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

2020 Annual Report

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Executive Summary

The **Columbia Basin PIT Tag Information System (PTAGIS)** is a coordination and data management project of Pacific States Marine Fisheries Commission (PSMFC). PTAGIS develops software used to collect and contribute Passive Integrated Transponder **(**PIT**)** tag data; manages and provides those data for download and for reporting through 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.

Tagging data is collected when fish are first marked with PIT tags or recaptured after having been previously PIT-tagged. Researchers from twenty-seven organizations marked over 1.7 million fish in 2020, with an accumulated total of nearly 51 million fish PIT-tagged since 1987.

Observation data collection occurs when PIT-tagged fish pass through automated detection systems, called interrogation sites, installed in facilities or streams. In 2020, the 280 interrogation sites contributing data to PTAGIS detected 825,549 unique fish, yielding a cumulative, detected fish total exceeding 19 million. One fish can generate many observation records as it passes through multiple PIT tag antennas at an interrogation site; 10.2 million observations were reported to PTAGIS in 2020, increasing the total number of observations recorded since 1987 to 257 million.

PTAGIS Operations and Maintenance (O&M) staff, headquartered in Kennewick, WA, are responsible for direct management and maintenance of thirty, large scale interrogation sites throughout the Columbia Basin, primarily at mainstem dam locations. This involves daily monitoring and regular onsite visits to maintain the detection equipment that provides the majority of the 257 million observation events available in the database. PTAGIS also supports the Separation by Code (SbyC) systems at nine locations, which enables researchers to selectively segregate individual PIT-tagged fish from other tagged and non-tagged fish. O&M staff also participate in the design, planning, and installation of new interrogation sites and detection technology.

2020 Highlights

Data Management: PTAGIS processed 818,000 data files with 119 million database rows updated or inserted. All PTAGIS website data is accessible to anyone; this year, 540 users executed 423,000 queries resulting in 14.4 billion rows of returned data.

Tagging and Observation Software: Four, new updates to the current PTAGIS field tagging software, P4, were released in 2020 that primarily focused on correcting defects and applying ergonomic changes. The next generation interrogation field software, M5, was tested both in the Kennewick lab and at active interrogation sites, running in parallel with production data collection platforms. Associated server and database upgrades were implemented to allow submission, processing, and reporting on the M5 data received from the testing platforms.

Formation of Instream PIT Tag Detection System Subcommittee: The Instream PIT Tag Detection System Subcommittee was formed and held three virtual meetings during 2020. The subcommittee worked on standardization of site configuration diagrams, evaluated a beta release of new PTAGIS interrogation software (I5), and provided input on the interrogation site metadata page for the new website.

New Data File Repository Browser: As part of the interrogation file submission infrastructure developed for M5, a new data file repository was launched to integrate legacy file submission data with next generation file information. The Data File Repository Browser was developed as an internal software utility that both audits data file storage and submission metadata, and provides streamlined viewing and retrieval of those data files. A web version of the Browser will be released with the new website in 2021 as the primary method for PTAGIS users to retrieve data files instead of FTP.

Upcoming Website: Launch of the new website is planned for spring 2021: two virtual servers were provisioned from PSMFC virtual infrastructure for website and reporting system hosting; upgrades and testing of the latest reporting software version; development of new reports for the upgraded reporting software; redesign of support databases; and migration and synchronization of existing production data to those new databases.

Separation by Code: SbyC was used to target fifty-seven groups of fish (691,000 target tags) for sampling or to have them treated as the untagged population at transport dams. SbyC projects targeting fish for additional sampling were canceled by the U.S. Army Corps of Engineers (USACE) as a pandemic safety measure, but the projects targeting fish to be treated as the untagged population at transport dams continued through the end of the year. The detection and diversion efficiencies at these sites remained very high (> 98%) throughout 2020.

Lower Granite Dam Spillway Interrogation Site (GRS): After the successful installation of the Lower Granite Dam Spillway interrogation site at the end of 2019, the early part of the 2020 out-migration season focused on monitoring the performance and addressing the technical issues remaining after installation. GRS (Figure 1) operated throughout the spill season in 2020 and detected approximately 160,000 distinct PIT tags. Although detection efficiency tests using live fish were canceled due to the pandemic, the number of tags detected surpassed most expectations.

Figure 1. Lower Granite Spill Bay #1 with PIT tag detectors in operation and detecting tags May 2020.

Barge Load Line Antennas: At the request of BPA, staff evaluated the feasibility and cost estimate of adding PIT tag detection to the barge load lines at Lower Granite, Little Goose, and Lower Monumental juvenile fish passage facilities. Installation planning was initiated at the end of 2020, with installation and data collection expected to commence before the 2021 sampling season.

Upgrades to Detection Systems at Bonneville Dam: PTAGIS staff collaborated with USACE personnel at Bonneville Dam to upgrade detection systems in the Washington Shore and Cascade Islands fish ladders. Construction of replacement antennas (Figure 2) for the serpentine weirs in the Washington Shore ladder was completed using NOAA's recently developed underwater cable that allows the weight to be decreased by two-thirds, while reducing the expense to less than 25% of the original antennas. Relocation of the Cascades Island system from the weir wall orifices in the lower part of the ladder to the counting window and Upstream Migrant Tunnel was similarly begun in late 2020. This relocation was necessary due to subsidence in the area around the current PIT tag room and should deliver enhancements of 100% passage area coverage, with the capability to detect half-duplex tags besides full-duplex.

Figure 2. Washington Shore serpentine weir replacement antennas under construction at the PTAGIS Kennewick Lab.

Ongoing data management, coordination and O&M activities:

- Maintenance of validation codes used in data entry and reporting systems in addition to metadata and contact information for interrogation sites
- The PTAGIS Data Specification was updated several times to standardize validation codes across P4 and the new website.
- Technical support to PTAGIS users.
- Additional video tutorials were produced for both P4 and the reporting system that included closed captions.

- Publication of newsletters and news items.
- Year-round daily monitoring of interrogation systems at large-scale mainstem dam fish passage facilities.
- Repair of detection system components.
- PIT tag distribution and quality assurance.

Owing to the pandemic, PTAGIS staff from both office locations transitioned to teleworking from home by utilizing online collaboration tools and remote access to systems and servers. USACE also limited onsite interrogation site visits to those requiring critical maintenance: prevention of permanent gaps in data collection; or significant impacts to diversion gates for research projects depending upon SbyC. Despite these imposed safety measures, staff were extremely productive and accomplished the principal objectives detailed in BPA's FY20 contract. Detection and diversion efficiencies at PTAGIS interrogation sites remained very high due to built-in system redundancy, near real-time operational reports, and recently developed remote operation tools to ensure the integrity and continuity of the PTAGIS dataset.

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 2020 and further describes work elements of the PTAGIS project related to collection, management and web delivery of all PTAGIS data.

Researchers contributed 1.75 million fish marked with a PIT tag to the PTAGIS database in 2020 with a cumulative 51 million records (Figure 3). These records were collected and submitted to PTAGIS by 27 organizations as they marked and released fish at 289 locations throughout the Columbia Basin. The composition of marked species was similar to previous years.
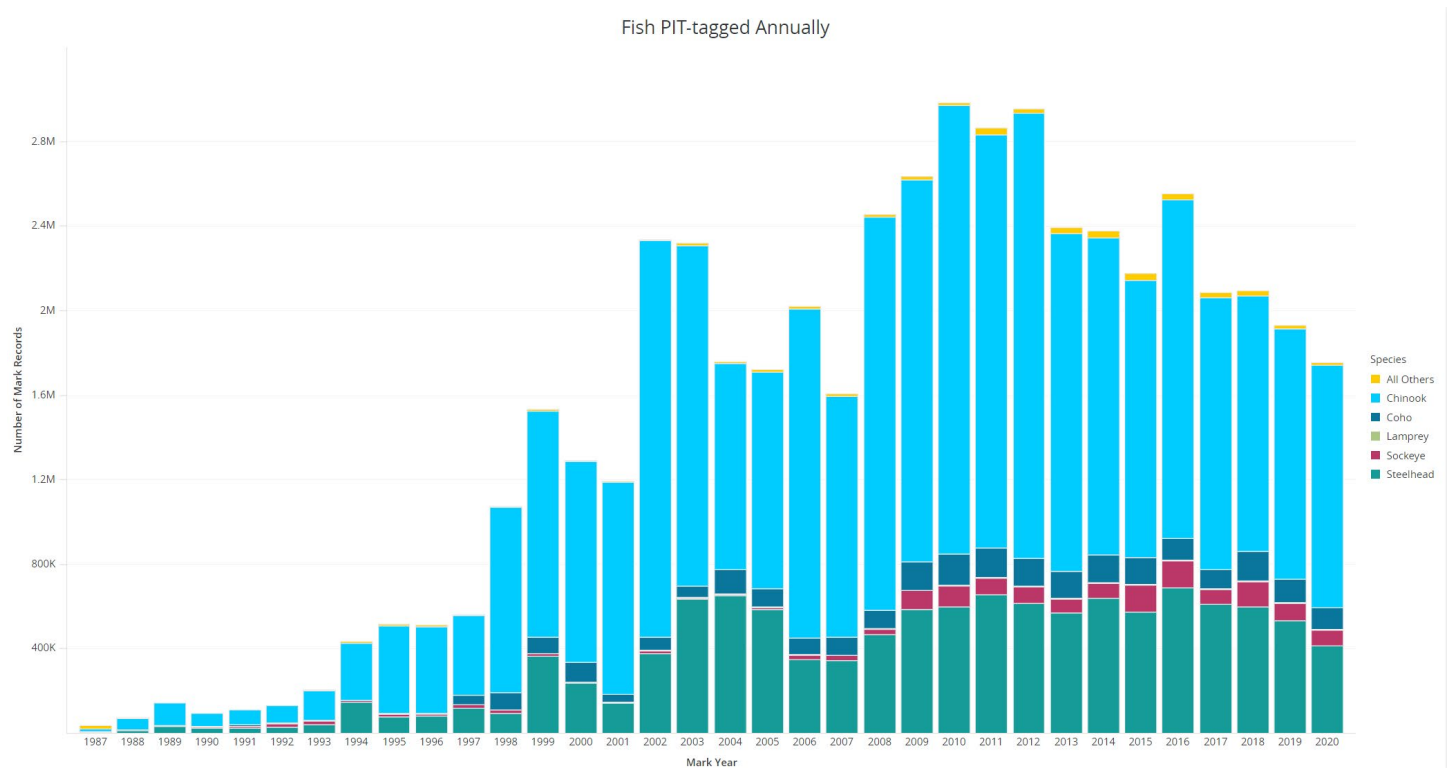

