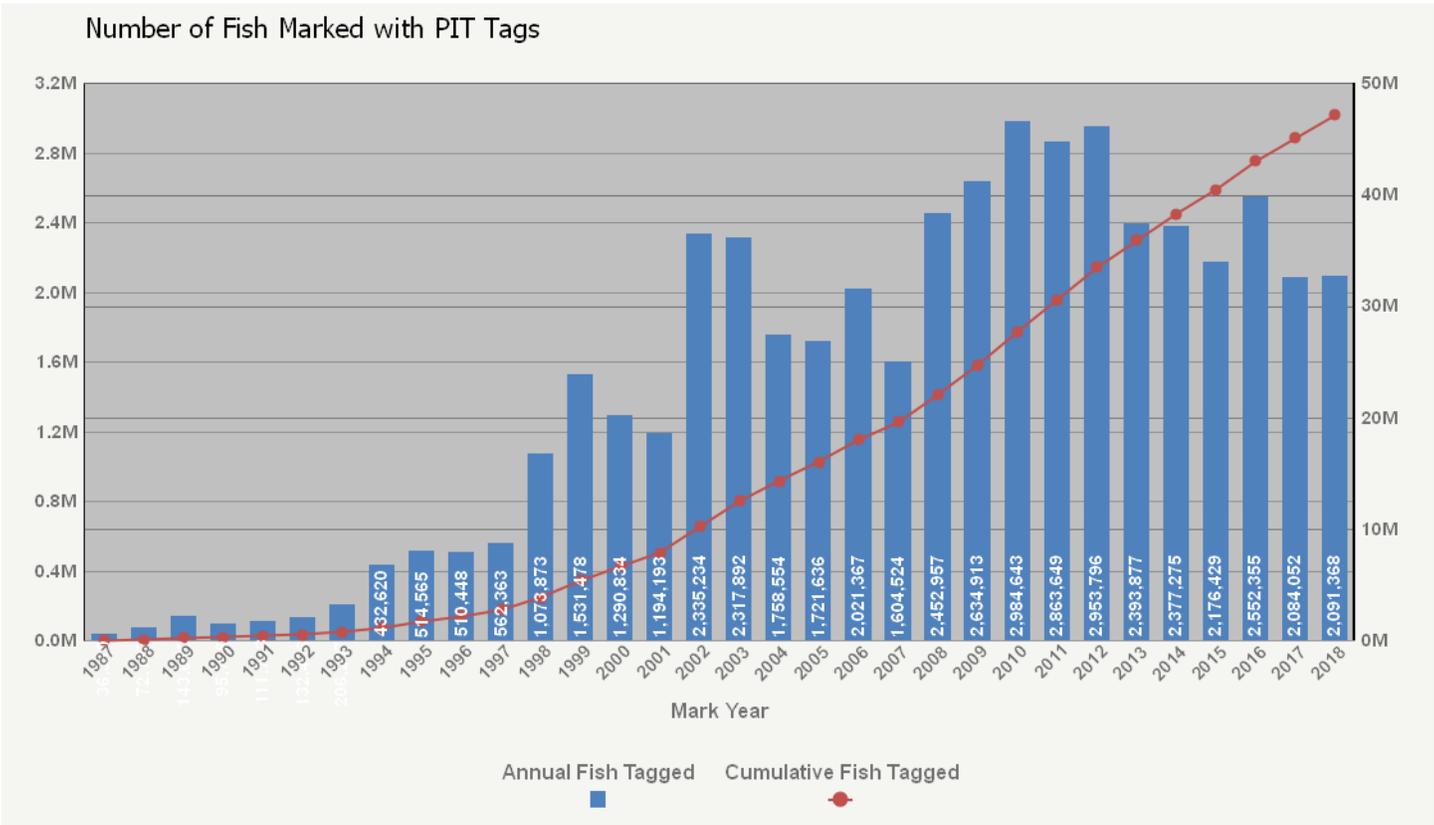
Figure 4. Annual and cumulative numbers of marked fish

Number of Fish Marked with PIT Tags, by Species
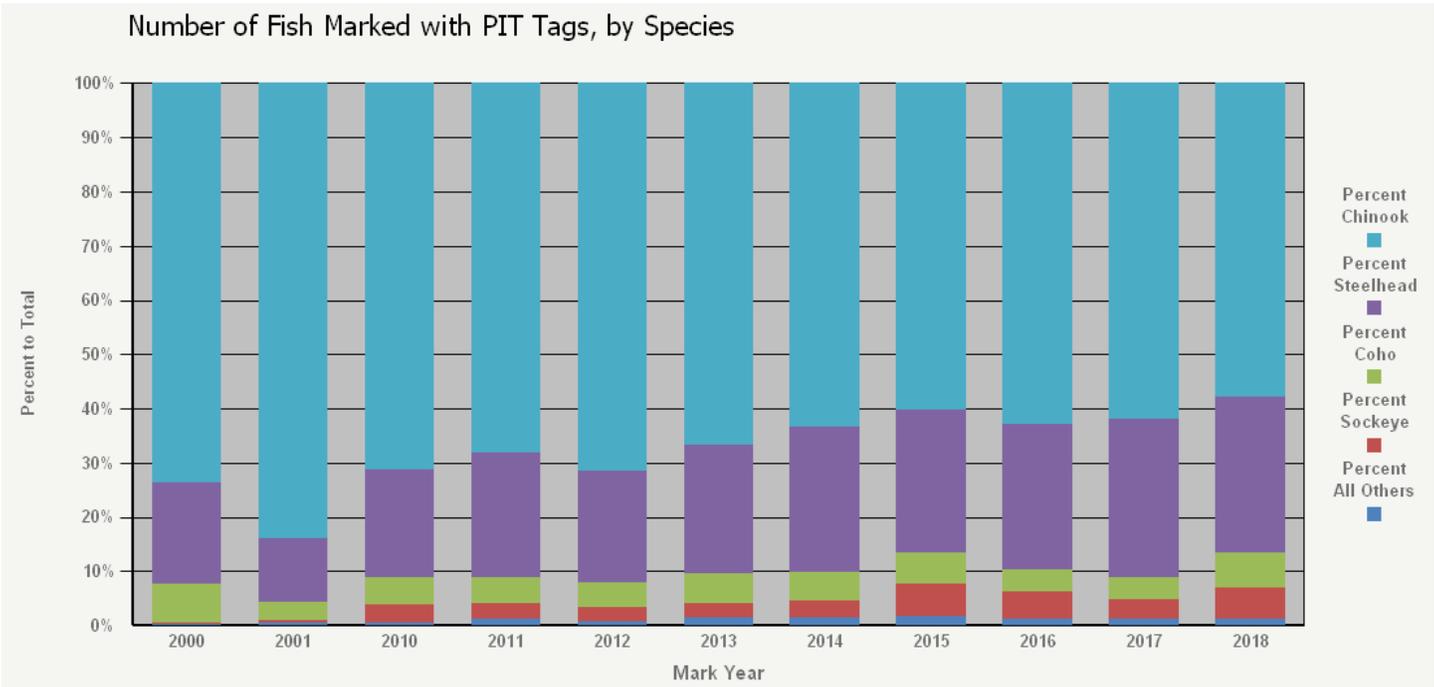
Figure 5. Number of marked fish by species

The number of marked fish reported as *recaptured and re-released* was just over 70,000. Currently there are 24 thousand recovery/mortality events contributed in 2018; however, this number will increase as the reporting of mortality/recovery events typically occur in outgoing years.

The 298 interrogation sites contributing data to PTAGIS detected 897 thousand uniquely tagged fish this year (*Figure 6*). One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites; 16.8 million detections were reported to PTAGIS in 2018 totaling 231 million detections since 1987 (*Figure 7*).
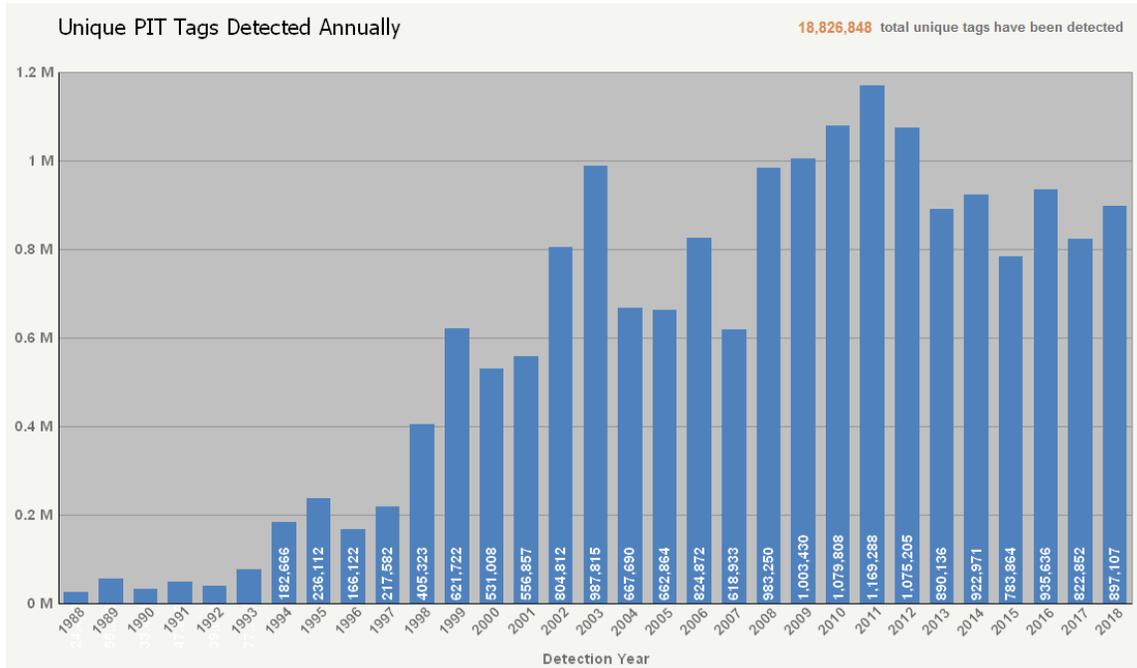
Figure 6. *Unique detections contributed annually*
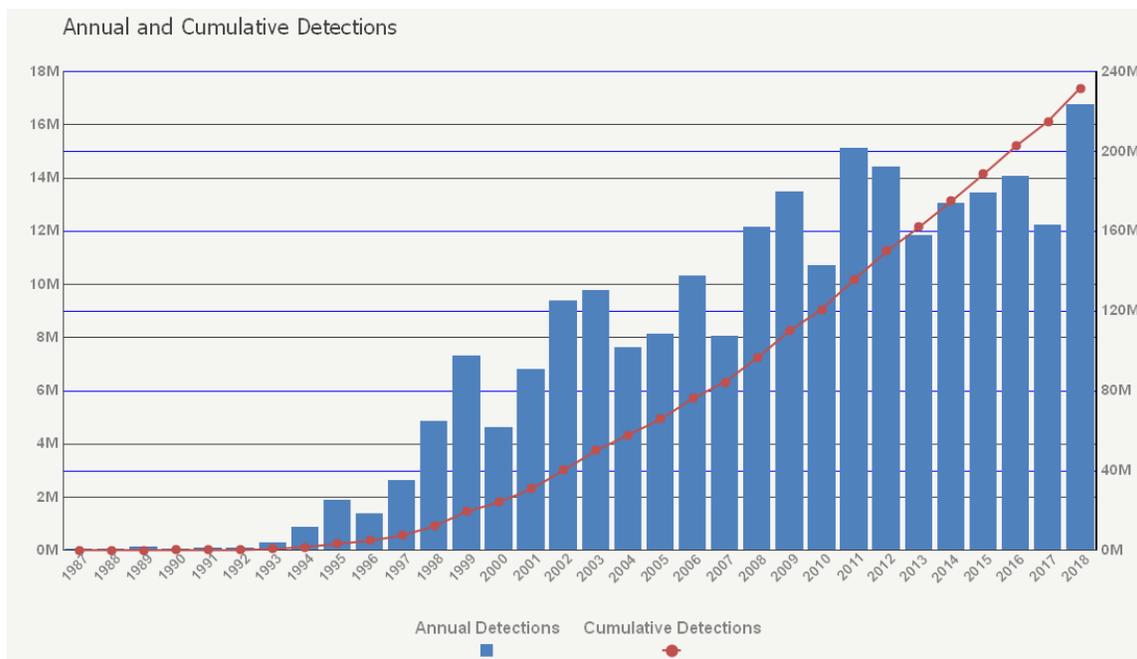
Figure 7. *Annual and cumulative detections*

