

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

2022 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) [Columbia Basin Fish & Wildlife Program](#).

Researchers from twenty-eight organizations contributed data for 2.03 million fish marked with a PIT tag in 2022, with an accumulated total of over 55 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 2022, the 294 interrogation sites contributing data to PTAGIS detected 897,823 unique fish, yielding a cumulative, detected fish total exceeding 22 million. One fish can generate many observation records as it passes through multiple PIT tag antennas at an interrogation site; 13.7 million observations were reported to PTAGIS in 2022, increasing the total number of observations recorded since 1987 to 281 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 281 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.

2022 Highlights

Data Management: PTAGIS processed 850 thousand data files with 565 million records¹ inserted into or updated in the database. All PIT tag data is accessible to anyone through the PTAGIS website; this year, 724 users executed 610 thousand queries resulting in 15.2 billion rows of returned data.

Website Usage: Most PTAGIS users interact with PTAGIS data and systems through the [PTAGIS website](#). In 2022, the site averaged 15 hundred unique visitors viewing 27 thousand pages per month. New tools were added to allow data contributors to manage the metadata for their interrogation sites and to control who can submit data and receive notifications. A user survey conducted at the end of the year confirmed high levels of satisfaction and provided constructive feedback for further refinement.

Evaluation of SbyC Platform Upgrade at LMJ: The new equipment and M5 software installed at [LMJ](#) near the end of 2021 was evaluated during the 2022 juvenile outmigration. Throughout the season, the new system was compared to old system and they reported the same diversion gate actions and efficiency. Staff will continue to upgrade remaining SbyC platforms.

Installation of Interrogation Systems: Completed installation of the new electronics room at the Bonneville Dam Cascade Island Fish Ladder ([BO2](#)) and promoted the new counting window and UMT antennas to production in February, taking the sinking electronics room and weir antennas out of service.

¹ Records include mark, recapture, recovery, and observation data as well as diagnostic output from field equipment

Lower Granite Dam Spillway Site O&M: All eleven antennas at the [GRS site](#) operated with significantly fewer issues than in 2021. The entire site is now controlled by a SCADA remote control system developed by staff in the Kennewick office. A remote sensor was added to detect gate position to alert staff to spill which influences the operation of the system. A NOAA-funded transceiver synchronization system was installed and tested after the 2021 season and performed without issue in 2022. PTAGIS staff developed a system to allow remote control of antenna power-supplies to further refine performance and detection efficiencies and will be installed in 2023.

PTAGIS Software and Systems: researchers uploaded 20 thousand data files² this year using [P4 tagging software](#) developed and released by PTAGIS in 2016. A new version was released this year to add support for the Biomark electronic measuring board and for Windows 11. A user survey conducted at the end of the year confirmed this mature software continues to meet the needs of the community.

A community version of the [M5 interrogation software](#) was released for use at interrogation sites operated by agencies other than PTAGIS which can support a dedicated data collection computer. At the request of researchers, the Windows-based software was rebuilt to run on less expensive Linux-based computers such as the Raspberry PI and to also leverage lower power requirements. The community release of M5 was installed at 8 interrogation sites not managed by PTAGIS and used to submit over 18 thousand files.

The [I5 interrogation software](#) was officially released for production use in early 2022. This software is used for interrogation sites lacking power or communication to operate M5 on a dedicated data collection computer. The software allows stewards to connect to one or more PIT tag readers at the site (in-person or over satellite/cell communication), download stored observation data, review and edit the data, and then submit it to PTAGIS with a push of a button. Researchers submitted over 750 data files from 98 sites this year using this software. Expanded documentation and video tutorials were also made available to the community. Five additional releases of this software provided feature refinements and bug fixes.

Progress was made this year to identify costs and evaluate technology for migrating PTAGIS server systems from on-premises to the [Azure cloud](#). Staff followed industrial best-practices to develop proof-of-concept, cloud-based systems to ensure a successful migration strategy. A portion of the fundamental infrastructure, such as virtual networking and database synchronization, was implemented in the cloud this year. Cloud migration is an established trend to increase flexibility, performance, and security while returning higher yields on investments. Once migrated, the program will no longer need to procure server hardware that becomes obsolete after a few years. Migrating to the cloud will provide an opportunity to leverage innovative, cloud-based analytical and querying tools, which can offer researchers deeper and more efficient insights into this large database at an economy of scale.