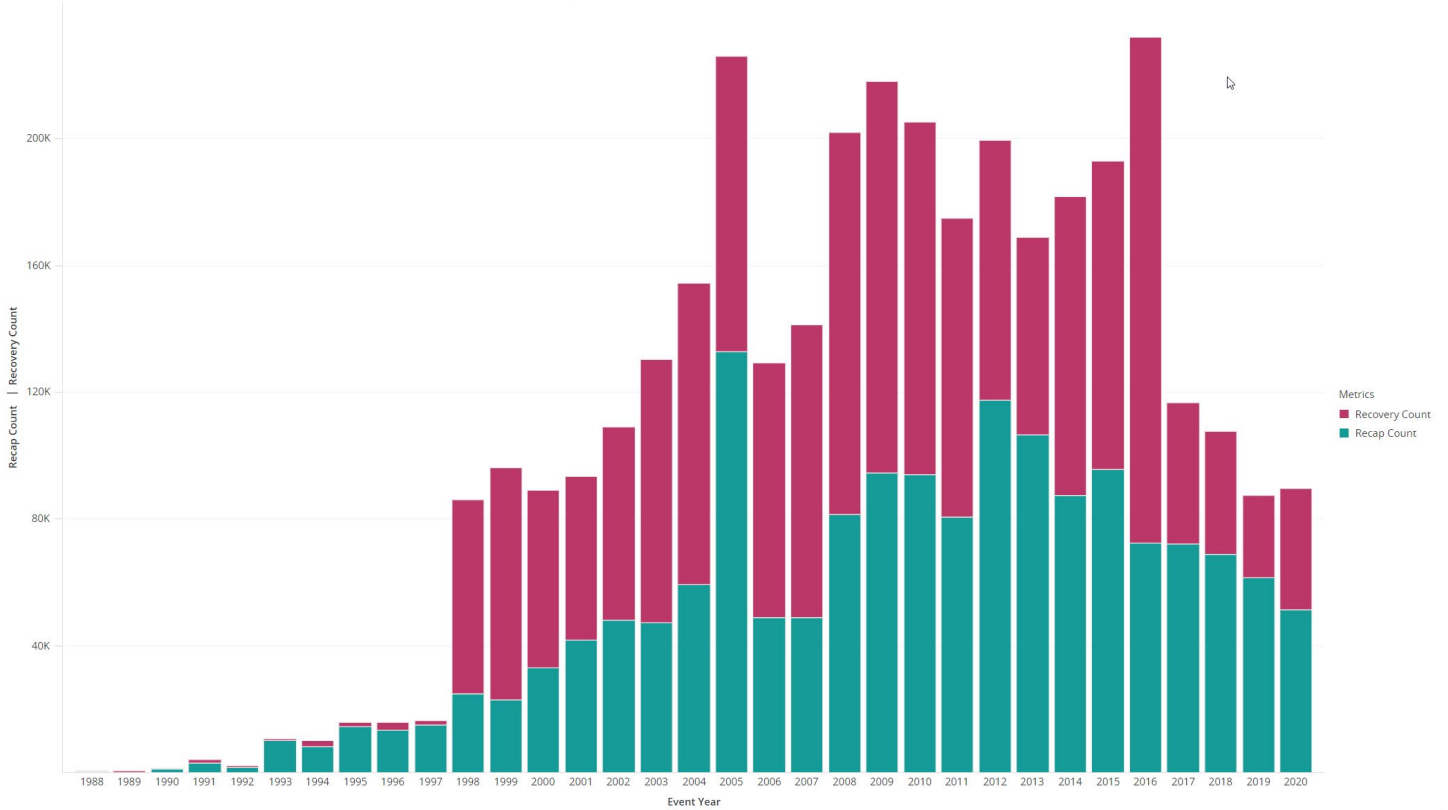*Figure 3.* *Numbers of fish PIT-tagged annually by major species group.*

Figure 4. Numbers of PIT-tagged fish recaptured or recovered annually.

The number of marked fish reported as *recaptured and re-released* in 2020 was just over 50,000 and approximately 38,000 have been reported as recovered (Figure 4).

The 280 interrogation sites contributing data to PTAGIS detected 825,549 uniquely tagged fish this year (Figure 5). One fish can generate many interrogation records (observations) as it passes through multiple PIT tag antennas at one or more interrogation sites; 10.2 million observations were reported to PTAGIS in 2020 totaling 257 million observations since 1987.
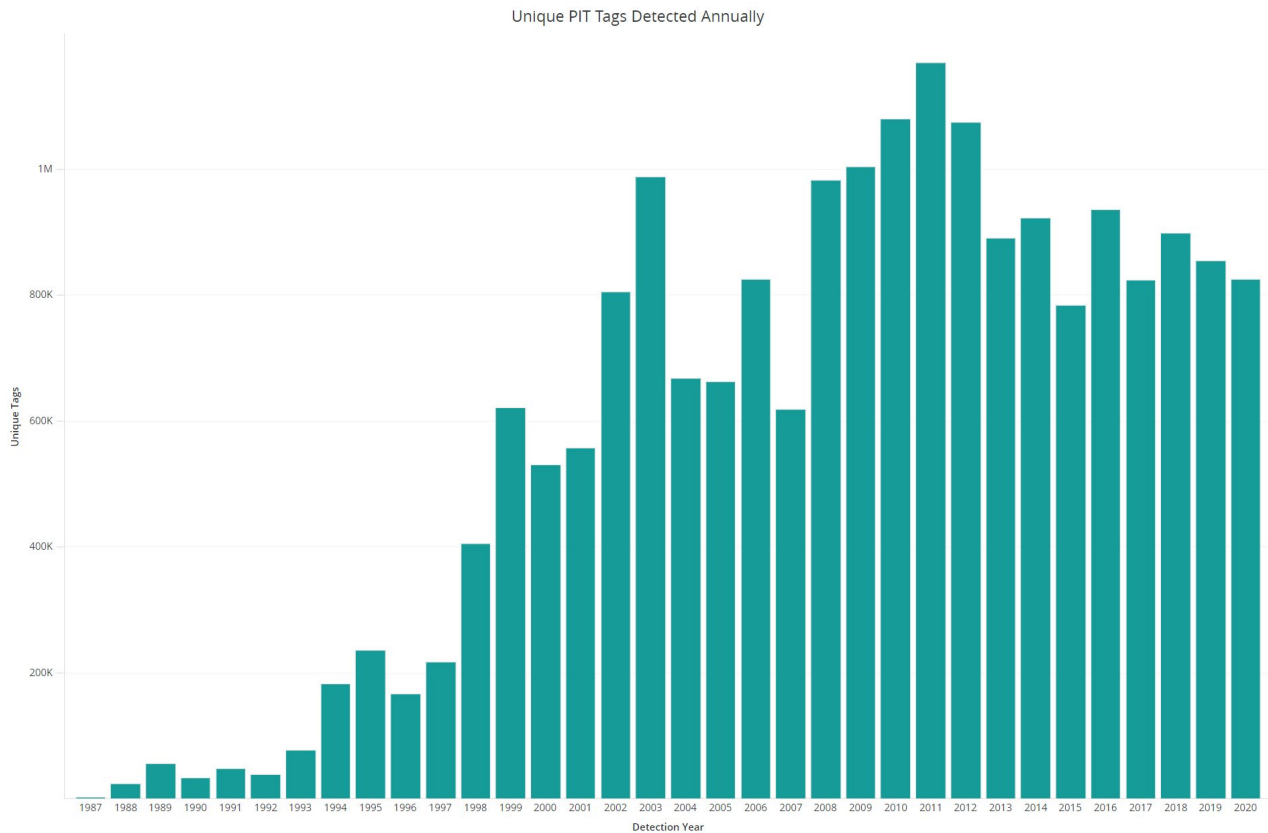
Figure 5. Unique tags detected annually.

To give additional scope to the overall data management efforts in 2020: 540 PTAGIS users executed 423,000 queries resulting in 14.4 billion rows of data returned. Those 540 users are grouped by their respective organizations in Table 1.

Organization	No. Users
All Others	175
Washington Dept. of Fish and Wildlife	51
Idaho Dept. of Fish and Game	48
Oregon Dept. of Fish and Wildlife	43
U.S. Fish and Wildlife Service	36
Nez Perce Tribe	28
Pacific States Marine Fisheries Commission	26
Yakama Nation	21
NOAA Fisheries	21
University of Idaho	19
Colville Confederated Tribes	15
Shoshone-Bannock Tribes	12
Confed. Tribes of the Warm Springs Reser.	12
Columbia River Inter-Tribal Fish Comm.	11
Biomark	11
U.S. Army Corps of Engineers	11
TOTAL	**540**

Table 1. PTAGIS data access in 2020 summarized by organization

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 2. This software is freely available to the research community to download and install on any modern Windows-based PC.

System Type	Software	Description
Tagging Software	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, Data File Repository Browser	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. New this year is a utility that supports browsing, searching, and viewing data files submitted and loaded into the database.

Table 2. Types of PTAGIS field data collection systems

2020 Accomplishments

P4 Tagging Software Upgrades

PTAGIS released four updates of the P4 tagging software in 2020, which included the following enhancements:

- Improved appending data to existing data in text fields and added the ability for Project Defined Fields.
- Improved validation error messages.
- Improved installation process and error reporting.
- Improved importing data process and error handling.
- Bug fixes.

Over 14 thousand files were submitted from researchers using P4 in 2020.

M5 Interrogation Software Development and Platform Evaluation

The principal features of M5 (site monitoring, data collection and submission) were completed and rigorously tested in the Kennewick lab (KLAB) running on a new-generation industrial PC hardware (Figure 6) from Phoenix Contact. This industrial PC was chosen as a potential candidate to replace standard Windows 7 hardware currently operating M4 at all PTAGIS interrogation sites. A data throughput test consisted of two platforms: one running M5 on the new candidate

hardware and the other running M4 on standard hardware. Several thousand tag codes were sent to both platforms over a period of a week from the same transceiver emulation software (also developed by PTAGIS) in addition to actual transceivers reading tags driven from a belt. Data submissions were analyzed from both platforms and the datasets were identical. Additional durability testing, such as recovering from power and communication outages, was performed on the new platform and deemed successful.

Figure 6. Phoenix Contact Industrial PC (IPC) evaluated with M5 data collection platform

The new M5 platform (IPC DCP) was deployed to the JO1 interrogation site in June, running side-by-side with the production M4 platform. Data and performance were analyzed throughout the year. Staff determined M5 and the ruggedized features tucked into the small form-factor of the industrial PC from Phoenix Contact are an excellent replacement of the obsolete data collection platforms currently operating in the field. The cost and warranty of the industrial PC are aligned with similar off-the-shelf desktop PCs.