To give additional scope to the overall data management efforts in 2018: 556 PTAGIS users executed 487 thousand queries resulting in 8.3 billion rows of data returned. Those 556 users are grouped by their respective organizations in *Table 1.*

| Organization	No. Users
Other	78
Washington Dept. of Fish and Wildlife	53
Idaho Dept. of Fish and Game	46
Oregon Dept. of Fish and Wildlife	46
U.S. Fish and Wildlife Service	45
Nez Perce Tribe	29
University of Idaho	28
NOAA Fisheries	25
Pacific States Marine Fisheries Commission	22
Biomark	22
Yakama Nation	19
U.S. Army Corps of Engineers	15
Columbia River Inter-Tribal Fish Commission	14
Shoshone-Bannock Tribes	14
Colville Confederated Tribes	11
Confed. Tribes of the Umatilla Indian Reser.	11
Confed. Tribes of the Warm Springs Reser.	9
University of Washington	9
U.S. Geological Survey	9
Pacific Northwest National Laboratory	8
Grant County Public Utility District	5
Idaho Power Company	5
Chelan County Public Utility District	5
Okanagan Nation Alliance	4
Fish Passage Center	3
Portland General Electric	3
Douglas County Public Utility District No. 1	3
Midas Gold Stibnite	3
Wild Fish Conservancy	3
Real Time Research, Inc.	3
Quantitative Consultants, Inc.	2
Bureau of Reclamation	1
Snake River Salmon Recovery Board	1
Oregon Cooperative Fish and Wildlife Research Unit	1
Spokane Tribe of Indians	1
TOTAL	556

Table 1. *PTAGIS data access in 2018 summarized by organization*

9

D: 160. Operate, Maintain and Enhance the PTAGIS System

This objective delivers high performance\availability systems for the collection and dissemination of near-real-time PIT tag data. Managed by PTAGIS staff in the Portland, OR office, the following three subsystems provide a logical grouping of this objective:

- Field Data Collection Systems
- Server Data Management Systems
- Web Data Management Systems

The following subsections provide background, efforts and plans related to each subsystem that comprise the whole of this objective.

Field Data Collection Systems Background

PTAGIS develops and maintains three basic types of field data collection systems described in *Table 1.* This software is freely available to the research community to download and install on any modern Window-based PC.

System Type	Software	Description
Tagging Software	P3, P4	Tagging software captures MRR data by interfacing with tag readers and other devices to provide an ergonomic and highly customizable data entry system to support various usages. Users can identify and correct issues with fish in-hand using robust validation and alerting. Authorized users can easily submit their datasets to PTAGIS using the software.
Interrogation Software	MiniMon, M4, M5	Interrogation software combined with communication networks provide unattended operation and continuous recording of observation data in real-time. The central database processes hourly uploads of observation data from hundreds of sites operating this software. Interrogation software provides automatic diversion of target fish to examination tanks or for transportation – called separation by code (SbyC).
Utility Software	Patch Manager, PIFF, Peripheral Emulator, Tag Inventory Manager, Tag Sorter Utility	PTAGIS provides utility software to import, standardize and submit raw observation data collected from the internal storage of a tag reader or from a data logger system operating at a small-scale interrogation site. PTAGIS also develops and supports internal software systems to perform data management, QA/QC as well as performance regression testing of the interrogation software systems.

Table 2. Types of PTAGIS field data collection systems

2018 Accomplishments in Field Data Collection Software

P4 Tagging Software Upgrades

That latest version of P4, v1.22, was released on September 23, 2018. There has been a total of 12 releases of P4 since it was first released two years ago. With each new version, multiple bugs have been fixed and community-requested features have been implemented. Versions earlier than 1.15 have multiple bugs and deprecated features that can cause issues when using P4; therefore, versions 1.10-1.14 will no longer be supported after 2019. If researchers have one of these older versions installed after 2019, it will continue to function but they cannot submit data to PTAGIS without upgrading their installation of P4.

PTAGIS released four updates of the P4 tagging software in 2018, which included the following enhancements:

- *Acoustic Tag*, *Radio Tag*, *Coded-Wire Tag*, *Scale ID* and *Genetic ID* fields can be set using an input device
- Various enhancements to the importing of data and configuration, including the ability to apply tag actions to imported data
- Enhanced querying features to support additional project QA requirements
- Added *History* panel to *Data Entry* – providing a tabular view of all records in the current session

- Changed *Dot-out Records from Tag List* to *Update Records from Tag List* (*Figure 8)*. This tool now can update all records that match the tag codes in the selected Tag Lists using a Repeating Value. Matching records can still be dotted out using this tool.
- Added support for external GPS unit to automatically enter lat/long coordinates during data entry
- *Download PIT Tags from Clip Files* directly from PTAGIS API into a P4 Tag List (Internet connection required) based upon a tag code or vial identifier
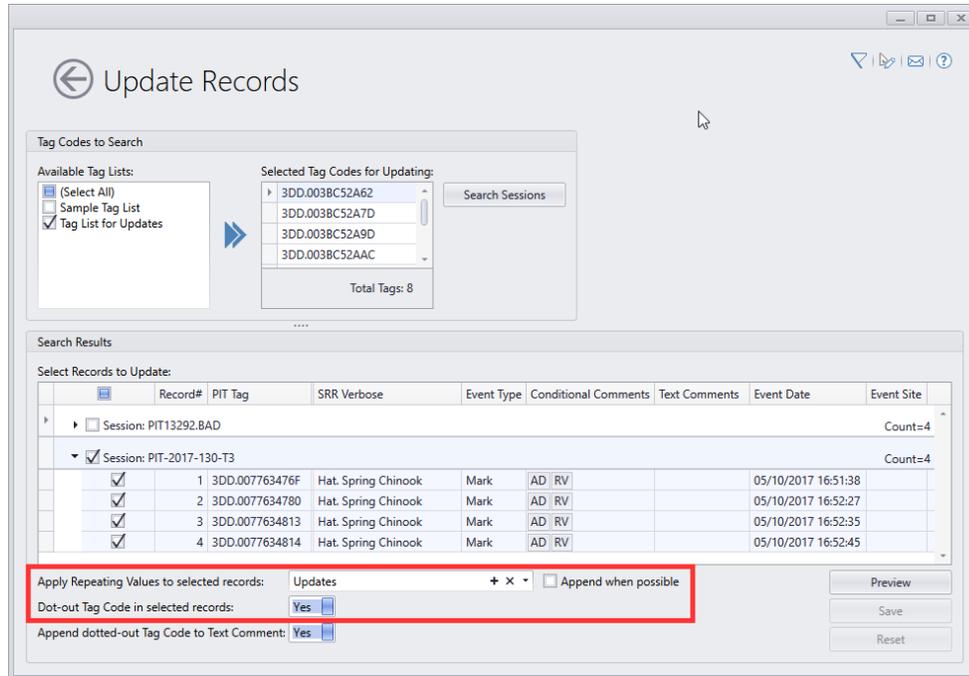
Figure 8. Update records using repeating comment based upon on or more selected tag lists

Refer to article *P4 Update and Expiration of Old Versions* article in October 2018 PTAGIS Newsletter[1] for more information.

P3 Tagging Software Retirement

In coordination with the PTSC, made multiple announcements to the community about the planned retirement of legacy P3 tagging software at the end of 2018. New features, improved performance, and an extended MRR dataset compelled most researchers to upgrade from P3 to P4.

As of January 1, 2019:

- PTAGIS will no longer accept tagging files in the P3 format
- PTAGIS will no longer accept tagging files via email submission
- Users may continue to use P3 but will need to import resulting files into P4 for submission to PTAGIS
- PTAGIS will no longer provide technical support for P3

M4 Interrogation Software Upgrade

Two releases of M4 were required this year to support firmware changes on transceivers operating at PTAGIS interrogation sites. Both releases required extensive evaluation using equipment in the Kennewick lab before deploying

---

[1] October 2018 PTAGIS Newsletter: https://www.ptagis.org/docs/default-source/ptagis-newsletter-archive/vol-16-no-2-october-2018.pdf?sfvrsn=4

to PTAGIS interrogation sites. The software tool used to create an installer for M4 was still using a deprecated technology from InstallShield that staff have moved away from due to poor technical support and performance. Upgrading the M4 installation to new installation technology for this release was debated but due to the effort and other competing priorities, the current InstallShield technology was used again for these releases. Later in the year, InstallShield software tool installed on staff development computers was made unusable by the vendor in an effort to force renewal of product support at a significant cost (which was illegal in terms of the EULA agreement for this software). Any future releases of M4 will require upgrading the installation technology using another product than InstallShield.