Ongoing data management, coordination and O&M activities:

- Meeting coordination for the [PIT Tag Steering Committee](#) and [Instream PIT Tag Data System \(IPTDS\) Subcommittee](#).
- Maintenance of validation codes used in data entry and reporting systems in addition to metadata and contact information for [interrogation sites](#).
- Technical support to PTAGIS users.
- Publication of [newsletters](#) and [news items](#).
- Provide computer-aided design (CAD) and other expertise in support of new interrogation site projects.
- Year-round daily monitoring of interrogation systems at large-scale mainstem dam fish passage facilities.

² 13 thousand P4 data files uploaded as new data and another 7 thousand uploaded as corrections

- Repair of detection system components.
- PIT tag distribution and quality assurance.

This year, the program's dedicated staff continued to work efficiently from their home offices, utilizing online collaboration tools for video conferencing, knowledge-sharing, and progress tracking. Multi-year objectives were completed and all contract work elements were delivered on-schedule and under-budget. The PTAGIS program continues to be a vital research tool to the region and provides an excellent return on investment to the BPA Fish and Wildlife Program.

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 2022 and further describes work elements of the PTAGIS project related to collection, management and web delivery of all PTAGIS data.

PTAGIS received and processed 20,628 MRR (mark/recapture/recovery) data file submissions in 2022. Through these data file submissions, researchers contributed 2.02 million fish marked with a PIT tag to the PTAGIS database in 2022 with a cumulative 55 million records (*Figure 1*). These records were collected and submitted to PTAGIS by 30 organizations as they marked and released fish at 399 locations throughout the Columbia Basin. The composition of marked species was similar to previous years.