Most of the complex features to perform Separation-by-Code (SbyC) in M5 were developed during this period. This includes custom utility software called *SbyC Configuration Manager* (Figure 7) to manage the complex configuration workflow for each site. Once online requests submitted by researchers are approved by FPAC, PTAGIS staff will use this software utility to implement the configuration that will be deployed to each interrogation site running M5. Because this configuration will be updated throughout the season, the software supports version control, validation and remote deployment features to ensure the correct actions are taken at each diversion gate in near real-time.
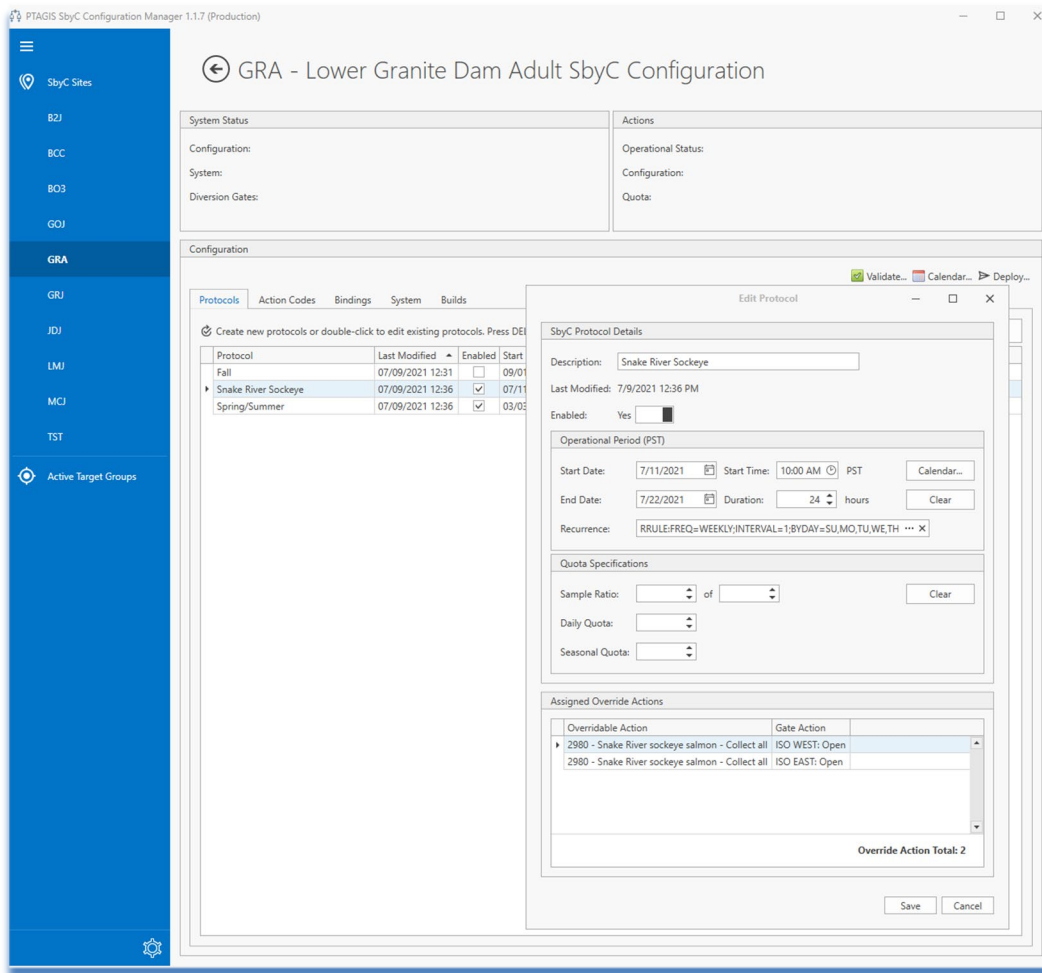
Figure 7. SbyC Configuration Manager developed by PTAGIS to support M5

Additional Utility Software Upgrades and Development

Based on the scoping accomplished in 2019, a beta version of software to replace PIFF was developed, called I5 (Figure 8). I5 allows the user to connect to a transceiver via serial or network connection to download observations stored in the device's onboard memory. It provides robust editing and validation tools to allow the user to quality check the data before formatting it into the new interrogation file format and submitting it to PTAGIS.

Figure 8. I5 data editing screen.

Staff developed utility software (Figure 9) to browse, view and audit the PTAGIS data file archive, called the Data File Repository Browser. This software allows staff to search for specific file submissions and loaded files, view when they were submitted and the final disposition, and open the file in read-only mode to view it. In addition, it can run an audit on the file archive to ensure that all files are accounted for.
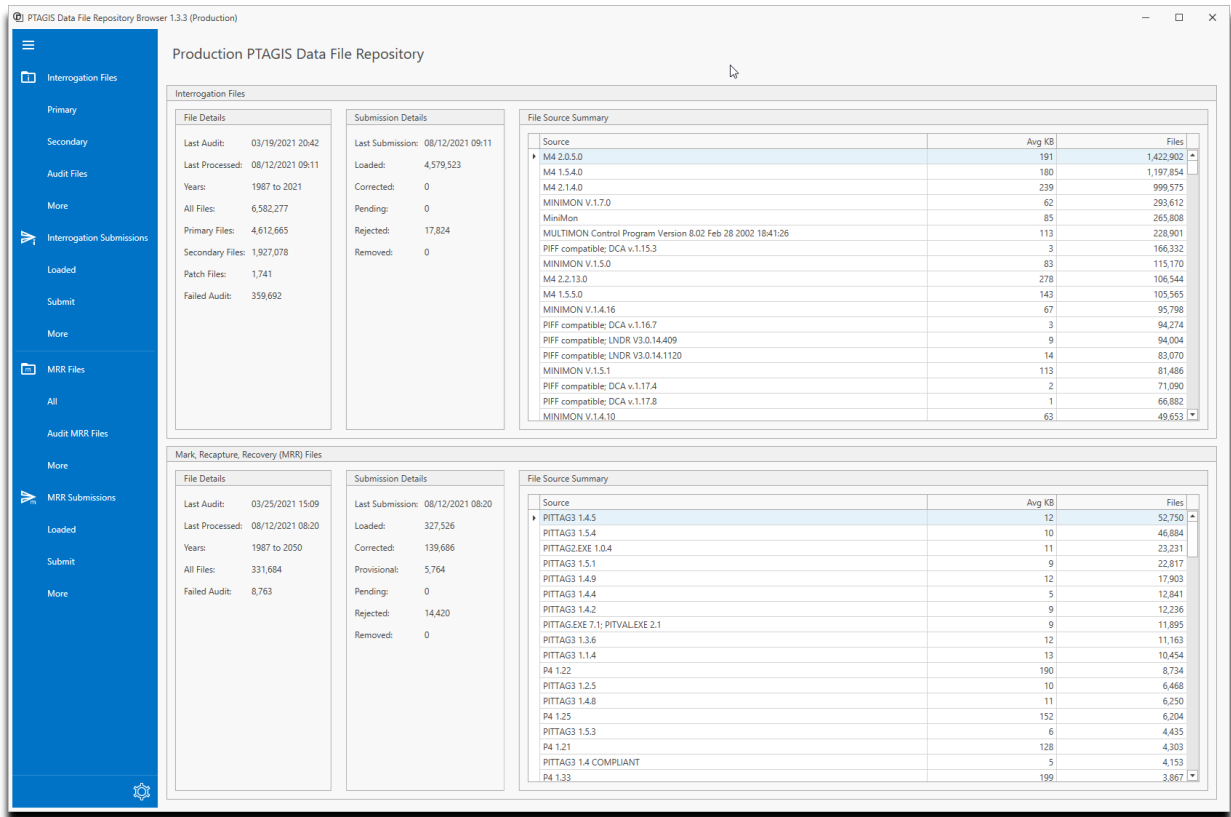
Figure 9. PTAGIS Data File Repository Browser

2021 Plans

Staff will continue to enhance P4, M4, PIFF 2 and internal utility software as needed. I5 will be tested with a working group from the Instream PIT Tag Detection System Subcommittee and released for production use in 2021.

Continue development, refinement, and testing of M5 interrogation software features and related utility software. Deploy in-situ at one or more interrogation sites to ensure long-term performance and reliability of M5 data collection and submission features as well as SbyC. Consider production release of M5 later in 2021 and deployments for the 2022 field season.

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 system.

Ongoing tasks related to this portion of the objective include:

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- 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

2020 Accomplishments
In addition to the mentioned ongoing administrative tasks, updates to the database included:

- Support for new interrogation data model and file format
- Support for new data file repository and audits
- Enhancements to the dimensional model that supports web reporting systems
- Refinement of O&M reports (TSR, ALE and CEA)
- Schema and data migration in support of the development of the new website

2021 Plans
Continue refinement and data migration in support of production release of new website and reporting system. Continue refinement of IDL features in support of M5, I5 and TSR systems. Continue effort to consolidate databases and server hardware used in development of the new PTAGIS website.

Continue to learn and leverage cloud services and solutions to maintain program goals for high-availability, security, performance and costs.

Continue support of database processing (ETL) for data loading, reporting, and system alerting. Perform daily system administration to ensure the overall integrity of the PTAGIS database.

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

2020 Accomplishments

In 2020, the PTAGIS website had 45 thousand visits from close to 9 thousand unique visitors and met the program goals for performance and availability.

Development of a new PTAGIS website continued in 2020 while concurrently supporting the production website. Focus this year was on refinement of workflow features on the Dashboard and implementation of the design and layout that was completed in 2019. The dashboard (Figure 10) is where users log in to the website to request new validation codes or sites; submit event logs for interrogation sites; manage MRR project submitters; request PIT tags; and request and manage SbyC projects.

Security for user authentication was enhanced. Most administrative content management features were implemented to replace features of a proprietary SiteFinity content management system (CMS) used in current production website. These are features supporting documents, images and other types of content served from the new website. Removing this proprietary CMS dependency will significantly ease maintenance and promote additional customization of the new website.
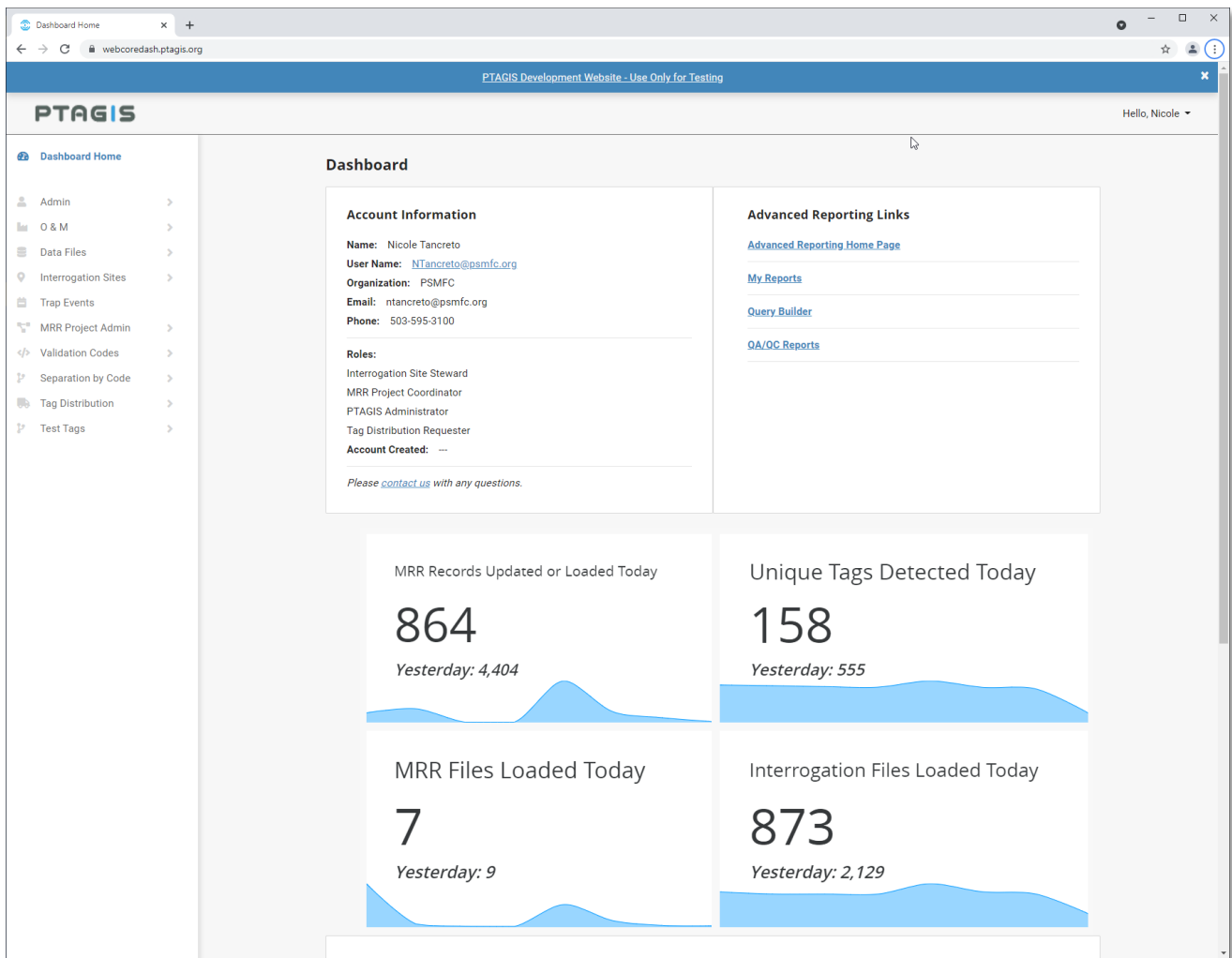
Figure 10. Dashboard section of the new PTAGIS website