M5 Interrogation Software Development

When completed, M5 software will replace M4 and also provide a more suitable replacement for legacy MiniMon software that some agencies still rely upon to collect and submit data at their instream interrogation sites. Progress was made this year in terms of server-side requirement analysis, prototyping, and agency coordination to support the submission of a new JSON-formatted interrogation file. M5 and related agency systems (*e.g.* Biomark's BioLogic System; USFW, ODFW, and NOAA's custom data collection systems) will eventually create this file for the submission of all future interrogation data to PTAGIS; the related coordination efforts are described in other sections of this document. Development of M5 interrogation software began in December 2018 and will continue through 2019.

Utility Software Upgrades and Development

A complete rewrite of the Tag Sorter Utility (TSU) software used internally to promote quality assurance of tags distributed by PTAGIS was completed this year in tandem with upgrades to the automation hardware. This version of TSU can recover from occasional network and system faults so that sorting a batch of tags can continue uninterrupted throughout the night, maintaining QA schedule. TSU can be adapted in a future release to capture QA metrics for each tag to be joined with observation data in the database; the rationale of which is discussed in the *PIT Tag Distribution and Quality Assurance* section of this document.

As an action from the PTSC, staff developed a prototype system based upon field equipment assembled in the Kennewick lab to further evaluate efforts to support direct acquisition of interrogation data from remote instream interrogation sites (operated by various agencies) via cell and satellite modem. The scope of this prototype was limited to commonly supported transceivers (the Biomark QuBE was not evaluated as the system was nearing end-of-life based upon discussions with the manufacturer). Results from rigorous evaluation of this prototype system:

- Technically feasible for PTAGIS to directly acquire data remotely via satellite/cell modems
- Concerns raised that PTAGIS will be competing with a private company already funded via FWP to provide this service for some agency instream interrogation sites contributing data to PTAGIS
- O&M of numerous and disparate instream interrogation sites operated by various agencies are outside the scope of PTAGIS program
- Considerable efforts to identify and correct data quality issues resulting from lack of site stewardship and/or antiquated field hardware would fall upon PTAGIS staff and further constrain program resources
- PTAGIS could extend features of existing PIFF 2 field software to mitigate some of the data collection and programmatic issues raised by agencies that resulted in this action
- Agency interrogation site data stewards could perform QA and apply corrections to field data using an enhanced PIFF 2 solution before submitting to PTAGIS (similar workflow as other PTAGIS field software)

Three upgrades to the PTAGIS Interrogation File Formatter (PIFF 2) utility software were released this year. This software converts raw interrogation (aka observation) data output from various PIT tag readers into a formatted file that can be submitted to the PTAGIS database. The upgrades provided additional data correction features as well as bug fixes.

Additional utility software was developed to easily correct semi-frequent formatting issues in the XML-based interrogation files related to communication line faults. The next-generation interrogation file format and server-side processing will be designed to better handle these formatting issues and automate the recovery of data messages by detecting and removing garbage characters within a file.

2019 Plans
Staff will continue to enhance P4, M4, PIFF 2 and internal utility software as needed. Continue the development of M5 interrogation software as part of the overall upgrade of the PTAGIS interrogation dataset.

As an action from PTSC and resulting prototype evaluation (described in the previous section), staff will continue to investigate expanding the features of PIFF 2 utility software to improve support for data management efforts at instream interrogation sites, such as:

- Extend data/metadata collection and submission using latest interrogation file format and server processing
- Interface directly with transceivers to download buffer data; detect any duplicated data
- Integrating satellite/cell modem communication from field office to remote site
- Extending data validation and related QA features

Server Data Management Systems
This portion of the objective addresses the continuous administration and development of a central repository for all PTAGIS data and related metadata. The central repository consists of relational and dimensional database systems that extract, transform, load and collate MRR and observation (interrogation) data submitted via various field data collection software systems developed by PTAGIS and other agencies. The deliverable of this objective is a highly functioning/available, cost-effective, and extensible data management server and related systems.

Ongoing tasks related to this portion of the objective include:

- Maintenance and enhancement of system components that support the automated extraction, transformation and loading (ETL) of field data into the central transactional and dimensional databases in near real-time with data validation and integrity verification
- Tuning automated alerting system notifying data stewards of anomalous events such as data validation failures or when remote interrogation sites fail to upload on schedule
- System administration, tuning, backup and capacity planning following industrial best practices
- Maintain processing of periodic data file extracts to support large scale data users (FPC, DART)
- Provide extended support (outside office hours) to maintain the high-availability goals of the program

2018 Accomplishments
The database server hardware and software upgrades initiated in 2017 were completed in 2018 with all production databases migrated to the new system. The previous server hardware, now out-of-warranty, was transitioned for development and staging purposes. The upgrade was done without impacting researchers or the continuity of the PTAGIS dataset.

Continued refinement of the ETL features to improve processing of MRR and tag distribution data. Database backup procedures were evaluated and optimized in coordination with IT staff using the Commission's NetVault system.

As part of the overall interrogation dataset upgrade, began the design and implementation of new interrogation data loading (IDL) features to support new interrogation data file format, data types, validation, and alerting.

Performed general system administration on production, staging and development servers hosting database and related ETL systems.

2019 Plans

Continue development of new IDL process to support the overall interrogation dataset upgrade and deploy into production without affecting data collection or research. This includes reimplementation of the robust data parsing strategies currently performed within M4 interrogation software in the field. With this logic centralized on the server, expansion of the interrogation dataset can be made more effectively along with responsive updates to support new transceiver, firmware and other field devices.

Continue to learn and leverage cloud services and solutions to maintain program goals for high-availability, security, performance and costs. Optimize the scheduling of maintenance to apply security and other patches to critical servers more frequently per latest industry standards without affecting data collection or retrieval.

Web Data Management Systems

The PTAGIS website (www.ptagis.org) provides online access to PTAGIS data, metadata, content and services to the public. Users can browse most of the online resources anonymously, but others needing identification and authorization require the user to create an account and log in to the system. The deliverable for this portion of the objective is a highly functioning/available, cost-effective, and extensible web server and reporting systems providing public access to PTAGIS data and related resources.

Key tasks related to this portion of the objective include:

- Development and refinement of online functionality such as:
  - Online request/approval workflow services, such as PIT tag distribution for all FWP
  - Content management
  - Community outreach features to support technical coordination
  - Web API interface to allow other automated systems to consume PTAGIS data and metadata
- Development and refinement of reports, dashboards and other related infrastructure for public research and internal O&M activities
- System administration, tuning, and capacity planning following best practices in the industry
- Interoperation with server data management systems and field data collection systems
- Support high-availability and security goals of the program

2018 Accomplishments

In 2018, the PTAGIS website had 50 thousand visits from 10 thousand unique visitors and met the program goals for performance and availability.

Development of a new PTAGIS website continued in 2018 while concurrently supporting the production website. The content-related features provided by the integrated content-management system of the production website had to be custom coded in the new site, such as document/image management, full-text searching, and page navigation. Analytical features were integrated to help understand how users will interact with the new site to promote better

experiences. Using the latest technology and standards, pages of the website will be secure, support commonly used web browsers, and respond appropriately to viewing on smaller devices, such as tablets and smartphones. The website was logically divided into two parts similar to a banking application: the public site and the dashboard. The public site promotes program objectives to the *casual user* with a programmatic overview, data specifications, documentation, quick access to summary datasets and metadata, and the ability to download field software. For more advanced users, the dashboard requires a login to access services to request new validation codes, register data collection sites, and request the distribution of tags. It is also where users go to generate complex reports from millions of records in the database to support their research.

Many of the features of the new public site (*Figure 9)* were implemented in 2018 and will continue into 2019. A subcontractor with expertise in HTML, Bootstrap, and graphic design was used to shape the layout, format content, and code the responsiveness of the public website. Portions of the dashboard were also implemented such as those with request-approve-implement workflows to support adding new validation codes, registering MRR sites, configuring SbyC actions, and distributing PIT tags to FWPs.
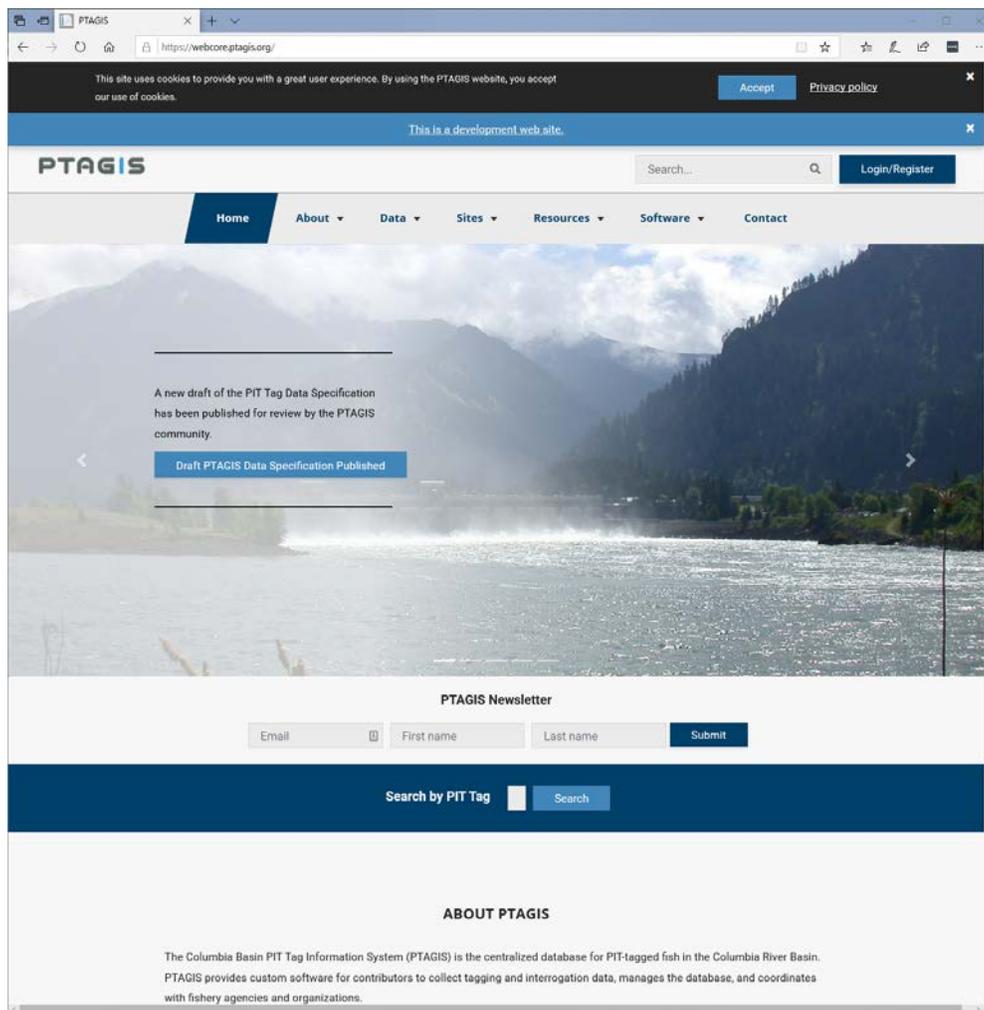
**Figure 9.** *Homepage of the new PTAGIS website currently under development*