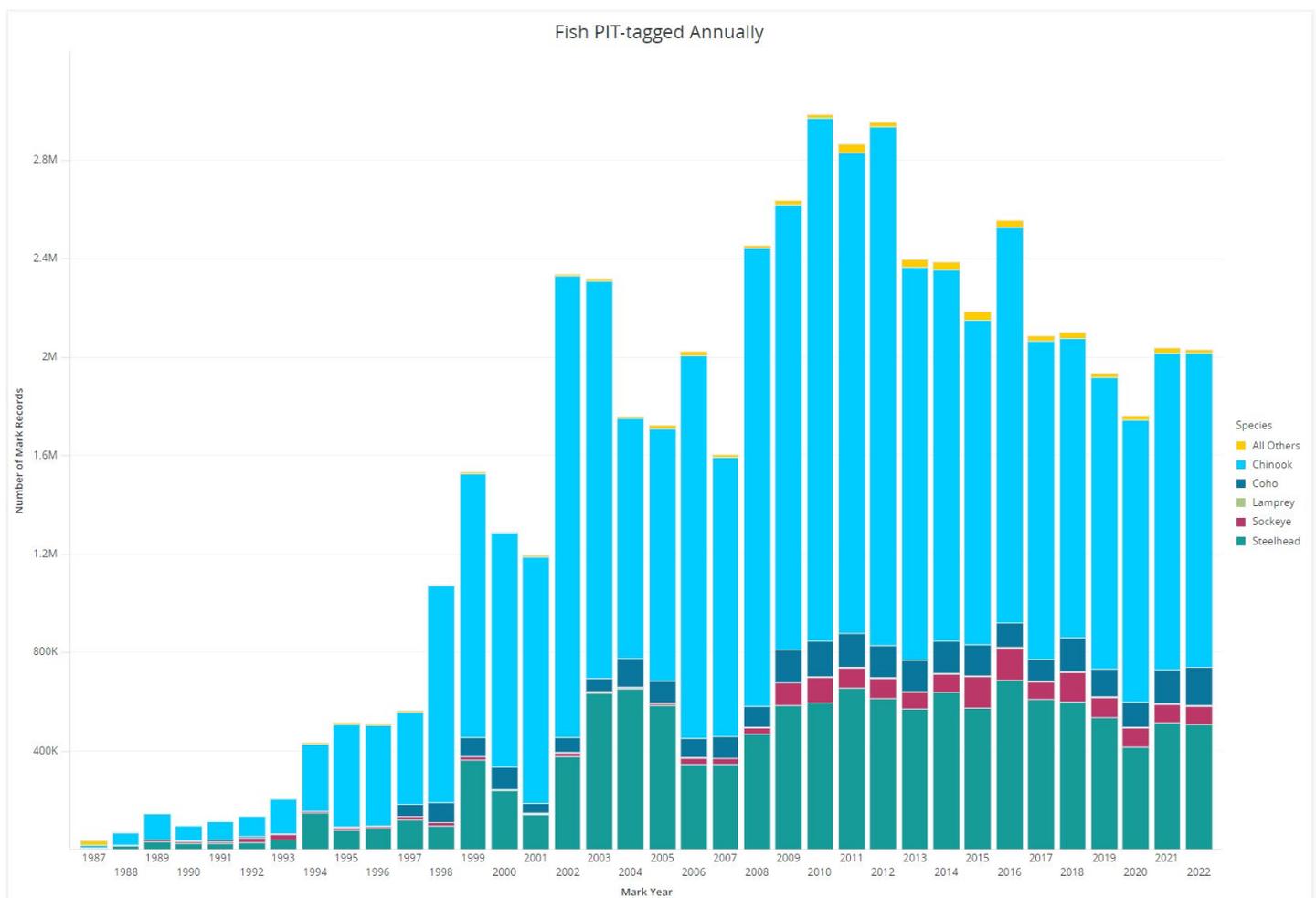


Figure 1. Numbers of fish PIT-tagged annually by major species group.