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Refinement of the layout and content available on the public part of the new website was also completed in 2020. This involved migrating content such as interrogation site metadata photos, videos, news items, documents, and workshop presentations to the new website. The About pages (Figure 11) were also refined and edited. These pages are intended to provide a brief introduction to visitors who are new to PTAGIS and provide links to learn more.
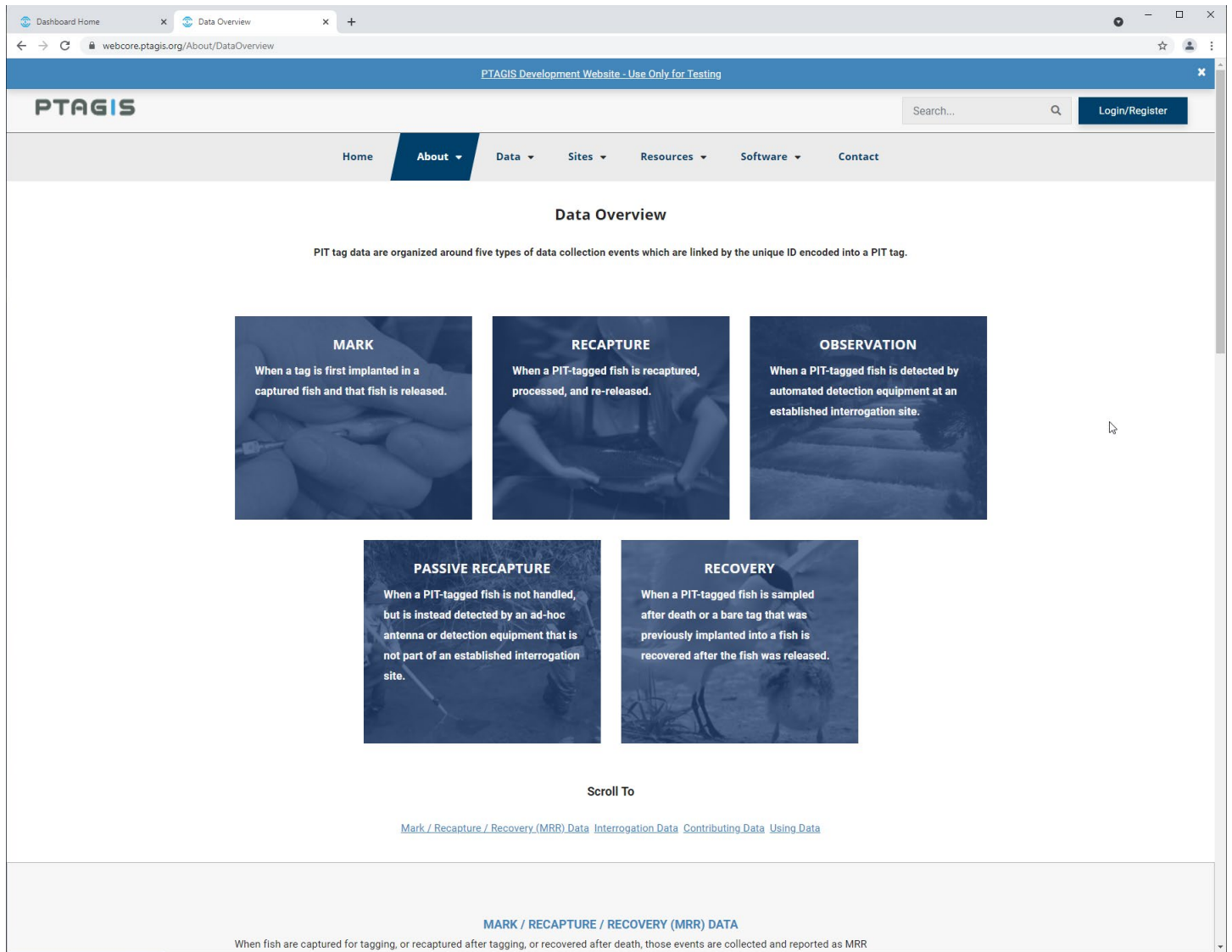
Figure 11. Part of the Data Overview under the About menu item.

Installation and testing of the latest version of reporting software was completed. The upgraded reporting technology was used to develop new reports to be seamlessly embedded on the public side of the website (Figure 12). These reports provide limited access to PIT tag data without the need to create or log into a web account.

Figure 12. Embedded report to view observations at one interrogation site.

The PTAGIS RESTful Web API was refined with additional features and endpoints. This was developed side-by-side with the new PTAGIS website, sharing prevalent technology and best-practices. The PTAGIS Web API provides an application programming interface for systems to acquire and submit data and metadata. A home page (Figure 13) provides a system overview of the endpoints available in the API.
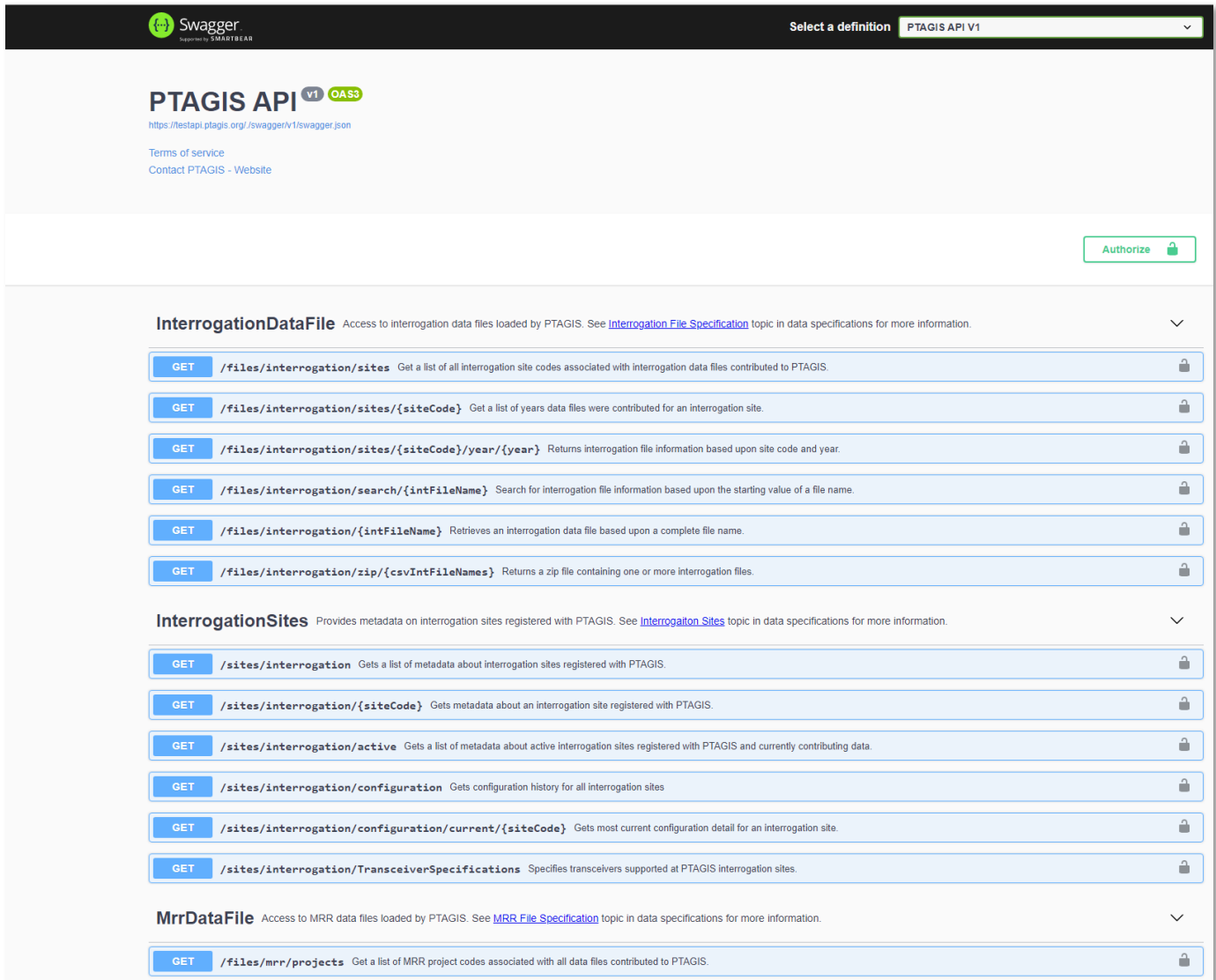
Figure 13. PTAGIS Web API home page

2021 Plans

Continue development and testing of new PTAGIS website and related Web API with goal of releasing in 2021. 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 and an upgraded MicroStrategy reporting system. Implement continuous monitoring and reporting of PTAGIS website availability and performance to ensure it meets the goals of the program.

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 USACE, 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.

2020 Accomplishments
In 2020, 14 projects requested 57 target groups of fish totaling 691,119 tags to be separated. The SbyC projects that involved collecting fish for additional sampling were postponed in early spring due to the pandemic, but the requests to treat PIT-tagged fish like the untagged population continued throughout the season. Table 3 provides a summary of the 2020 projects.