PTAGIS has an API to allow systems internal and external to PTAGIS to interact with data and metadata following industrial standards. Enhance authorized data submission, access to metadata, and notification alerting for the production PTAGIS API (Figure 10). As part of the effort to update the interrogation dataset, a development API was

produced to evaluate submission features for a new JSON-formatted interrogation file with some of the agencies that contribute data to PTAGIS. The coordination efforts of this task are also described in this document.
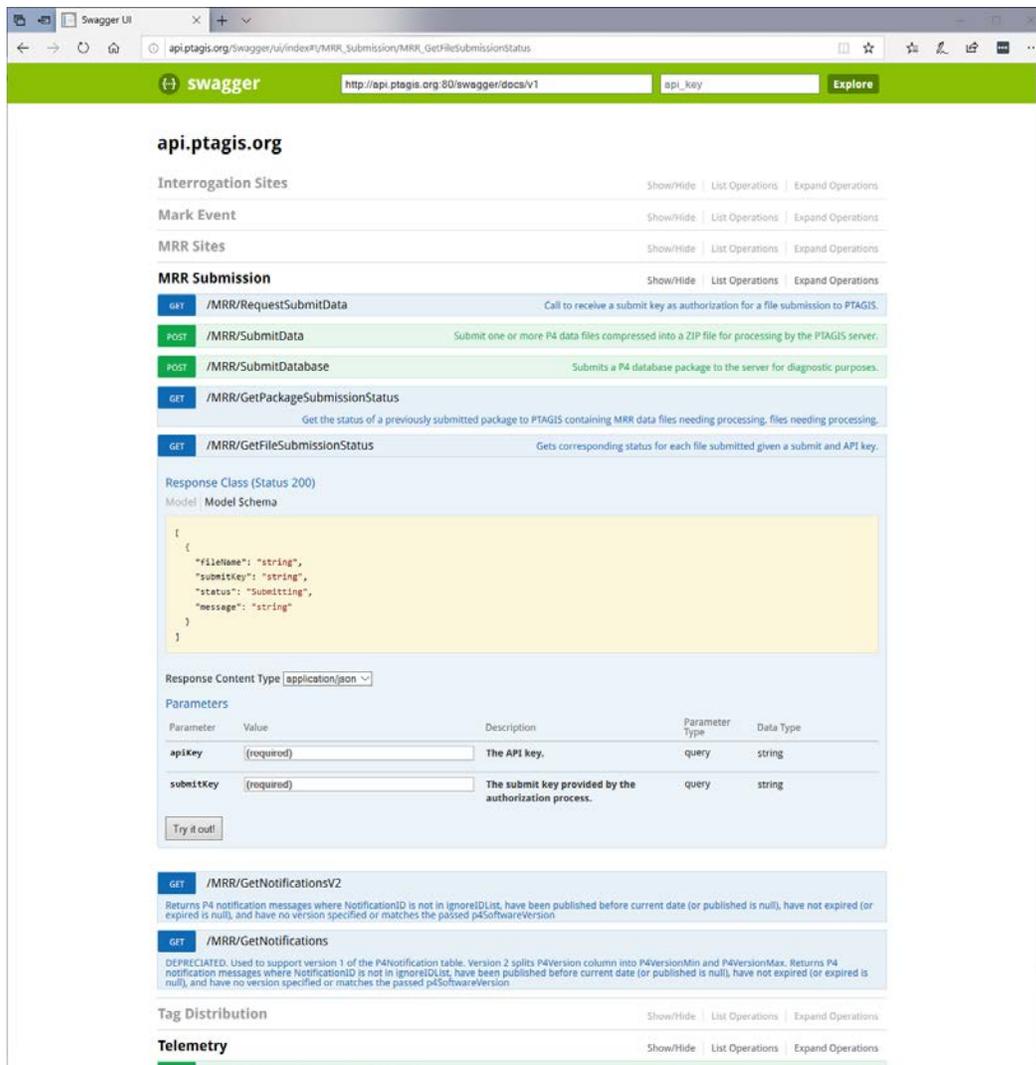
Figure 10. Production PTAGIS API

Further refinement was added to the PTAGIS reporting system by taking advantage of new features of the underlying MicroStrategy system upgraded to version 10 in 2017. Additional data attributes were added to the reporting system which required modifications to the database as well. The Cumulative Efficiency Analysis (CEA) O&M report compares detection efficiencies between groupings of transceivers at each interrogation site managed by PTAGIS. This report was expanded to include species groupings: salmonids, lamprey and other species. A new O&M report was created to identify misreads and 'unknown tags' (detections where the tag code doesn't match up within a well-known list of tag masks).

Performed system administration on production, staging and development servers hosting website and reporting systems.

2019 Plans
Continue development of new PTAGIS website and related web API with goal of releasing in 2019 or early 2020. Continue to learn and leverage cloud services and solutions to maintain program goals for high-availability, security, performance and costs. Refine reporting features in coordination with interrogation dataset enhancements, including

the design of new dimensional data model. Optimize the scheduling of maintenance to apply security and other patches to critical servers more frequently per latest industry standards without affecting data collection or retrieval.

E: 160. Operate and Maintain the Separation by Code Database

Before PTAGIS implements a Separation by Code (SbyC) project, the researcher must coordinate with all applicable agency contacts. The necessary coordination varies from project to project and facility to facility. If the project involves only routing PIT-tagged fish toward collection for transportation, minimal coordination is necessary. If the project involves diverting fish into holding tanks, much more coordination is necessary.

PTAGIS is responsible for the coordination and implementation of SbyC requests in the following nine fish passage structures at six mainstream FCRPS:

- Lower Granite Juvenile Bypass (GRJ)
- Lower Granite Adult Fish Trap (GRA)
- Little Goose Juvenile Bypass (GOJ)
- Lower Monumental Juvenile Bypass (LMJ)
- Ice Harbor Dam South Ladder (ICH)
- McNary Juvenile Bypass (MCJ)
- John Day Juvenile Bypass (JDJ)
- Bonneville PH2 Juvenile Bypass (B2J)
- Bonneville Adult Fish Facility (BO3)

The agencies and researchers whom request SbyC vary year-to-year. The focal species are typically salmonids.

The coordination portion of this objective requires various researchers to enter request metadata for each SbyC project into the database using an online service implemented on the PTAGIS website. The requester must notify appropriate contacts at the COE, NOAA and Smolt Monitoring Program which are referenced on the PTAGIS website. If the planned SbyC projects targets another researcher's PIT-tagged fish, the requester must contact and obtain the permission of that researcher. The online request service provides a checklist for these coordination actions with automated workflow so that the Fish Passage Advisory Council (FPAC) can approve each request based upon the metadata provided.

Once approved, PTAGIS staff implements the SbyC request by updating the local database of the interrogation software operating at the target facility, often more than once for each request. This is a time-sensitive process and requests often overlap each other at the same passage structure of an interrogation site. In some cases, the database containing the target fish must be computed and updated by staff in near real-time. Internal O&M reports are used to verify implementation. Additional ad-hoc coordination with researchers and facility staff is necessary to resolve issues and to ensure a successful implementation.

Implemented requests are permanently stored as metadata in the PTAGIS database and are available on the website for public review. Researchers can use past requests to quickly populate new SbyC requests that are on-going.

2018 Accomplishments

In 2018, 19 projects requested 60 target groups (action codes) of fish totaling 832 thousand tags to be separated. *Table 3* provides a summary of these projects.

Agency	Project Title	Target Tags
FPC	Comparative Survival Study 2018	477,987
NOAA	Migration timing and parr-to-smolt estimated survival for wild Snake River spring/summer Chinook salmon smolts	21,111
WDFW	2017 Lyons Ferry Hatchery Complex -Snake River, Steelhead Tributary Releases	27,981
USFWS	Evaluation of Warm Springs NFH Brood Year 2016 smolts	14,972
IDFG	SY2018 Lochsa River Adult Radio Telemetry	5
IDFG	SY2018 Potlatch River wild Steelhead Radio-telemetry	3
IDFG	Travel timing and habitat use of Pahsimeroi Fish Hatchery summer Chinook Salmon - Implications as they pertain to upper Salmon River salmon fisheries.	44,692
WDFW	Performance Evaluation of PIT tagged subyearling Chinook released at Lyons Ferry Hatchery 2017	20,000
WDFW	Performance Evaluation of PIT tagged yearling Chinook released at Lyons Ferry Hatchery 2017	30,000
PNL	Post-Construction Evaluation of the Upgraded Juvenile Bypass System at Lower Granite Dam	1,478
NPT	Nez Perce Tribe 2018 Separation by Code Request	10,174
NOAA	Transportation and survival research	47,088
NOAA	Investigating the origin and migration patterns of bull trout encountered at Lower Granite Dam	10
IDFG	Monitoring Upper Salmon River A-run Steelhead Reared in Circular Tanks	15,026
ODFW	Wallowa and Imnaha Stock Steelhead Smolt Monitoring and Evaluation	24,000
IDFG	Monitoring and evaluation of BY2016 Chinook Salmon smolts released from Idaho hatcheries in the Clearwater and Salmon River basins.	95,236
NPT	Adult Coho Salmon acquisition at Lower Granite Adult Trap through Separation by Code to acquire adult broodstock	28
IDFG	Adult Fall Chinook acquisition at Lower Granite Adult Trap through Separation by Code to acquire adult broodstock for Lyons Ferry and Nez Perce Tribal Hatchery	330
IDFG	SY2018 Dworshak Hatchery Steelhead Radio telemetry	15
	Total Target Tags	**832,448**

Table 3. Separation by Code request summary for 2018

2019 Plans

Continue processing SbyC Requests in a similar manner as this year.

Interrogation Site System O&M and Installation

PTAGIS has a complete field operations office that designs, installs, and maintains the equipment and software needed for automated PIT tag detection, including systems for enabling individual fish segregation, examinations and relocation (SbyC). This section provides additional background on these activities and further describes the work efforts as defined in the statement of work portion of the BPA contract.