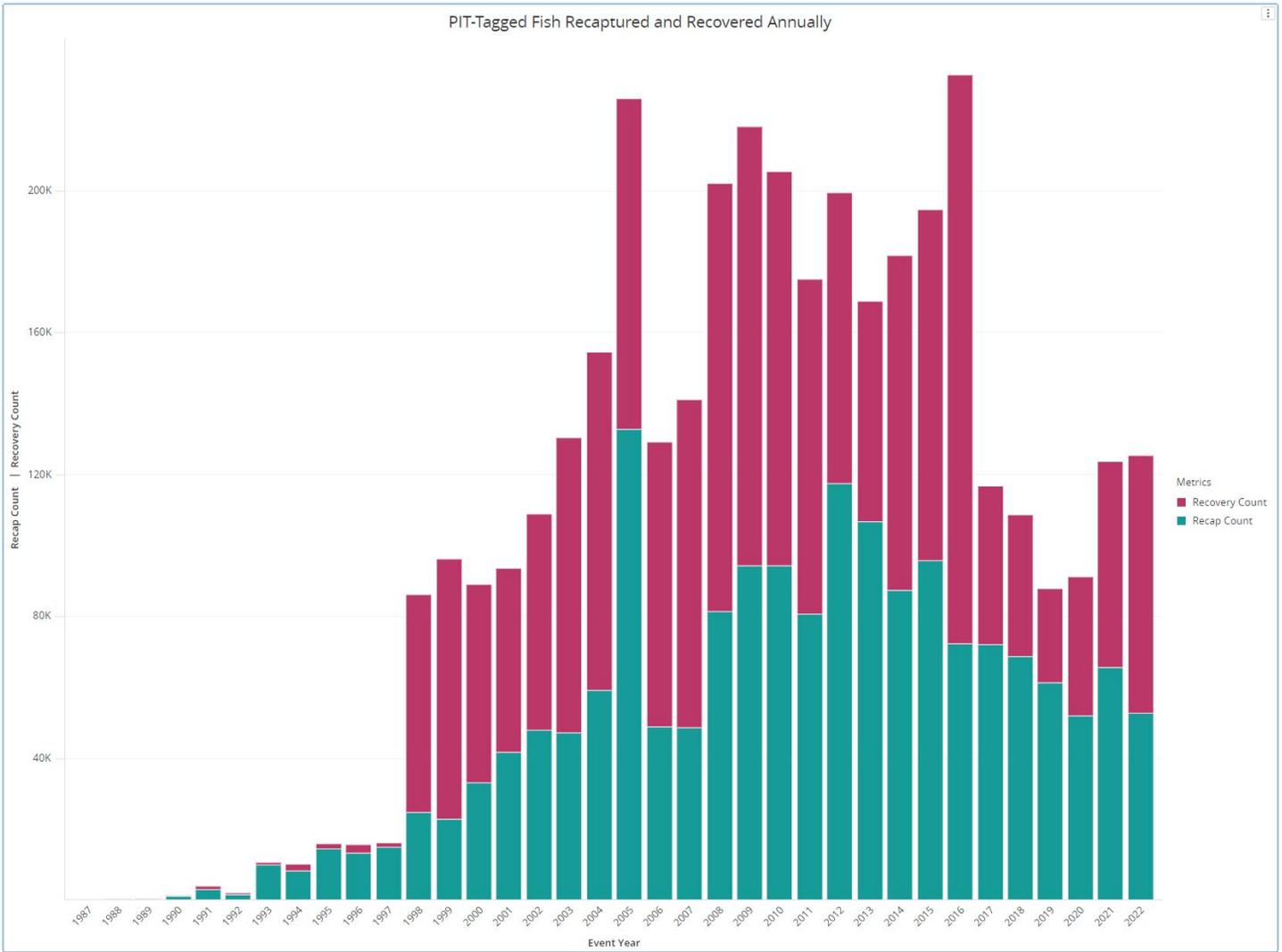


Figure 2. Numbers of PIT-tagged fish recaptured or recovered annually.

The number of marked fish reported as *recaptured and re-released* in 2022 was just over 52 thousand and approximately 72 thousand have been reported as recovered (*Figure 2*).

PTAGIS received and processed over 828 thousand interrogation data file submissions from 294 interrogation sites in 2022. These data file submissions contained detections of 897,823 distinct tagged fish (*Figure 3*). One fish can generate many interrogation records (observations) as it passes through multiple PIT tag antennas at one or more interrogation sites; 13.7 million observations were reported to PTAGIS in 2022 totaling 280 million observations since 1987.