Agency	Project Title	Target Tags
FPC	Comparative Survival Study 2020	389,073
IDFG	Monitoring and evaluation of BY2018 Chinook Salmon smolts released from Idaho hatcheries in the Clearwater and Salmon River basins.	95,985
IDFG	Monitoring Upper Salmon River A-run Steelhead Reared in Circular Tanks	14,976
NOAA	Migration timing and parr-to-smolt estimated survival for wild Snake River spring/summer Chinook salmon smolts	14,949
NOAA	Investigating the origin and migration patterns of bull trout encountered at Lower Granite Dam	11
NPT	Nez Perce Tribe 2020 Separation by Code Request	23,923
ODFW	Wallowa and Imnaha Stock Steelhead Smolt Monitoring and Evaluation_2020 Releases	18,600
ODFW	John Day Adult Steelhead Overshoot Investigation	64,386
USGS	Estimate growth of Clearwater River fall Chinook yearlings, 2020	4,363
USGS	Estimate growth of Clearwater River juvenile fall Chinook salmon subyearlings, 2020	6,874
WDFW	Brood year 2019 Grande Ronde River release	4,500
WDFW	Performance Evaluation of PIT tagged subyearling Chinook released at Lyons Ferry Hatchery 2020	20,000
WDFW	Performance Evaluation of PIT tagged yearling Chinook released at Lyons Ferry Hatchery 2020	10,000
WDFW	2020 Lyons Ferry Hatchery Complex -Snake River, Steelhead Tributary Releases	23,479
	Total Target Tags	691,119

Table 3. Separation by Code request summary for 2020

2021 Plans

Continue processing SbyC Requests in a similar manner as this year. Utilize new configuration management tools when available.

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, known as Separation by Code (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 257 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 14). PTAGIS staff operate and maintain the electronic detection systems that collect this information under a *Memorandum of Understanding (*MOU)[1] between BPA and USACE. Staff performing these tasks work out of a centrally located office in Kennewick, WA.
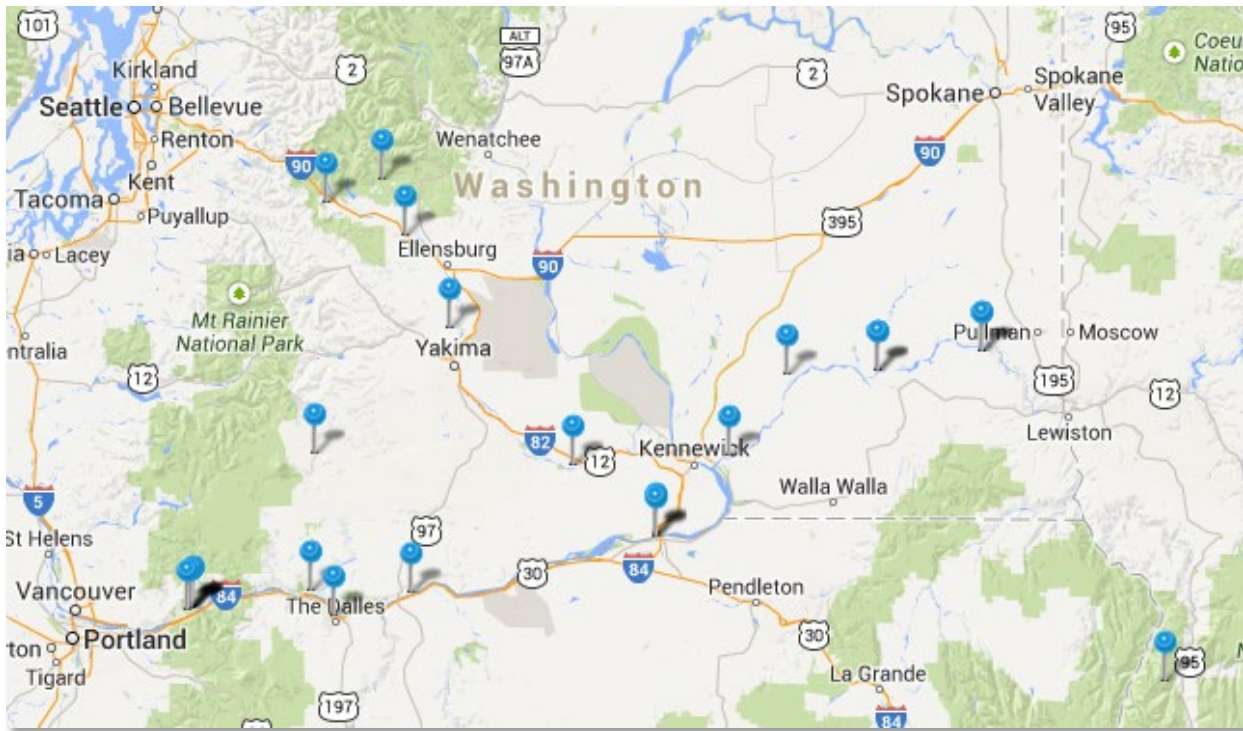
Figure 14. Map of large-scale interrogation sites maintained by PTAGIS

F: 70. Support Separation by Code Systems

The SbyC system is composed of fish-ways 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 USACE 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

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[1] MOU between BPA and USACE (COE) defining roles for installing and maintaining PIT tag infrastructure: https://www.ptagis.org/content/documents/coe-and-bpa-mou-regarding-pit-tag-infrastructure.pdf

cumulative year-to-date efficiencies are refreshed in near real-time as new detection data are received into the PTAGIS database. Staff review those efficiencies from a Web-accessible DGE report (Figure 15) 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.

2020 Accomplishments

The diversion gate efficiencies at each SbyC site remain high due to PTAGIS and USACE in-year and off-season maintenance programs (Figure 15).

Diversion Gate Efficiency Summary

({Divert Time} (Value) Between 1/1/2020 12:00:00 AM and 1/1/2021 12:00:00 AM)

B2J - Bonneville PH2 Juvenile

Site Code	Diversion Gate Antenna Group	YTD Total Fish	YTD Success Count	YTD Failure Count	YTD Percent
B2J	SBYC SEPARATOR GATE	19,965	19,960	1	100.0%

GOJ - Little Goose Dam Juvenile

Site Code	Diversion Gate Antenna Group	YTD Total Fish	YTD Success Count	YTD Failure Count	YTD Percent
	A-SEPARATOR GATE	3,384	3,362	15	99.6%
GOJ	B-SEPARATOR GATE	5,858	5,809	40	99.3%
	DIVERSION SBYC GATE	4,664	4,651	8	99.8%

GRJ - Lower Granite Dam Juvenile

Site Code	Diversion Gate Antenna Group	YTD Total Fish	YTD Success Count	YTD Failure Count	YTD Percent
	A-SEPARATOR GATE	8,198	8,133	59	99.3%
	B-SEPARATOR GATE	6,157	6,075	72	98.8%
GRJ	DIVERSION / SBYC GATE	6,609	6,607	0	100.0%
	RCWY-10 GATE	6,989	6,805	183	97.4%
	SBYC GATE	0	0	0	

JDJ - John Day Dam Juvenile

Site Code	Diversion Gate Antenna Group	YTD Total Fish	YTD Success Count	YTD Failure Count	YTD Percent
JDJ	SBYC GATE	0	0	0	0.0%
	SBYC SEPARATOR GATE	2,202	2,188	14	99.4%

LMJ - Lower Monumental Dam Juvenile

Site Code	Diversion Gate Antenna Group	YTD Total Fish	YTD Success Count	YTD Failure Count	YTD Percent
LMJ	A-SEPARATOR GATE	1,512	1,503	7	99.5%
	B-SEPARATOR GATE	4,416	4,381	30	99.3%

Figure 15. Diversion gate efficiency (DGE) summary for 2020

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.

With the support of the USACE site biologists and site maintenance personnel at three of the Snake River dams, PTAGIS field 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. This will considerably reduce the daily and annual maintenance required by the current pneumatic cylinders. In March of 2019, with full support of the Lower Monumental Dam site biologist, a prototype electric cylinder and actuator was installed on the B-side slide gate (Figure 16) in place of the pneumatic cylinder. During the full season of 2019, the diversion efficiencies on the B-side slide gate met or exceeded efficiencies from 2018. After some slight modifications and enhancements to the prototype cylinder this winter, it remained in service during the 2020 season for further evaluation. With the success of the B-side gate, the A-side gate was also fitted with an electric actuator. Both gate's 2020 diversion efficiency rates exceeded those of 2019.

Figure 16. New electric cylinder at LMJ B-side gate

Field staff assisted with performance analysis of SbyC features of M5 and new hardware platforms throughout the year. Using custom software developed by PTAGIS to emulate tagged-fish traffic at a site, M5 SbyC features were evaluated in the Kennewick Lab (KLAB). This included a new generation of Programmable Logic Controller (PLC) model manufactured by Allen Bradley called Compact Logix. Custom logic was implemented via the PLC and SCADA systems (Figure 17) to measure and report diversion efficiency between M5 and M4. Overall, M5 had lower latency (higher performance) due to the enhanced communication features of the new PLC.

M5 Speed Test Controls

PTAGIS Nav: 🏠 | ⏰ 1 alarm 👤 Sign In Nov 17, 2020, 10:14 PM

Reset All Testing Counts

Testing Information

Testing Revolutions:	5,000
Testing Speed (ft/sec):	10
Tags Per Revolution:	2
Expected Tag Hits:	10,000
Revolutions Remaining:	0
Estimated Time Remaining:	0.1 min

M4-SLC PC:	Dell 780 W7
M5-SLC PC:	Phoenix Contact i5 IPC
M5-CPL PC:	M5-CPL Computer Used...

Reset Testing Variables

01 SLC Comparison	02 SLC Comparison	03 SLC Comparison	04 SLC Comparison
Gate Out Count: 10000	Gate Out Count: 10000	Gate Out Count: 10000	Gate Out Count: 9999
M4 Open Requests: 10000	M4 Open Requests: 10000	M4 Open Requests: 10000	M4 Open Requests: 10000
Last M4 Open Delay: 10	Last M4 Open Delay: 14	Last M4 Open Delay: 9	Last M4 Open Delay: 9
M4 Average Delay: 11	M4 Average Delay: 10	M4 Average Delay: 10	M4 Average Delay: 10
M4 Largest Delay: 45	M4 Largest Delay: 33	M4 Largest Delay: 20	M4 Largest Delay: 52
at: 11/17/20, 6:00:28 PM	at: 11/17/20, 6:25:37 PM	at: 11/17/20, 5:03:38 PM	at: 11/17/20, 5:49:52 PM
M5 Open Requests: 10000	M5 Open Requests: 10000	M5 Open Requests: 10000	M5 Open Requests: 10000
Last M5 Open Delay: 10	Last M5 Open Delay: 14	Last M5 Open Delay: 9	Last M5 Open Delay: 8
M5 Average Delay: 10	M5 Average Delay: 10	M5 Average Delay: 10	M5 Average Delay: 9
M5 Largest Delay: 33	M5 Largest Delay: 34	M5 Largest Delay: 56	M5 Largest Delay: 74
at: 11/17/20, 7:00:18 PM	at: 11/17/20, 5:37:39 PM	at: 11/17/20, 3:12:19 PM	at: 11/17/20, 3:12:18 PM

Dell 780 W7 — M4's Largest Time Elapsed for Selected time: 01: 45 | 02: 33 | 03: 20 | 04: 52

11-17-2020 16:11:15
01 Time Elapsed: 12
02 Time Elapsed: 9
03 Time Elapsed: 10
04 Time Elapsed: 15
01 Time Average: 11
02 Time Average: 10
03 Time Average: 10
04 Time Average: 10

PxC i5 IPC — M5's Largest Time Elapsed for Selected time: 01: 33 | 02: 34 | 03: 56 | 04: 74

Transceivers
- 01
- 02
- 03
- 04

Graph Details

Chart Scaling:
| Max: | 80 |
| Min: | 0 |

Chart Visibility:
- M4 to SLC
- M5 to SLC
- M5 to CmpLogx

Graph Time Selection: Real Time | Days: 0 | Hours: 7 | Minutes: 60 | Time is accumulative. 36 hours is the same as 1 day and 12 hours

Figure 17. M5 vs M4 SbyC diversion gate performance analysis

Additional scoping was performed this year to acquire facility operation metadata from each interrogation site, such as sample gate disposition. This metadata is used for diversion gate efficiency analysis (DGE). Currently, the M4 software captures this metadata via the PLC in the field and submits it in the data file for processing into PTAGIS reporting system. A newly deployed SCADA system is also capturing and reporting this data in real-time from a proprietary database server located in Kennewick office. The goal is not to build additional features into M5 to capture this metadata in the field; instead migrate the metadata on a near real-time basis from the SCADA system database into the PTAGIS reporting system. To support DGE analysis, timestamp fidelity to the second between the SCADA and M5 datasets is required and a suitable time synchronization strategy will need to be implemented.