An overwhelming majority of the 231 million observation records contributed to the PTAGIS system have come from large-scale interrogation sites located at Federal Columbia River Power Systems (FCRPS) projects on the Columbia and

Snake rivers (*Figure 11*). PTAGIS staff operate and maintain the electronic detection systems that collect this information under a *Memorandum of Understanding (*MOU)[2] between BPA and COE. Staff performing these tasks work out of a centrally located office in Kennewick, WA.
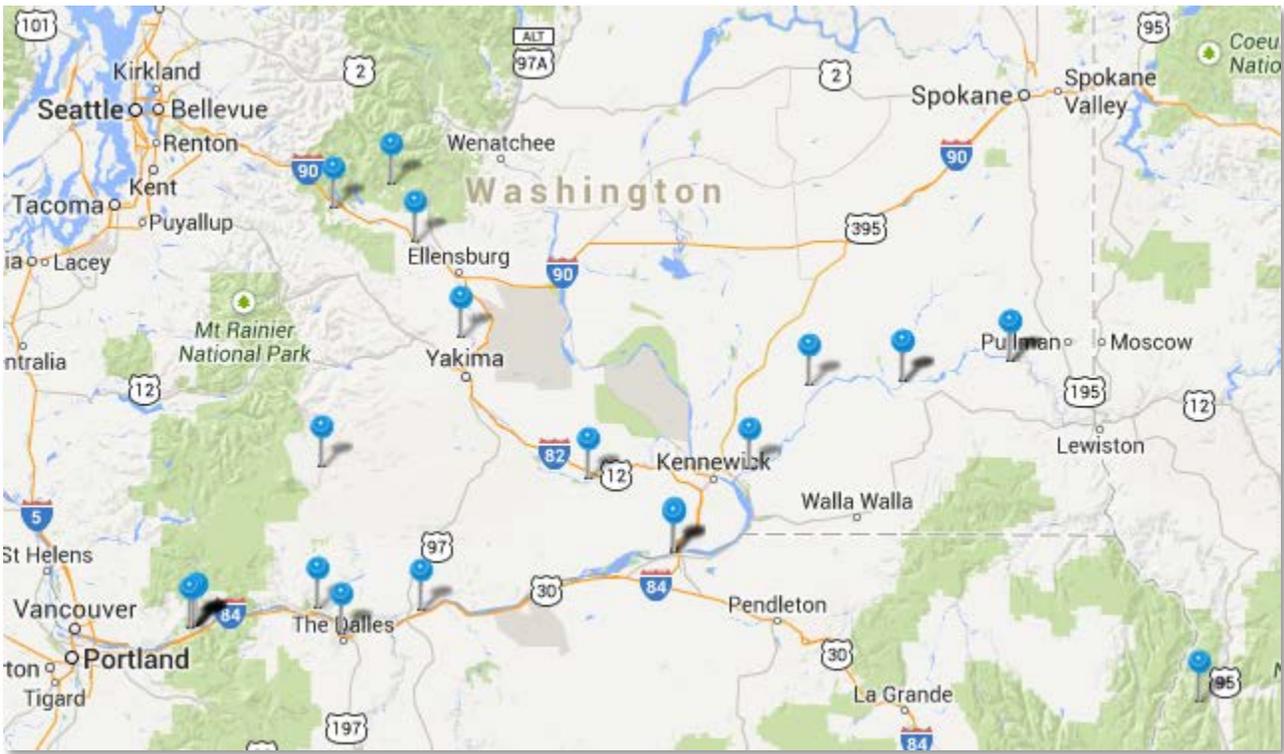

Figure 11. Map of large-scale interrogation sites maintained by PTAGIS

F: 70. Support Separation by Code Systems

The SbyC system is composed of fishways or flumes, diversion gates of all types (slide gates, rotational gates, side to side gates), air cylinders, solenoids, Programmable Logic Controllers (PLC), serial and Ethernet interfaces to PTAGIS data collection software, server-side system diagnostics and more. This work element relates to mandatory efforts to operate and maintain the systems and controls necessary to actuate the gates based upon SbyC database lookup information.

During the migration season, PTAGIS field systems personnel inspect and test SbyC pneumatic, electrical, and mechanical components at each facility on a weekly basis. During these site visits, PTAGIS staff coordinate with COE facility biologists and other researchers at the site. PTAGIS is fully responsible for the design, installation, operations and maintenance of the SbyC electrical control equipment and infrastructure to support this on-going process. The SbyC diversion gates are directly incorporated into complex passage fish structures and any malfunction or failure of the SbyC equipment can result in catastrophic consequences for smolts and adult fish routed through these facilities.

Detectors located downstream of the PIT tag diversion gates audit the path taken by tagged fish passing through those gates. The Diversion Gate Efficiency (DGE) system automatically computes the rate at which individual tagged fish are correctly routed through the diversion and facility sub-sample gates at those facilities. The instantaneous and cumulative year-to-date efficiencies are refreshed in near real-time as new detection data are received into the PTAGIS

---

[2] MOU between BPA and COE defining roles for installing and maintaining PIT tag infrastructure:
http://www.ptagis.org/docs/default-source/ptagis-program-documents/pit-mou.pdf?sfvrsn=6

database. Staff review those efficiencies from a Web-accessible DGE report (*Fig. 12)* to verify that, for each gate, the SbyC system issues the correct instructions to divert or ignore PIT-tagged fish, and that the gate operates properly to divert the targeted tags. A reported drop in the instantaneous efficiency is usually indicative of a mechanical problem at that gate. Having been alerted to the problem through the DGE report, PTAGIS staff can respond to and resolve the issue before the gate fails.

2018 Accomplishments

The diversion gate efficiencies at each SbyC site remain high due to PTAGIS and COE in-year and off-season maintenance programs (*Figure 12*).

Diversion Gate Efficiency Summary
({Divert Time} (Value) Between 1/1/2018 12:00:00 AM and 12/31/2018 11:59:59 PM)

B2J - Bonneville PH2 Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
B2J	SBYC SEPARATOR GATE	24,602	24,560	37	99.8%

Last Processed at 9/12/2019 10:15:00 AM

GOJ - Little Goose Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
	A-SEPARATOR GATE	57,486	56,440	991	98.3%
GOJ	B-SEPARATOR GATE	69,966	68,551	1,312	98.1%
	DIVERSION SBYC GATE	68,046	67,961	0	100.0%

Last Processed at 9/12/2019 10:15:01 AM

GRJ - Lower Granite Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
	A-SEPARATOR GATE	97,600	95,553	1,866	98.1%
	B-SEPARATOR GATE	52,835	51,517	1,209	97.7%
GRJ	DIVERSION / SBYC GATE	59,648	59,285	261	99.6%
	RCWY-10 GATE	72,094	70,855	1,124	98.4%
	SBYC GATE	1,663	0	0	

Last Processed at 9/12/2019 10:15:01 AM

JDJ - John Day Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
JDJ	SBYC GATE	0	0	0	0.0%
	SBYC SEPARATOR GATE	44,596	44,468	118	99.7%

Last Processed at 9/12/2019 10:15:01 AM

LMJ - Lower Monumental Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
LMJ	A-SEPARATOR GATE	33,324	32,829	468	98.6%
	B-SEPARATOR GATE	50,582	49,365	1,193	97.6%

Last Processed at 9/12/2019 10:15:02 AM

Figure 12. Diversion gate efficiency summary for 2018

Note: the diversion efficiency of the gate labeled *SBYC GATE* at GRJ cannot be measured because it does not have a downstream detection point. No SbyC projects were operated at MCJ this year.

In December 2018, a lab demonstration of an electronic gate prototype (*Figure 13*), developed by PTAGIS field staff, was given high praise by Lower Monumental and Little Goose COE juvenile fish facility operators. In agreement with the COE,

this prototype will replace the pneumatic system that operates the SbyC B-Gate at Lower Monumental. Performance will be evaluated over the 2019 season.
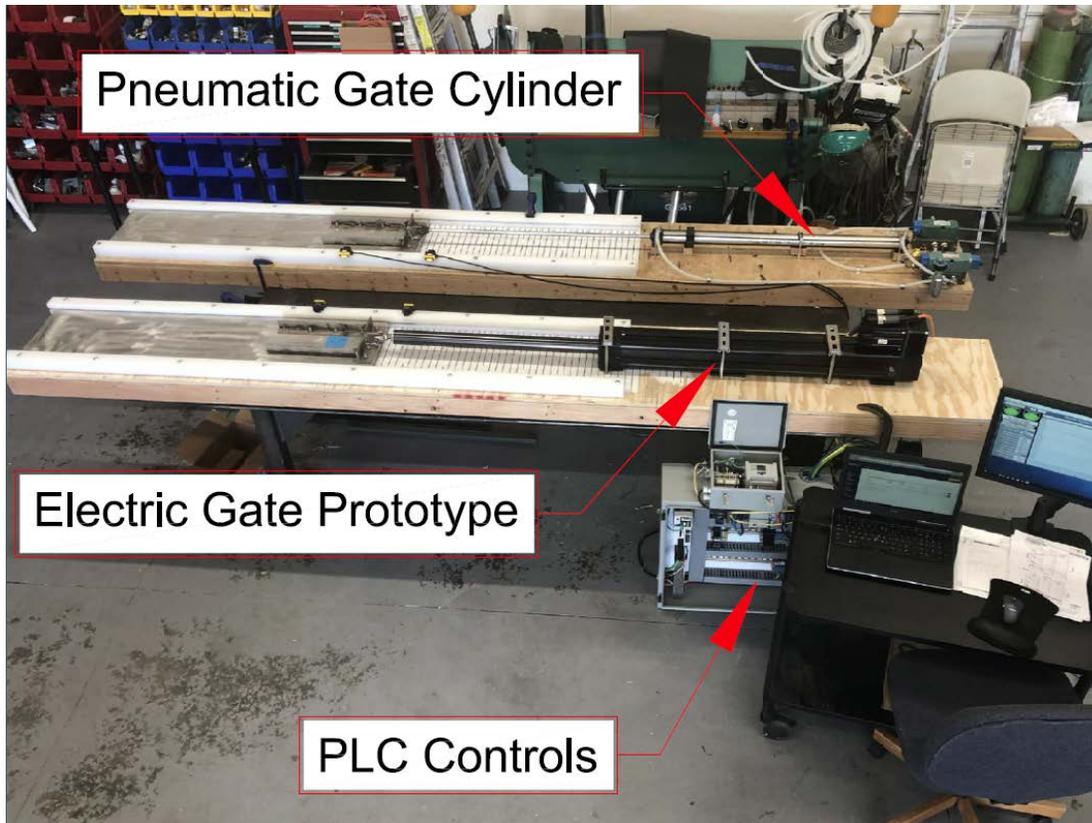

Figure 13. Electric diversion gate prototype compared to pneumatic gate in PSMFC Kennewick Lab

Electronic gates will lower costs by requiring less maintenance, have a significantly longer life span, and will increase diversion efficiency. They are also more operator friendly as they don't require constant lubrication inherent to pneumatic systems. If successful at Lower Monumental, electronic gates would potentially replace pneumatic systems at other Snake River COE sites.