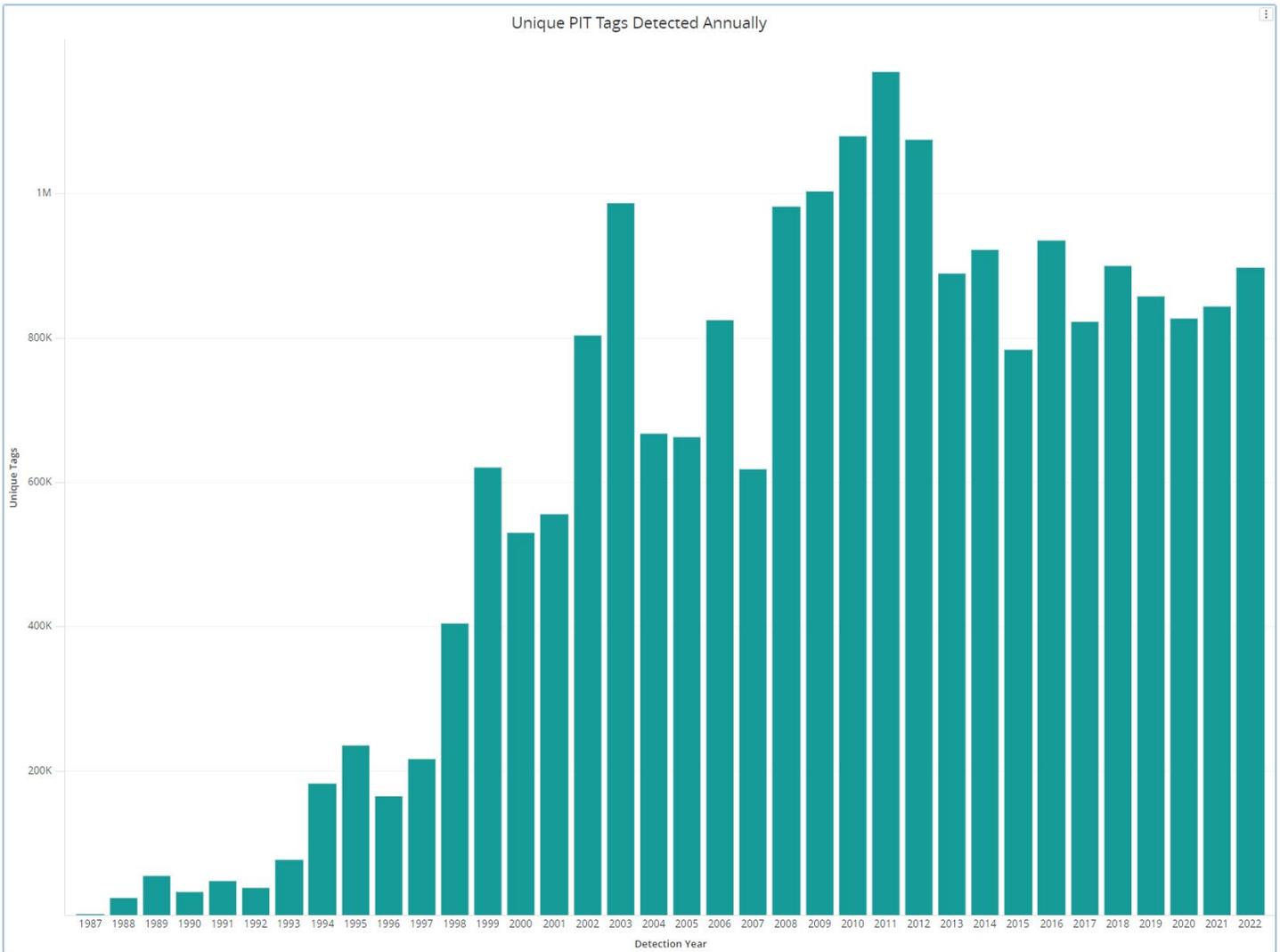


Figure 3. Unique tags detected annually at interrogation sites registered with PTAGIS.

To give additional scope to the overall data management efforts in 2022: 724 PTAGIS users executed 610 thousand queries resulting in 15.2 billion rows of data returned. Those 724 users are grouped by their respective organizations in Table 1.

Organization	No. Users
All Others	284
Washington Dept. of Fish and Wildlife	84
Oregon Dept. of Fish and Wildlife	65
Idaho Dept. of Fish and Game	51
U.S. Fish and Wildlife Service	38
Yakama Nation	33
Pacific States Marine Fisheries Commission	32
NOAA Fisheries	30
Nez Perce Tribe	28
University of Idaho	22
Colville Confederated Tribes	16

US Army Corps of Engineers	15
U.S. Geological Survey	14
Confed. Tribes of the Umatilla Indian Reser.	12
TOTAL	724

Table 1. PTAGIS data access in 2022 summarized by organization

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

This objective delivers secure, highly performant and highly available 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	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 dozens 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	I5, SbyC Configuration Manager, Tag Inventory Manager, Tag Sorter Utility, Data File Repository Browser, Patch Manager, Peripheral Emulator	PTAGIS provides utility software to import, standardize and submit raw observation data collected from the internal storage of a tag reader operating at a small-scale interrogation site. PTAGIS also develops and supports internal software systems to perform data/configuration/file management, QA/QC, and performance regression testing of software systems.