2021 Plans

Staff will continue to operate and maintain the SbyC systems. Staff will coordinate with USACE to locate and fund additional opportunities in replacing current pneumatic gate mechanisms with electrically activated diversion gates to reduce maintenance costs and improve performance. Continue evaluation of M5 SbyC and hardware features with existing diversion infrastructure with goal for a phased production deployment in 2022. Develop and test migration of facility operation metadata from SCADA system database into PTAGIS on a near real-time basis.

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 USACE 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, antennas, diversion gates and transceivers that provides greater read range, and lower cost for installation.

2020 Accomplishments

BO2 Cascades Island Relocation Project:

Two major upgrades to the PIT tag detection system at Bonneville Dam were partially completed in 2020. First is the complete relocation of the Cascades Island system (BO2). All four antennas shown in Figure 18 were constructed and staged for installation in January 2021. The main reason for the relocation is due to subsidence of the area around the existing system. This has caused the PIT tag electronics room to sink and list to the point of possibly becoming unusable. Access to the ladder transceivers could also be restricted in the near future.
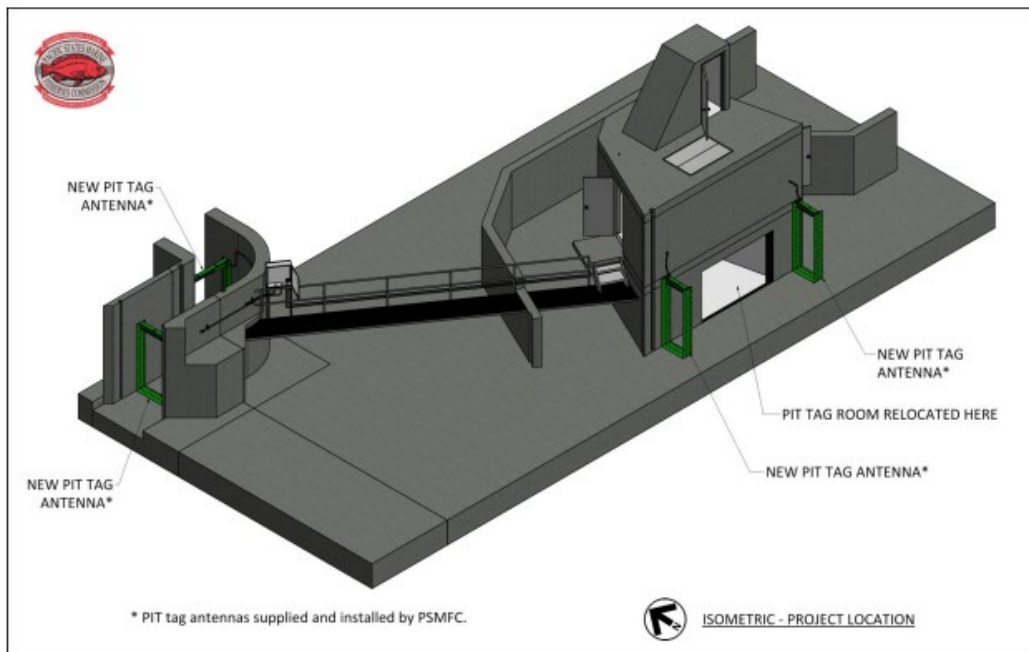
Figure 18. BO2 UMT/counting window conceptual design

A decision was made to install the new antennas at a juncture of the ladder counting window and the Upstream Migrant Tunnel (UMT). Two antennas will be mounted within the UMT and two others will be mounted within the counting window slot (Figure 18). These highly-efficient thin body, ferrite tile antennas will improve detection efficiency over the existing systems in two ways: first, the antennas will cover 100% of the passage area where the existing system only covered the weir-wall underwater orifices and not the overflows. Secondly, the new system will have the capability of running in dual-mode, detecting both HDX and FDX tags (the existing system can only read FDX tags).

The antennas were installed during a planned outage during winter of 2021. The installation date of additional infrastructure to support the system (electrical conduit, etc.) is yet to be determined as the USACE works through the funding process. Once the infrastructure is in place the new system will come into operation.

BO4 Slot Antenna Replacement Project:

Another major upgrade is the replacement of the slot antennas within the Washington Shore serpentine weirs (BO4). All four slot antennas were constructed in 2020 and staged for installation in January 2021. The system, originally installed in 2005, has seen periodic failures of the antennas due to water leakage into the windings. PTAGIS has kept the system in operation using a rotation of repaired spare units. In early 2020 one of the spare units was found to be non-repairable.

The original antennas were a potted design, making them heavy (3000+ pounds) and expensive to build. With this in mind, PTAGIS began designing a replacement antenna using NOAA's recently developed underwater cable. This cable allowed us to build the antennas without a watertight housing. This reduced the weight by two-thirds and reduced the cost to less than 25% of the original.

The four new antennas are slated to be installed in January of 2021 using crane support from the project.

Figure 19. New BO4 PIT tag antennas under construction at the Kennewick lab.

New PIT Tag Antennas on Barge Load Lines at GRJ, GOJ and LMJ:

PSMFC was asked by BPA to investigate the possibility of adding PIT tag detection on the barge load lines at Lower Granite, Little Goose and Lower Monumental juvenile fish facilities. PSMFC investigated and wrote a feasibility report along with cost estimates and submitted it to BPA. The report was reviewed and the decision was made to move forward with the installation of the new antennas and scheduled to start once the facilities shut down for the 2020 season. Prior to the facilities shutting down, PTAGIS gathered components and began construction of the necessary PVC pipes, electrical enclosures, antenna shields, and support structures for the new antennas.

Figure 20. Barge load lines at Lower Granite Dam.

Once the final locations and transitions were agreed upon, it was decided to install two antennas on the barge load line at Lower Granite (Figure 20), four antennas at Little Goose (they are currently the only facility that utilizes the barge load lines and direct barge load lines) and two antennas on the barge load lines at Lower Monumental. All antennas will be installed on new 10" PVC pipe sections provided by PSMFC.

In September PSMFC began working to assemble the necessary equipment for construction and installation of the new antennas. This included the design of a low-profile donut style shield for shielding the antennas from outside interference. This work was completed at PSMFC's Kennewick lab.

As of November, the progress has been moving forward on schedule. The infrastructure and electronic enclosures have been installed at Lower Monumental. The antenna shields for all three sites were fabricated and the PVC pipe pieces are being constructed.

The project has proceeded successfully thanks to the collaborative efforts of the USACE site biologists and related staff. The new antennas will be installed and functional prior to the 2021 season.

2021 Plans

- PSMFC/NOAA was requested by the Yakima Nation to R&D new antennas for the Castile Falls Weir Wall and/or In-Stream type antennas. Designs and prototyping will start in 2021 with installation projected for 2022.
- Easton Dam Adult Ladder & Juvenile Bypass design for the BOR. This will include 5 antennas on the ladder and 2 on the juvenile bypass and a PIT tag electronics room. Once complete PSMFC will take over O&M of the system.
- B1 I&T Sluiceway Automated Antenna Gate Design. This first of its kind system will be designed and prototyped in the Kennewick lab.
- Investigate the possibility of detection at the Little Goose adult ladder 3 entrances. A low-cost system will be designed and submitted to the USACE FFDRWG and FPOM groups.

- Along with the new IPC DCP, a new PLC/HMI/SCADA system will be designed for LMJ in support of M5 production deployment. Installation of the system will be started in the winter of 2021 and will be completed prior to 2022 season start.

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 456 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. USACE and other agencies are cooperative in helping to control noise sources.

Field staff record general maintenance and anomalous events by submitting event logs to the PTAGIS system. The logs 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, repairs the equipment in-house.

2020 Accomplishments
System-Wide Data Collection Platform Upgrade

A multi-year effort to replace currently deployed, consumer-grade, Windows 7 PCs (obsolete due to lack of support from Dell or Microsoft) with industrial-rated Phoenix Contacts IPCs (Figure 6) running [Windows 10 Enterprise LTSC](#). This data collection platform (DCP) upgrade will consist of replacing 60 field computers and the remodeling of all PIT tag electronic rooms at 30 remote interrogation sites. This upgrade will also include:

- Production deployment and configuration of M5 software using tag-based communication between the software and PLC.
- Replace the current generation of Allen-Bradley SLC-505 PLCs (no longer supported by Allen-Bradley) with Allen-Bradley Compact Logic 5380 PLCs; replace all HMIs with Phoenix Contacts WP4000s HMIs.

- Replace the majority of serial communications equipment with Ethernet-based counterparts, eliminating all serial RocketPort multiport, serial cards and serial "Y" cables.
  - PSMFC-Kennewick office developed a Serial to Ethernet (STE) converter that allows a transceiver to be I/P addressable with emulated serial communications to support older generation of transceivers that lack Ethernet connections.
- Replace all lead-acid UPS systems (currently failing) with SCADA-ready, lithium battery models.
- Link all DCPs, PLCs, UPSs and HMIs under SCADA.
- Meet [FISMA](#) and other industrial security requirements for all systems

Juvenile Bypass and GRS O&M

Juvenile fish bypass facilities on the Snake and Columbia Rivers began operating in March and April. Detection efficiency rates for 2020 are being kept 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 on NOAA live fish testing using 12mm tags.

On April 3, 2020, the spill gates were opened and the GRS Pit tag detection system began immediately detecting 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 OGEE is periodically opened, then closed for various reasons. As of Nov. 4th, 2020, all 11 antennas have detected nearly 160,000 PIT tags combined.