A request was received from the COE Walla Walla District to design and install a fully operational SbyC system (*Figure 14)* for the Ice Harbor south ladder adult fish trap. The electronics for the submersible SbyC system was designed by PTAGIS field staff using M4 and PLC controls to notify the operator that a targeted fish was in the trap. A four-weir wall alerting system was designed to warn the operator of approaching PIT tagged fish.

Figure 14. Ice Harbor adult fish trap and alerting system for target fish

2019 Plans
Staff will continue to operate and maintain the SbyC systems. Staff will evaluate electrically activated diversion gates to replace the current mechanisms to reduce maintenance costs and improve performance.

G: 70. Install Interrogation Systems in Field Locations

PTAGIS works with a wide range of researchers and agencies that are looking to incorporate PIT tag detection equipment into large-scale interrogation sites.

This process for installing a new interrogation system typically has the following stages:

- Field staff evaluate fish passage conditions at the proposed site
- Pre-qualification of the proposed site using radio frequency detection equipment
- Provide design requirements and feedback throughout the process to ensure the success of the project

Once a system is approved by BPA, PTAGIS coordinates with COE or other agency to install the electrical components of this system that include the transceivers, network, PLC, and the data collection computers.

Since 1993, PTAGIS has had an integral role in the NOAA Fisheries project 1983-31-900 (New Marking and Monitoring Techniques for Fish) when PTAGIS assumed responsibility from NMFS for the operation and maintenance of the permanent interrogation systems installed in the juvenile fish bypass facilities at Lower Granite, Little Goose, and McNary dams. In recent years, PTAGIS has assumed a larger role in the research, development, and evaluation of new PIT tag technologies, such as a new generation of tags and transceivers that provides greater read range, and the construction of arrays of PIT tag antennas in close proximity.

2018 Accomplishments
John Day Adult Ladder PIT Tag Project – South (JO1) and North (JO2) Ladders
In October 2017, PTAGIS upgraded the broadband internet connection that serves not only JO1 and JO2 systems, but the juvenile fish facility as well. This upgrade was necessary as the existing connection was being phased out by the service

provider and in jeopardy of being terminated at any time. To accommodate the new service, PTAGIS technicians were required to install two antenna towers, one for the central repeater and another near the JO1 PIT tag building. This service upgrade will help ensure consistent and reliable data files submissions, remote access and long-term stability for years to come.

In February 2018, USACE allowed PTAGIS technicians access to complete installation of power and communications wiring to the transceivers, complete construction and wiring of the PIT tag electronics room and installation of the data collection platforms (Figure 15). Real-time data collection and automated data file submissions for sites JO1 and JO2 began in February 2018. Both ladders operated at 98% efficiency levels in 2018. A record-high shad run clogged the ladders in midsummer and may have forced tagged fish into the lock avoiding detection.

Figure 14. Installation of antennas in John Day Adult Ladder North (JO2)

Lower Granite Dam Juvenile Bypass System Remodel

On March 15, 2018, PTAGIS technicians completed the tuning and optimization of the GRJ Full Flow PIT tag detectors (*Figure 16*). The three antennas were fully functional prior to the initial water-up of the new bypass system; therefore, no PIT tag detections were lost. Integrated the new antenna array into the GRJ data collection platform. Antenna IDs beginning upstream are 01, 02, and 03 respectively. The YTD detection efficiencies for the full flow antenna array is greater than 99 %.

Figure 16. New full-flow antenna system installed at Lower Granite Juvenile Bypass

Lower Granite Spillway (GRS) PIT Tag Project

During the September 2018 FDDRWG meeting, the COE announced the postponement of the PIT tag portion of the GRS project until fall of 2019. The weekly design and coordination meetings will continue.

Lamprey Bypass System (LPS) Project

New bypass systems for lamprey are in operation at all three Bonneville ladders. Each of the bypasses is equipped with two antennas maintained by PTAGIS.

Figure 17. Additional antennas added to the Lamprey Bypass System at Bradford Island Ladder

2019 Plans

Continue to coordinate as part of the design team on the PIT Tag detection system for spillways. Install equipment for Lower Granite Spillway (GRS) project starting in late 2019 and completed in 2020.

H: 160. Operate and Maintain Interrogation Systems in Field Locations

The PTAGIS field staff monitor operational reports throughout the day, 365 days a year. These reports identify the following conditions and allow field staff to respond to situations quickly:

- Data collection gaps
- Low reading efficiency of a detection system
- Transceiver failures and alarms
- Computer, network or other system failures and alarms
- Changes in environmental conditions (such as power, temperature, relative humidity) that may impact a detection system

During the portions of the season with high fish migration, field staff performed weekly, on-site, standard maintenance checks at each facility. Perform maintenance checks every other week in periods with lower migration. Site visits include tuning all readers, inspecting and adjusting the timing of diversion gates, maintenance of the data collection computers, and coordination with site operators and biologists.

Juvenile fish bypass facilities on the Snake and Columbia rivers begin operating around April 1st. Prior to these operations, the field staff perform all the necessary preseason tuning and maintenance to ensure peak performance of the juvenile fish detection and diversion equipment.

Radio frequency (RF) noise data is tracked on a continual basis, 365 days per year for the 445 antennas PTAGIS currently operates. Sites that have been quiet for years may suddenly become noisy. Tracking and mitigation consumes 10% to 30% of labor resources per year. COE and other agencies are cooperative in helping to control noise sources. Noise sources can come from a multitude of devices, from a defective cell phone charger, to a new type of lighting, or a US Navy beacon in California.

Field staff record general maintenance and anomalous events by submitting event logs to the PTAGIS system. The logs[3] are publicly available on the PTAGIS website as metadata for each interrogation site.

As certified electricians and electronic technicians, field staff repair and extensively test PIT tag reading equipment in the Kennewick lab before returning devices to service. PTAGIS inventories a minimal number of spare readers to expedite the replacement of failures and, as a cost savings, repair the equipment in-house.

2018 Accomplishments
Juvenile Bypass O&M
Juvenile fish bypass facilities on the Snake and Columbia Rivers began operating in March and April. Maintained detection efficiency rates for 2018 at or above previous year's rates of greater than 99%. The single antenna in the Bonneville Corner Collector is the exception to this with an estimated efficiency rate in the seventies based upon a live fish test using 12mm tags conducted by NOAA.

Adult Ladder O&M
Adult ladder detection efficiency also remains high. In dam-to-dam comparisons, all sites maintained an approximate 98-99% detection efficiency over a 12-month rolling report period (*Figure 18*). In 2016, the efficiencies at LMA lowered to 97% due to the raising of the picketed leads that allowed fish to bypass the counting window and not pass through the

---

[3] PTAGIS Event Logs for Interrogation Sites: http://www.ptagis.org/services/event-logs/view-event-logs

PIT antennas. Since the decision was made at the May 2017 FPOM Meeting to leave the picketed leads in through November each year, LMA detection efficiencies have risen to 98.8% in 2018.

Bracket Tags	Number of tags detected both downstream and upstream of ladder site
Ladder Tags	Number of tags detected at bracket sites and ladder site
Missed Tags	Number of tags detected at bracket sites, but not detected at ladder site
Percent Detected	Percent of tags detected by ladder site

Ladder Site	Bracket Tags	Ladder Tags	Missed Tags	Percent Detected
BON	5,021	5,003	18	99.6
TDA	8,654	8,605	49	99.4
MCN	3,830	3,799	31	99.2
ICH	3,694	3,641	53	98.6
LMA	3,450	3,408	42	98.8
GOA	3,732	3,698	34	99.1
GRA	878	876	2	99.8

Figure 18. 2018 adult ladder efficiencies in dam-to-dam comparisons

Network Enhancements

Deployed firewall appliances to the local networks of all interrogation sites operated by PTAGIS to meet security standards and improve VPN connectivity between sites and field office. To further O&M efficiency, field staff are completing the development of a SCADA interface for all sites that allows real-time communication and monitoring of PLC and related equipment in the field. Figures 19 and 20 show the drill-through features of the online SCADA interface for remote monitoring. The sites in green are currently implemented and the other sites in grey will be added in 2019-2020.
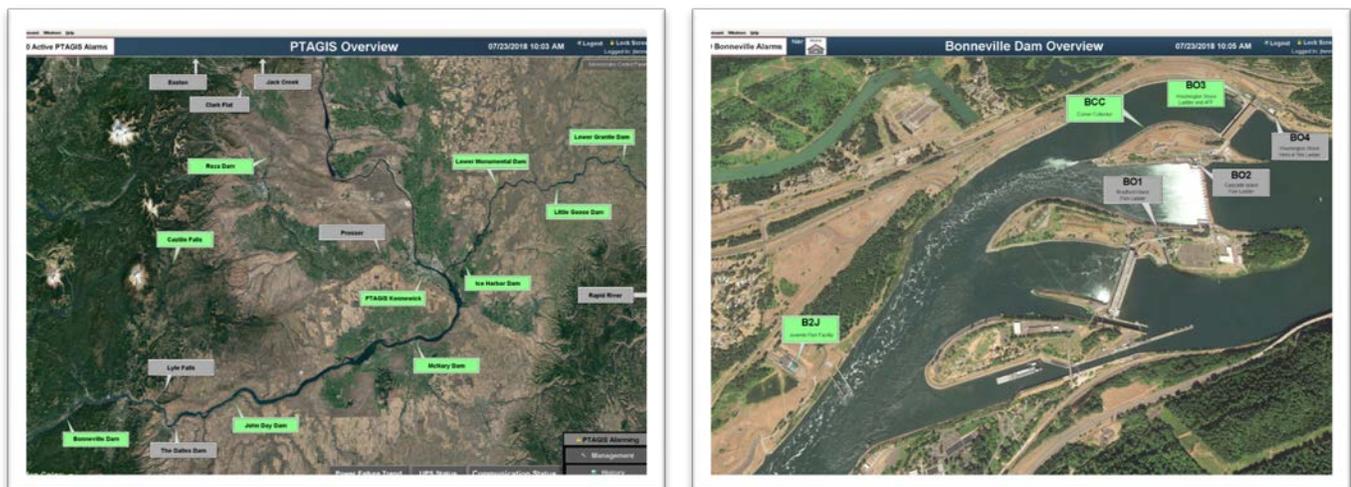