Table 2. Types of PTAGIS field data collection systems

2022 Accomplishments

M5 Software Community Release and Successful SbyC Evaluation

A community version of fifth-generation interrogation software, called [M5](#) (Figure 4), was released in 2022. The community release targeted both Windows and Linux so that it can be operated on low-powered platforms such as a Raspberry Pi. PTAGIS staff worked with data contributors operating remote interrogation sites to install M5 on Raspberry Pi systems to collect and submit production data. Eight sites successfully used M5 to submit data during the 2022 season. The community release required developing scripts to support automated installation on Linux similar to that of the Windows version. Documentation was also updated including a section on [security considerations for M5 deployments on Raspberry Pi](#) based upon research from PTAGIS staff and IPTDS Subcommittee members.

In support of interrogation sites operated by PTAGIS, M5 SbyC features were evaluated in situ at one separation-by-code site (LMJ) for the 2022 season. M5 was installed side-by-side with M4 and the target tags and gate diversions of both systems were compared over the 2022 season, with M5 successfully diverting all target tags as expected.

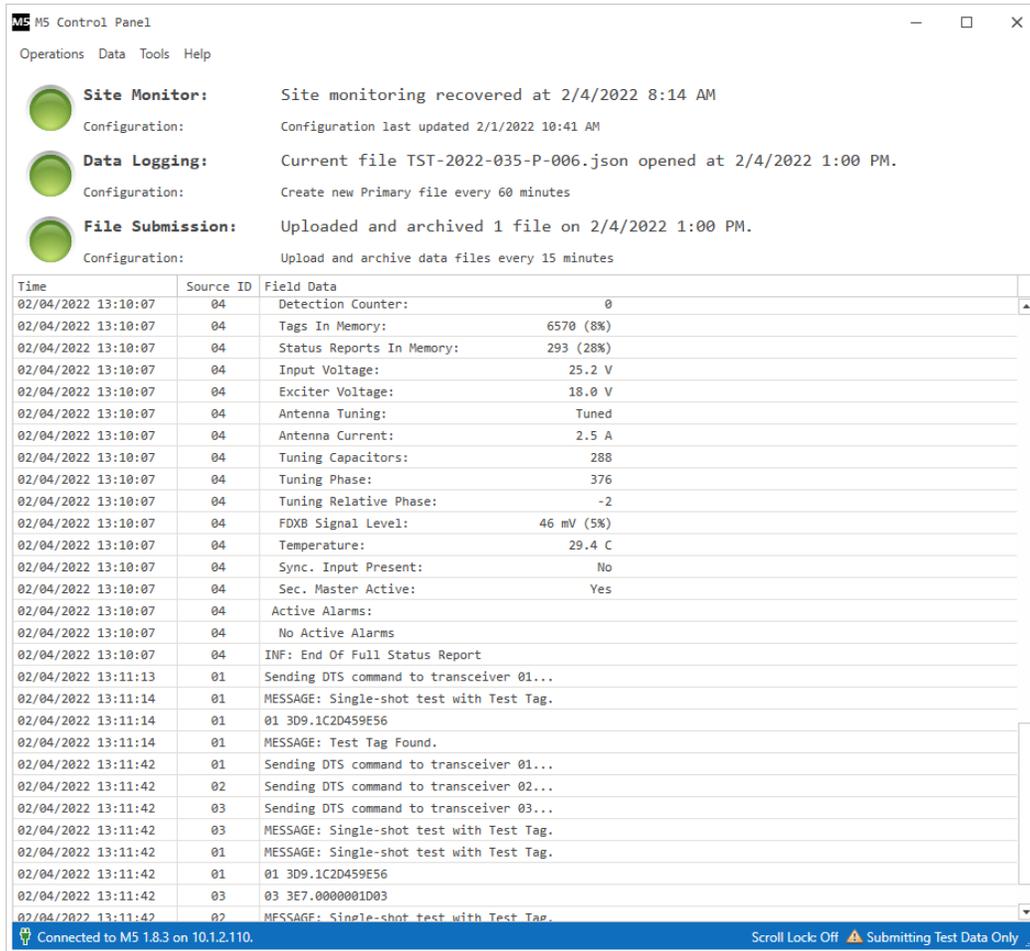


Figure 4. Control Panel of the M5 interrogation software system

Additional releases of M5 were provided this year that include:

- Integrated and [online documentation](#)
- Support for the Biomark IS1001-MUX device
- Feature to allow users check for new software releases
- Bug fixes and feature enhancements

P4 Tagging Software Upgrades

[P4 tagging software](#) required only one minor update this year to add support for the Biomark electronic measuring board and enhance Windows 11 compatibility. Users uploaded 20-thousand data files to PTAGIS from this mature software released in 2016. This software is near its end of life and requirements gathering for the next generation tagging software have started. Staff evaluated newly released cross-platform technology called [.NET MAUI](#) that could allow researchers to operate data-collection features of P5 on additional types of hardware such as tablets and notebooks (e.g. combining the features of a connected digitizer tablet into a touch screen interface to capture length and enter data without using a keyboard and mouse). It was determined .NET MAUI needed more work before it could be reliably used for developing production-grade systems.

Additional Utility Software Upgrades and Development

Published a production release of [I5 interrogation software](#) in support of manual data collection and submission for remote instream interrogation sites. This software allows site stewards of remote interrogation sites that are unable to use a computer for data collection to download data stored directly on the transceivers. Once downloaded, I5 allows some basic corrections to be made, validates the data against the site configuration, and creates and submits an interrogation file to PTAGIS. Through successive downloads into I5, it keeps track of the records that have already been written to a file and makes sure only new records are added to the next file. We released five updates over the course of 2022 following feedback from users and the IPTDS Subcommittee. Site stewards from 98 interrogation sites used I5 to submit over 750 files in 2022.

2023 Plans

Maintain all field data collection systems and enhance as needed. Continue refinement of all utility software utilized by PTAGIS staff in support of program objectives.

Following the successful evaluation of M5 at the SbyC interrogation site LMJ, upgrade the remaining SbyC sites to use M5 and retire M4. This will include adding legacy PLC support into M5 until remaining SbyC site platforms can be completely upgraded with electronically-trigger diversion gates and new PLC/networking equipment.

Continue redevelopment of the next-generation version of P4 software as a project named P5. Upgrade the underlying technology to latest releases and verify functionality. Ensure P5 will meet the installation requirements in support of trending agency security policies that will also scale to meet large QA/QC workflows performance needs. Update data file format from XML to JSON and enhance PTAGIS web API to support P5 data file submissions and other features. Assemble a focus group of users to evaluate P5 and any proof-of-concept, ergonomic-based solutions such as using tablet platforms as a potential replacement of using digitizer tablets for data entry and length measurements.

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 performant, highly available, cost-effective, extensible, and secure data management system.

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 of an 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

2022 Accomplishments

While concurrently administrating the production database and related systems, considerable effort was applied to learning and evaluating Azure cloud technology for the eventual migration of all PTAGIS server systems. The general goal behind this migration effort is to leverage cloud [platforms-as-a-service](#) and related infrastructure to enhance security,

availability, performance and scalability so that staff can focus on developing and maintaining features of this growing system without having to procure hardware, patch operating systems, and keep apprised of the ever-changing landscape of system security (which is becoming more demanding even with the support of an exceptional PSMFC IT department). Cost is a primary concern moving forward and staff will perform this migration “in-house” instead of paying up-front for outside consulting, due to the program’s flat funding. Plans are in place to leverage [hybrid](#) and [reservation](#) licensing to mitigate cost overruns. It is estimated the “in-house” migration process should be completed at the end of 2023 with a return-on-investment in outgoing years. Staff attempted to use [Azure Dev/Test subscription benefits](#) to implement cloud infrastructure at lower cost; however, this proved to be inefficient as infrastructure wouldn’t be available for our needs or suddenly become ‘unavailable’ once implemented.