Before April 3rd, in conjunction with the US. Army Corps of Engineers, PSMFC, and NOAA fisheries conducted short-duration test spills to evaluate the system performance before the mandated, continuous spill. During these tests, an issue arose on antenna 0A located in the lower row. After extensive troubleshooting and evaluation, in order to determine the cause of the failing antenna was to access components inside the antenna itself. During the evaluation, it was found that a gland fitting used to keep water out of critical locations within the antenna body had failed and water had come in close contact with one of the antenna cable connections (Figure 21). This caused severe electrical arching due to the high voltage generated by the antenna, loss of antenna current, and excessive interference.
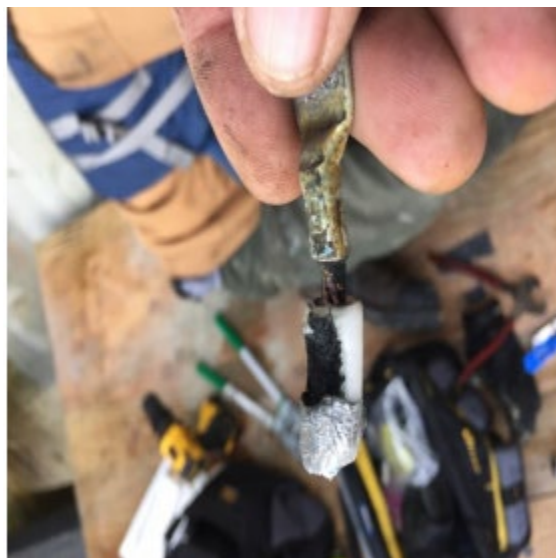

Figure 21. Antenna cable end damaged by electrical arching.

Figure 22. Work skiff providing access to the OGEE.

After repairs were made to the antenna cable end, along with the failed cable gland fitting, the antenna was returned to service and was operating as expected. Currently, there have been no additional failures on any of the 11 antennas as they continue to operate at peak performance. Currently, a few remaining issues are being addressed:

1. Junction boxes the antenna cables pass thru periodically loosen due to vibration from the spill, causing electrical noise in the transceivers. PSMFC is working with the USACE to resolve this and has proposed a solution to permanently correct this.
2. The conduits that contain the antenna cables are filling with water due to mass head pressure. PSMFC coordinated with USACE to find a solution to prevent the water from backing up into the transceiver enclosures.
3. To provide future access to the OGEE surface for repairs and or inspection of the antennas, a work barge access platform is currently being designed by the USACE and will provide the access necessary for longterm maintenance of the GRS detection system. PSMFC-Kennewick staff continue to provide daily monitoring of the GRS PIT tag system performance and supporting infrastructure.

PRO-Chandler Dam PIT tag transceivers in the right, center, and left ladders transmit detection data via radio link to a central data collection platform located at the Juvenile Fish Facility (JFF) approximately ½ mile east of Chandler Dam. The transceivers in the JFF transmit data over fiber optic cable directly to the data collection platform located in the JFF.

This next phase of communication upgrades consists of replacing the legacy serial multiplexer RocketPort I/O cards. These cards are obsolete and will not integrate into the long-term plan of Ethernet I/P based communications schema. PSMFC-Kennewick office developed a Serial to Ethernet (STE) converter that allows a transceiver to be I/P addressable while still sending data via serial communications. Ethernet I/P allows for a more maintainable, cleaner and modern approach to data collection. This upgrade will also integrate well into the new M5 data collection software.

Figure 23. Upgraded communications panel ready for installation at PRO

Adult Ladder O&M

Adult ladder detection efficiency also remains high in dam-to-dam comparisons. All sites maintained an approximate 98 to 99% detection efficiency over a 12-month rolling report period (Figure 24).

Ladder Location	Bracket Tags	Ladder Tags	Missed Tags	Percent Detected
BON	5,326	5,325	1	100.0
GOA	3,795	3,776	19	99.5
GRA	669	669	0	100.0
ICH	4,089	4,044	45	98.9
JDA	12,551	12,305	246	98.0
LMA	3,865	3,833	32	99.2
MCN	4,169	4,151	18	99.6
TDA	12,576	12,415	161	98.7

Definitions

Column	Definition
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 tags detected at bracket sites also detected at ladder site

Sites Used

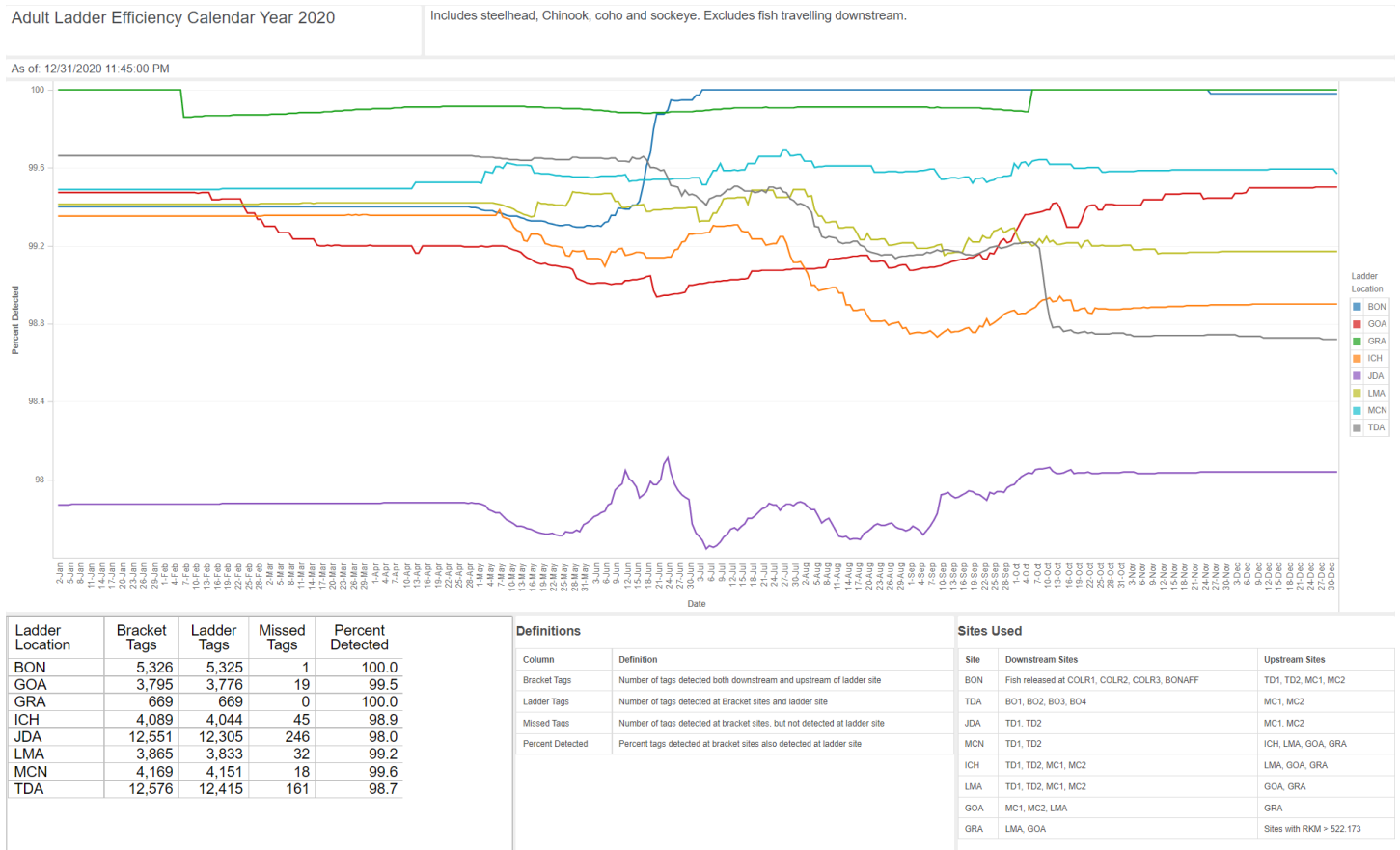| Site	Downstream Sites	Upstream Sites
BON	Fish released at COLR1, COLR2, COLR3, BONAFF	TD1, TD2, MC1, MC2
TDA	BO1, BO2, BO3, BO4	MC1, MC2
JDA	TD1, TD2	MC1, MC2
MCN	TD1, TD2	ICH, LMA, GOA, GRA
ICH	TD1, TD2, MC1, MC2	LMA, GOA, GRA
LMA	TD1, TD2, MC1, MC2	GOA, GRA
GOA	MC1, MC2, LMA	GRA
GRA	LMA, GOA	Sites with RKM > 522.173

Figure 24. 2020 adult ladder efficiencies in dam-to-dam comparisons

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Enable HDX Detection at Full Flow Bypass Systems

Recently, fish biologists and researchers have expressed interest in lamprey detection capability in full flow juvenile bypass pipes. Currently, the juvenile bypass detection RFID transceivers at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, and John Day dams are configured to detect full duplex (FDXB) tags only. In order to detect lamprey tagged with half duplex (HDX) tags, dual detection mode would need to be enabled on these transceivers so they can detect both FDXB and HDX tags. There was some concern that enabling dual detection might negatively impact juvenile salmonid detection. This is due to the operation mode of HDX detection having an on/off cycle time of 70 milliseconds.

FDXB tags have a detection time of 30.5 milliseconds and therefore would only read once for every HDX cycle, or less than half as often when HDX is not enabled. Using known historical data of reads per tag, we determined that salmonid detections should not be negatively impacted. Due to an abundance of caution, it was decided to pick one site to test turning on dual detection mode. We chose the full flow detection system at the Bonneville juvenile facility (site code B2J) for the test due to the redundancy of the separator monitors being able to provide data to compare detection efficiencies.

Dual detection was enabled on full flow transceivers 01 through 04 at B2J on 4/24/2020. These full flow detection counts were compared to the counts on the separator monitors to ensure detection efficiencies were not negatively impacted. No HDX lamprey detections have occurred at this site during this period. In coordination with a NOAA statistician, a full analysis of system performance was completed in the fall of 2020 with no loss of detection observed on the full flow bypass pipe. The results will be presented to the PTSC in support of enabling HDX detection system-wide.

2021 Plans

- Replace the unreliable DSL services at Lower Granite and Little Goose with StarTouch microwave communication service. Lower Monumental is currently operating microwave communication without issue.
- Assume O&M of the West-Fork System installed by the USACE in 2016 at GRA. This requires acquiring transceiver and other assets from USACE inventory.
- Complete the design of the Easton Dam antennas and infrastructure and assist the BOR with the installation.
- Complete the installation of PTAGIS-designed STE boxes that replace obsolete RocketPort serial interfaces.
- Test M5 and start the deployment of M5 and IPC DCPs at all sites.
- Complete the installation of barge load line antennas at LMJ, GOJ and GRJ.