Figure 19. SCADA drill-through interface to PTAGIS interrogation sites (sites in green currently implemented)
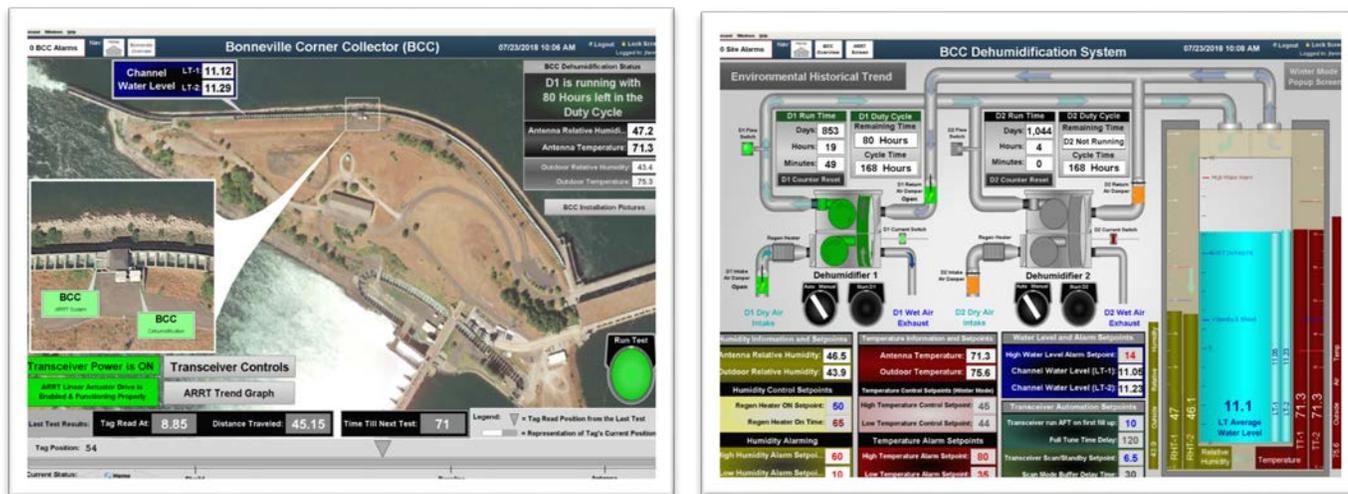
Figure 20. *SCADA drill-through interface showing humidity-control automation for large antenna at Bonneville Corner Collector (BCC)*

The online SCADA interface for the Bonneville Corner Collector (BCC) site (*Figure 20*) allows staff to monitor and control the redundant dehumidification system that ensures the large antenna is operating at peak efficiency in real-time without having to make a 350-mile round trip to perform this on site.

Antenna Repair and Other Efforts

Field staff repair or replace failed antennas on an ongoing basis. Large antennas used at adult ladders are showing their age and are becoming more problematic. Designed in 2000 to 2002, these antennas (some weighing 1500 to 4000 pounds) are lifted out of the ladders with a crane and transported to the Kennewick office. Repair efforts include dismantling the antenna bodies, drying the interiors, repairing areas where leakage has occurred and replacing connectors. Repair efforts become costlier with increased deterioration of the antenna bodies. Staff attempted to repair a 4000-pound antenna for BO4 but water damage was too severe. The field staff has put together a design team to replace the aging antennas with a modern thin body design using ferrite tiles. These antennas will cost less to build, require less maintenance, and read at higher efficiencies. The first of these antennas will be available in 2019.

Staff tested wireless Ethernet systems for Prosser Dam upgrades scheduled for 2019.

2019 Plans

Operate and maintain interrogation sites per established standard operating procedures (SOP). Develop a project plan for the replacement of the BO2 PIT tag room, which is currently sinking. Expand SCADA monitoring features to additional sites. Work with the Portland PTAGIS group to develop a UPS health monitoring system. Develop a thin-body antenna design to replace the failing BO1/BO4 slot antennas. Continue system and network upgrades at Prosser site.

J: 122. Additional Support Actions

The regional community often tasks PTAGIS staff to share their unique expertise in solving complex PIT tag detection and operational issues. This "catch-all" deliverable describes these types of ad-hoc requests that are within the program's scope of work and typically range from the following tasks:

- Regional coordination including FPOM and FFDRWG
- Transceiver, antenna and PIT tag conformance testing
- Electronics, process and control engineering
- Electrical design for PLC controls at sampling facilities
- Radio frequency identification (RFID) design

27

- Computer-aided design (CAD) detail
- Antenna design for the COE and others
- Cost analysis for installing PIT tag systems for the COE, NOAA and other various agencies

These tasks often overlap with deliverables described in section *F: 70. Install Interrogation Systems in Field Locations,* as they are typically the first steps performed before the installation of a new interrogation site.

2018 Accomplishments

Dual Mode Detection

After a thorough and successful evaluation by NOAA statisticians and PTAGIS staff, the detection efficiency for FDX tags does not appear to be impacted by dual-mode operations. Based on these conclusions and support of the PTSC, PTAGIS technicians enabled dual-mode at all PTAGIS maintained adult interrogation sites that have transceivers with this capability. As of October 2018, all ladder sites, other than the John Day, are currently operating in dual-mode. The John Day ladder system will remain in FDX-mode only until January of 2019 in order to determine a baseline detection efficiency in 2018. Post evaluation, dual-mode will be enabled at both adult ladders, JO1 and JO2.

After enabling dual-mode detection, staff discovered problems with the synchronization between transceivers that required a transceiver firmware update by the manufacturer. Staff coordinated with the manufacturer to correct this issue and evaluate the new firmware. The new firmware formatting was incompatible with M4 data collection software and required modification and redeployment to restore compatibility.

Pending further technical review and evaluation, staff are considering dual-mode operation on the full-flow bypass systems at COE juvenile fish facilities. These systems are instrumented with FS2020 transceivers, but further lab and field-testing are needed to determine if dual-mode is possible at these locations. This would allow for the detection of juvenile lamprey tagged with HDX tags. If FDX salmon detections won't be affected, any change over to dual-mode on these types of systems would likely occur in 2020.

Lower Granite Spillway (GRS) PIT Tag Project

The PTAGIS Kennewick office continues to coordinate with USACE and NOAA personnel as part of the design team on PIT tag detection systems for spillways. PTAGIS staff actively participates in weekly construction meetings and design reviews providing technical expertise and guidance along with conceptual CADD drawings (Figures 3 and 21) for various aspects of the PIT tag portion of the project. These drawing sets help guide the COE and subcontractors in the placement of critical components such as antenna conduit routing, PIT tag building layout, as well as communicating electrical requirements.
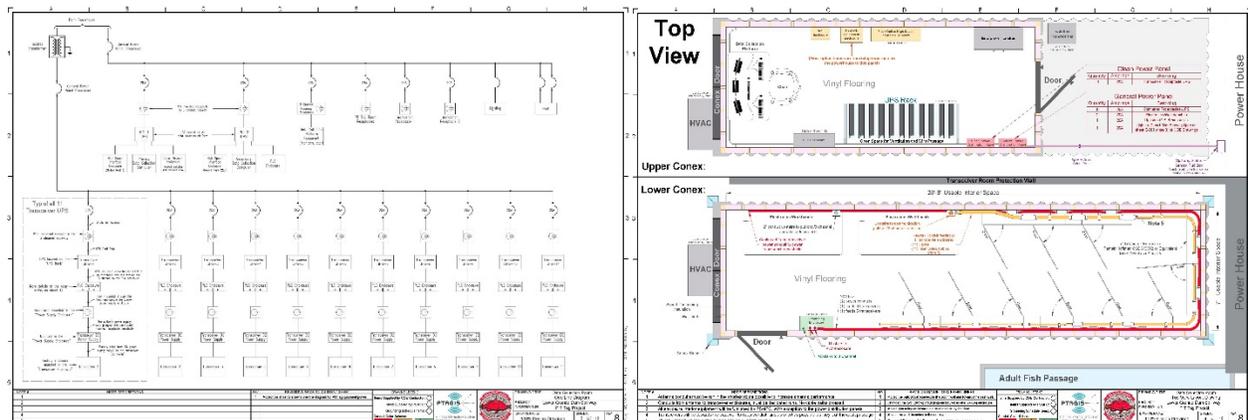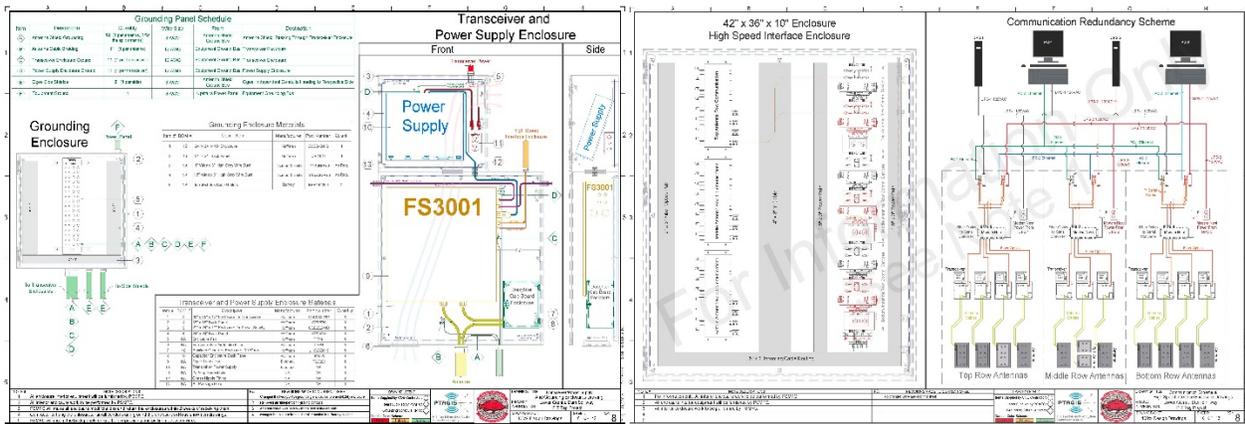
Figure 21. *Sample of CADD schematics and designs developed by PTAGIS staff for GRS project*

Other Efforts

Reviewed COE plans for a PIT tag system at Mill Creek Dam near Walla Walla.

2019 Plans

Staff will continue to be members of design teams for multi-year, multi-agency projects described in this section. Continue to team with NOAA to develop antenna designs for the B1 Ice & Trash Sluiceway and a second antenna at BCC.

Administration, Management and Coordination

This objective is comprised of the multiple contract work elements described in the following subsections. The work elements listed below are limited in scope and/or well defined:

- A: 185. Produce Pisces Status Reports – Periodic Status Reports for BPA
- B: 165. Produce Environmental Compliance Documentation
- L: 132. Submit Annual Progress Reports
- M: 202. Produce BiOp RPA Report

C: 119 Routine Administration of the Contract

This work element delivers general administration and on-going management of the BPA contract including:

- Funding package
- Hiring and supervising personnel
- Subcontracting
- Purchasing
- Budget and inventory tracking

PTAGIS is a fisheries data project of the Pacific States Marine Fisheries Commission. The Commission provides administrative support to the program, such as:

- Payroll
- Procurement
- Accounting
- Travel arrangements
- Contract review and monitoring

- Benefits, recruitment and other HR-related administration
- IT services

2018 Accomplishments
Completed all contract-related deliverables such as annual and periodic status reports on schedule. Submitted new funding package for FY19 contract on December 11, 2018. Staff performed an annual inventory audit and the product was loaded into Pisces for the FY19 funding package.

Staff performed a cost analysis to host a PIT Tag Workshop in 2020 and submitted to BPA for approval. Due to scheduling, the workshop will be postponed until 2021 requiring an updated cost analysis as part of the FY19 contract.

In past years, request for permission to dispose of obsolete assets were submitted with the new contract. This has caused some confusion as staff wait for approval while concurrently submitting asset inventory as part of the fiscal contract deliverables. To mitigate confusion, staff will wait until mid-fiscal year to request permission for asset disposals.

Staff performance plans and reviews were completed and submitted on schedule per PSMFC guidelines.

2019 Plans
Continue routine administration of the contract as described. Audit program inventory and submit request to dispose obsolete equipment well before contracting period. Perform a cost analysis of hosting a PIT Tag Workshop in 2021 and submit this with the FY19 contract for approval.

I: 122 Technical Support and Training Assistance to Field Users
This work element delivers online, email, and phone technical support/training to entities engaged in PIT tag research activities in the Columbia Basin. The focus of this support pertains to the publicly accessible *PTAGIS Field Data Collection* and *Web Data Management* systems described in previous sections of this document.

2018 Accomplishments
Staff answer approximately 50 support and coordination-related requests a month for various field software and web/reporting systems. Updated the context-sensitive help installed with P4 and PIFF 2 software with each new release. Continued to utilize Basecamp change tracking software-as-a-service to manage support requests and related software changes. Updated web-based technical documentation and online tutorial videos.

Upon request, staff performed an in-person, P4 training event for approximately 40 people from Oregon Department of Fish and Wildlife, Portland General Electric, and Confederated Tribes of Warm Springs.

2019 Plans
Continue providing technical support for all publicly available PTAGIS systems. Create additional online video tutorials and email surveys to promote better user experiences. Discontinue online forums as a form of technical support within the new PTAGIS website due to underutilization.

K: 189 Coordination- Columbia Basinwide
This objective covers standard regional coordination activities such as:

- Participating and the hosting of PIT Tag Steering Committee meetings[4]
- Participating in and providing ad-hoc data requests to policy and technical forums

---

[4] PIT Tag Steering Committee Meeting Notes Archive: https://www.ptagis.org/resources/document-library/meeting-notes

- Conducting email campaigns and surveys
- Publishing and distributing a semi-annual PTAGIS newsletter[5]

The following subsections describe additional coordination activities.

Data Contributor Coordination

A diverse array of fisheries management and research organizations working in the Columbia Basin contribute MRR data and some observation data to PTAGIS. Basinwide coordination is necessary to ensure the contribution of these data are valid, timely and have adequate metadata. New *Tag Data Projects* and interrogation sites must be coordinated and approved through the PTSC before they can submit data into PTAGIS. Once approved, staff add the site metadata and implement automation features in the Server Data Management System. Ongoing coordination among active data contributors involves the following activities:

- Manage Tag Data Project coordinator information
- Manage Interrogation Site steward information
- Manage validation codes, MRR sites and interrogation sites
- Provide start-up information for new data contributors
- Notifications about data anomalies
- Year-end reminders about data QA/QC and metadata requirements
- Special mailings as needed to disseminate information about process changes

PIT Tag Distribution and Quality Assurance

PTAGIS inventories and distributes all PIT tags to BPA Fish and Wildlife Projects (FWP). PTAGIS provides a web-enabled workflow to simplify the coordination effort and make it transparent. Aspects of this workflow process are:

- Forecasting annual PIT tag needs from FWP project leads
- Inventory management coordination between BPA and the PTAGIS Kennewick office
- BPA approval of tag requests for each project
- PTAGIS staff ship tags for each approved request
- Coordinate distribution with vendors for tags that are preloaded into needles
- Tag distribution information is archived and made available online

In addition to inventory and distribution, PTAGIS performs quality assurance (QA) on a sample of the PIT tags. This QA process uses advanced automation technology to verify the manufacturing of PIT tags meet specifications described in the contract between BPA and the vendor. This includes:

- Turn-on voltage
- Modulation percentage
- Resonant frequency
- Bandwidth/"Q"
- Size and weight

---

[5] PTAGIS Newsletter Archive: http://www.ptagis.org/resources/document-library/ptagis-newsletter-archive

2018 Accomplishments

Safety Issue with Older Portable Reader

PTAGIS issued an announcement in June, 2018 warning the community about an older FS2001F portable reader exploding during normal use. Biomark (the manufacturer) issued a technical bulletin that was published on the PTAGIS website. BPA warned FWP contacts via email to discontinue using this model of portable reader. On behalf of BPA, PTAGIS helped identify replacement needs for all of the FWP by emailing an online survey to the community. To ensure a suitable replacement for this reader, PTAGIS and the PTSC coordinated with Biomark to resolve outstanding performance issues (identified in 2016) with the *HPR Plus* portable reader. Biomark announced a solution for these issues in the October 2018 PTAGIS Newsletter. BPA procured and distributed replacement *HPR Plus* units to projects. Upon request, PTAGIS implemented a portable reader loan program for FWP that do not require this equipment year-round.

Instream PIT Tag Detection Sites Coordination

The sites operated by FWP contracted through Biomark use satellite and cell modem technology to acquire data from the remote instream interrogation sites. Researchers and the PTSC requested PTAGIS develop similar capabilities to acquire data from remote interrogations sites. PTAGIS staff evaluated the efforts required to provide these capabilities in and reported back to PTSC in September 2018; the results are described in *2018 Accomplishments in Field Data Collection Software* section of this document.

The PTSC request PTAGIS enhance the interrogation dataset to capture additional metadata to help researchers identify detection probabilities at instream sites. PTAGIS coordinated with Biomark (FWP# 2018-002-00) and other data stewards to develop a new interrogation file format to extend the submission of detection data with transceiver diagnostics and environmental data to be incorporated into the database as metadata and publicly accessible to the research community (similar to how large-scale interrogation sites are currently operated by PTAGIS). Staff also coordinated an evaluation of a prototype submission system using the new data file format. This coordination effort was successful and staff incorporated feedback into the latest specification of this file and submission system.

PTAGIS staff were part of the planning team and presented at the *Tributary PIT Tag Arrays in the Columbia Basin Workshop*[6] in October 2018. Staff and PTSC are working on an action from this workshop to coordinate with agencies to create a formal instream steering committee to guide the on-going PTAGIS support of instream interrogation sites.

PIT Tag Data Specification

Staff developed a draft *PTAGIS Data Specification*[7] describing PTAGIS field definitions, value domains, and file specifications. For those new to PTAGIS, it also provides an overview of the data model, data collection tools and query tools. The PTSC reviewed a draft of this specification for several months. An updated draft was published for public review in October 2018 (see article #5 in *October 2018 PTAGIS Newsletter*[8]). The final review of the draft specification will occur at the annual PTSC meeting scheduled for January 2019.

---

[6] *Tributary PIT Tag Arrays in the Columbia Basin Workshop*: https://www.pnamp.org/event/tributary-pit-tag-arrays-in-the-columbia-basin-workshop

[7] PTAGIS Data Specification: https://www.ptagis.org/data/data-specification

[8] October 2018 Newsletter: https://www.ptagis.org/docs/default-source/ptagis-newsletter-archive/vol-16-no-2-october-2018.pdf?sfvrsn=4

PIT Tag Distribution

PTAGIS staff distributed 1.53 million tags to 66 FWP in FY18. The testing of 3% sample of those tags for quality assurance found no significant manufacturing defects. However, the QA process discovered a batch of tags that did not meet specification and would perform poorly in the system. Staff coordinated with BPA and the vendor to return these tags. The vendor was reluctant to exchange the tags as they felt they would perform as well as previous tags. Staff considered adding metrics from the QA process to each tag as metadata that could be joined with observations to potentially determine if certain tags were consistently undetected in certain systems related to performance in outgoing years. Eventually the vendor capitulated and exchanged this batch of tags.

Data Contributor Coordination

The following table provides a very brief summary of data contribution coordination:

Data Type	Validation Code Type	Added in 2018	Total Active
MRR	Tag Data Projects	4	160
MRR	MRR Site (mark/release site)	43	1,245
Observation	Interrogation Site	18	300

***Table 4.** Annual changes to data contributors*

PIT Tag Forecast Coordination

PTAGIS staff expressed concern the coordination efforts required to get projects to consistently update the forecast each year is beyond the scope of the program and require the influence of BPA, NOAA and NPCC. The project sponsors agreed to perform this coordination. However, coordination efforts have diminished and the forecast data is increasingly stale (demonstrated by selecting the *Projects* tab and viewing the *Last Forecast Update* column in the forecast dashboard[9]). PTAGIS will coordinate with the proponents of the forecast to see if it should be added to the new PTAGIS website or just archive the data.

ISRP Review

PTAGIS participated in the Independent Science Review Panel (ISRP) project review at the end of 2018, with final presentations to the panel being completed in January 2019. Staff coordinated with the PTSC to help identify suitable answers for some of the RM&E questions in the proposal that seemed out-of-scope for the program. The ISRP indicated that PTAGIS meets the scientific review criteria.

Plans for 2019

Continue distribution, inventory and QA sampling of PIT tags to all FWP. Continue coordination with PTSC and community to publish a final draft of the *PTAGIS Data Specification*. Coordinate with the PTSC to assemble an Instream PIT Tag Detection (IPTDS) subcommittee and coordinate meetings similar to those for the PTSC. Coordinate with NOAA, BPA and COE to update the expired MOU defining roles for installing and maintaining PIT tag infrastructure. Obtain consensus on the future of the PIT Tag Forecaster and related data. Perform a presentation for the 2019 ISRP review.

---

[9] PIT Tag Forecaster Dashboard: https://www.ptagis.org/services/forecaster/forecast-dashboard