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

NOTE: tasks in this section overlap with deliverables already described in previous sections

- *F: 70. Support Separation by Code Systems*
- *G: 70. Install Interrogation Systems in Field Locations*
- *H: 160 Operate and Maintain Interrogation Systems in Field Locations*

2020 Accomplishments

Examples of 3D CAD drawings created by Kennewick staff in support of new interrogation site installation and antenna design.
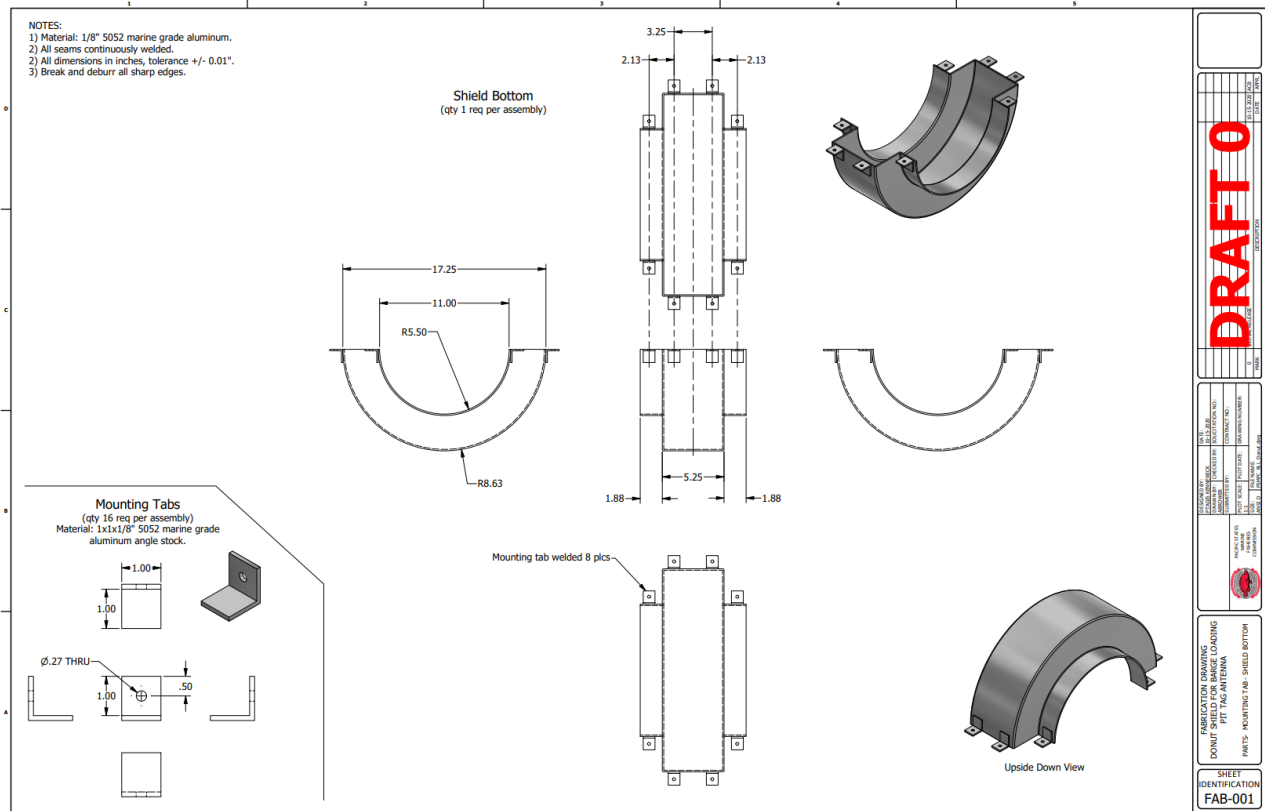

Figure 25. Antenna shield fabrication specifications in support of barge load line systems
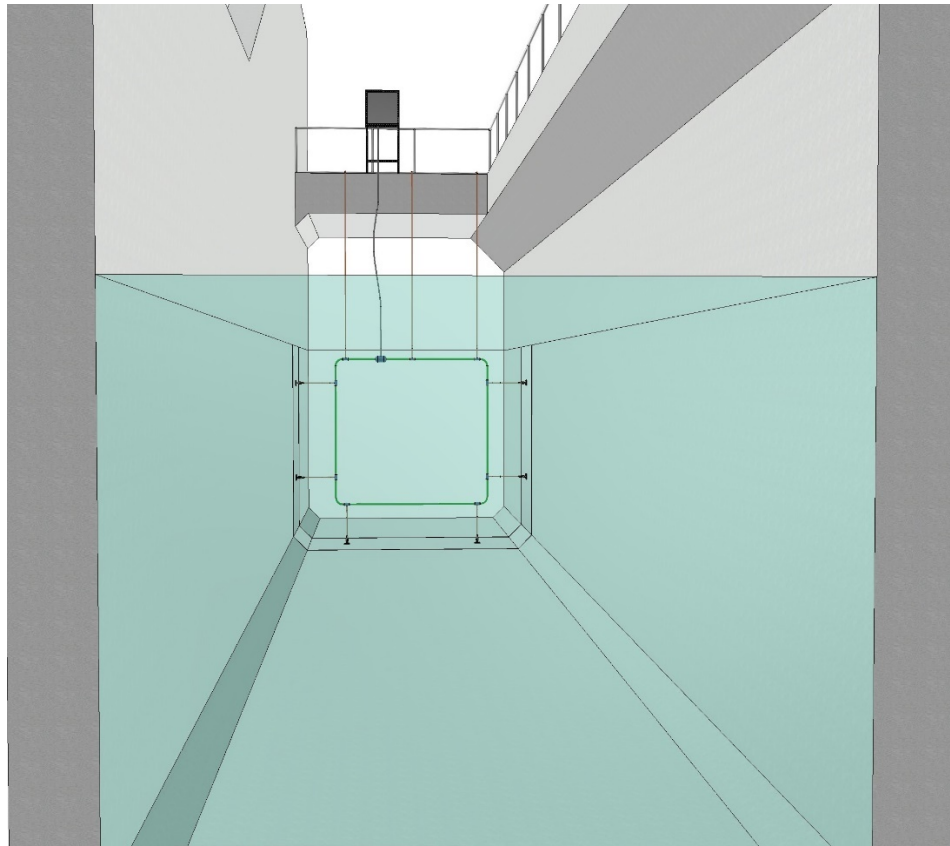
Figure 26. Conceptual antenna design for Little Goose NSE communicated at FFDRWG

2021 Plans
Continue these ad-hoc tasks in support of program deliverables.

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 are well defined; therefore, no additional detail is needed:

- 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

2020 Accomplishments

Completed all contract-related deliverables such as annual and periodic status reports on schedule. Submitted new funding package for FY21 in December 2020. Staff performed an annual inventory audit and the product was loaded into Pisces for the FY21 funding package.

Revised budgets were submitted for the FY20 contract in support of Barge Pipe Antenna installation at LWG, LGS and LMN; replacement antennas at BO2, BO1 and BO4; and a portion of the data collection platform upgrades for interrogation sites managed by PTAGIS. The 2021 PIT Tag Workshop and installation of additional electronic gate installations were postponed due to pandemic.

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

2021 Plans

Continue routine administration of the contract as described. Audit program inventory and submit request to dispose obsolete equipment well before contracting period.

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.

2020 Accomplishments

Staff answer approximately 20 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.

Staff continued work on P4 training videos and created new training videos for the reporting system These video tutorials are short 5 to 10-minute videos providing instruction on how to do specific tasks in P4 and in the advanced reporting system. New staff of data contributor organizations can find them on the PTAGIS Tutorials web page and view the videos covering the tasks they need to learn. Five P4 videos were produced and published on the PTAGIS website in 2020. Seven advanced reporting videos were produced and will be featured on the new website when it goes into production.

Complete the P4 and advanced reporting video tutorial series for the new website. Add closed captions to all tutorial videos. Continue providing technical support for all publicly available PTAGIS systems. Create additional online video tutorials as needed and email surveys to promote better user experiences.

K: 189 Coordination- Columbia Basinwide

This objective covers standard regional coordination activities such as:

- Participating and the hosting of PIT Tag Steering Committee meetings[2]
- Participating in and providing ad-hoc data requests to policy and technical forums
- Conducting email campaigns and surveys
- Publishing and distributing a semi-annual PTAGIS newsletter[3]

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

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[2] PIT Tag Steering Committee Meeting Notes Archive:
https://www.ptagis.org/Resources/DocumentLibrary?filterDocumentsBy=Meeting Notes
[3] PTAGIS Newsletter Archive: https://www.ptagis.org/Resources/DocumentLibrary?filterDocumentsBy=Newsletter

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

2020 Accomplishments

Staff participated in a PNAMP meeting in November of 2020 to improve standardization of facility layers managed by StreamNet into MonitoringResources.org's Sample Design and Monitoring Explorer tools, reusing PTAGIS interrogation site metadata from the PSMFC GIS system.

PTAGIS staff distributed 1.47 million tags to 68 FWP in 2020. The testing of 3% sample of those tags for quality assurance found no significant manufacturing defects.

General, on-going activities that include data contributor coordination are summarized in Table 4.

Coordination Type	Action	Count
MRR Projects	Added/Updated	17
MRR Sites	Added/Updated	25
Interrogation Sites	Added	13
	Decommissioned	5
	Updated	131
Newsletters	Published	2
News Items	Published	9
Support Requests	Fielded	~20/mo.

Table 4. Summary of on-going, general coordination activities performed in 2020

The subsequent sections describe other principal coordination activities completed in 2020.

PIT Tag Steering Committee Coordination

The annual PIT Tag Steering Committee (PTSC) Meeting took place February 6, 2020, in Portland, OR. Meeting notes are available in the PTAGIS document library. Staff provided a review of program accomplishments in 2019 and plans for 2020. NOAA staff provided a similar update on the NOAA R&D contract. The chair and co-chair of the Instream PIT Tag Detection Subcommittee (IPTDS) reported back to the PTSC about their first annual meeting. Notable action items:

- Initiate process to install new site at Easton Dam upon request from Bureau of Reclamation (BOR)
- PTAGIS to coordinate with NOAA on R&D for expansion of Castile Falls site
- PTSC to coordinate with FPAC/FPOM to request USACE sign over Lower Granite ladder entrance and exit antennas to PSMFC so PTAGIS can assume O&M
- On-going coordination with USACE and USFW was established to obtain agency tag distribution metadata to be incorporated into PTAGIS database
- PTAGIS to implement online event log feature for MRR sites

Instream PIT Tag Data System Steering Subcommittee Coordination

PTAGIS coordinated and hosted three Instream PIT Tag Data System (IPTDS) Subcommittee meetings in 2020. The inaugural meeting took place in person in the PSMFC Portland office and meeting notes are available on the PTAGIS document library.

The group reviewed the charter and discussed committee membership and roles. Committee members are expected to coordinate with their respective organizations when providing input and feedback on committee discussions. The IPTDS Subcommittee webpage shows a list of current members along with contact information.

Subsequent virtual meetings were conducted in July and December of 2020. Notable actions from these meetings:

- Workshop topics were identified based upon the results of a community survey
- Standards for interrogation site diagrams were discussed and working group was formed; a template was subsequently presented with instructions using Google Earth image and optional stream profile.
- A working group was identified to provide feedback on a beta release of PTAGIS I5 software

PTAGIS Data Specification

The PTAGIS Data Specification is a living web publication that replaced the PIT Tag Specification Document that has traditionally been published as a static document. The primary purpose of the Data Specification is to provide details about both MRR and interrogation data and file requirements, submission procedures, and lists of current validation codes. A change log provides links to past specification documents and will record any changes made to current specification. The PTAGIS Data Specification is available online at www.ptagis.org/Resources/Specifications.

In 2020, the data specification section on Validation Codes was updated and reorganized to better fit how validation codes are used in P4 tagging software and on the new website.

Plans for 2021

Coordinate annual meetings and related activities with the PTSC and IPTDS. Determine if a PIT Tag Workshop can be held in 2022 (it was originally scheduled for 2021, but postponed due to the pandemic). Continue distribution, inventory and QA sampling of PIT tags to all FWP. Participate in other ad-hoc coordination efforts as requested.