Building upon efforts from last year to identify cloud database technology and migration techniques, staff implemented [virtual networking](#) with subnets and a gateway. On top of this, a virtual private network (VPN) between on-premise and Azure cloud tenant with certificate authentication was implemented. Using this VPN, data was successfully migrated out of the on-premise production database into a new [Azure SQL Managed Instance](#) configured in the cloud. This data migration process, called linking, was further refined to reduce latency and to ensure all data was successfully migrated to the cloud. A final database linking process would be executed before going live in the cloud. Performance of the Azure SQL Managed Instance (cloud database) was evaluated to ensure affordability and similar performance as on-premise database; additional evaluation is needed to achieve this goal. Considered migrating from on-premise database to a cloud-native database called [SQL Azure Database](#) which presumably has lower costs and better performance, however, the data linking feature is not available and would require significant modification to the database schema currently used on-premise; therefore, to reduce complexity in database migration, a decision was made to migrate to Azure SQL Managed Instance at least in the interim. Staff evaluated [Azure Data Factory](#) features to process data files submitted from the field. It appears processing data files directly utilizing database stored-procedures is more performant and less costly option than using data factory at this point in time.

Evaluated [cloud storage technology](#) to host 1.7 million data files that represent the data inside the database. These data files are preserved for data lineage as a long-standing goal of the program. Cloud storage is also needed to store content hosted via the PTAGIS website. Based upon testing, all data files and web content could be migrated to cloud storage over the VPN and would only take a few days, which is the least expensive option. The data file migration process can run subsequently to append new data files and content to cloud storage as needed.

Staff designed and built the new Diversion Gate Efficiency (DGE) system with greatly improved performance and aligned with current PTAGIS systems and terminology. Rebuilt data handling routines have reduced backlog processing times from hours to minutes and are also easier to maintain. DGE consists of several software components and monitors the efficiency of fish diversion gates, which are used by researchers to divert individual fish into holding tanks for inspection. This upgrade was necessary to support data platform hardware and M5 software upgrades at PTAGIS interrogation sites supporting SbyC.

2023 Plans

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 and backups. Refine features of transactional and dimensional databases as needed. Continue support for data file extracts for large scale data users. Finalize the retirement of processing data files transferred from the field via obsolete systems using FTP and email.

Complete migration of on-premise server systems (*e.g.* database, website, reporting system, and file storage) to the cloud with a tentative go-live date in last quarter of calendar year. Migration should be transparent to end users with

minimal downtime and no data loss. All features and performance in the cloud should match those on the existing on-premise system. Continue to refine cloud systems post-migration to employ additional cloud-native features to maximize performance, availability, and return on investment.

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 performant, highly available, cost-effective, extensible, and secure 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 automated systems to consume and submit 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 industrial best-practices
- Interoperation with server data management systems and field data collection systems
- Support high-availability and security goals of the program and the Commission

2022 Accomplishments

Following the successful release of the newly redesigned PTAGIS website in 2021, updates were published about once a month in 2022 to refine existing features or to publish new features and content.

We conducted a survey of PTAGIS users at the end of 2022 regarding their use of the website. About 45% of respondents use the website weekly or daily, 45% use it monthly, and the remaining 10% use it a few times a year (Figure 5). The overwhelming majority of respondents reported a high level of satisfaction with the website (Figure 6).

“On average, how often do you use the PTAGIS website?”

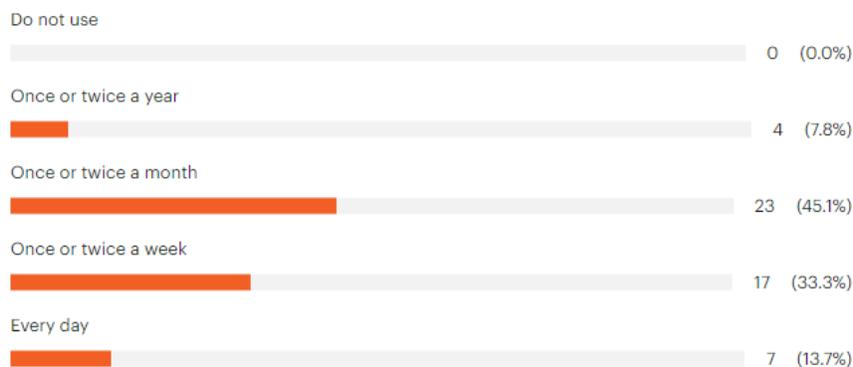


Figure 5. Respondents to survey question about frequency of use.

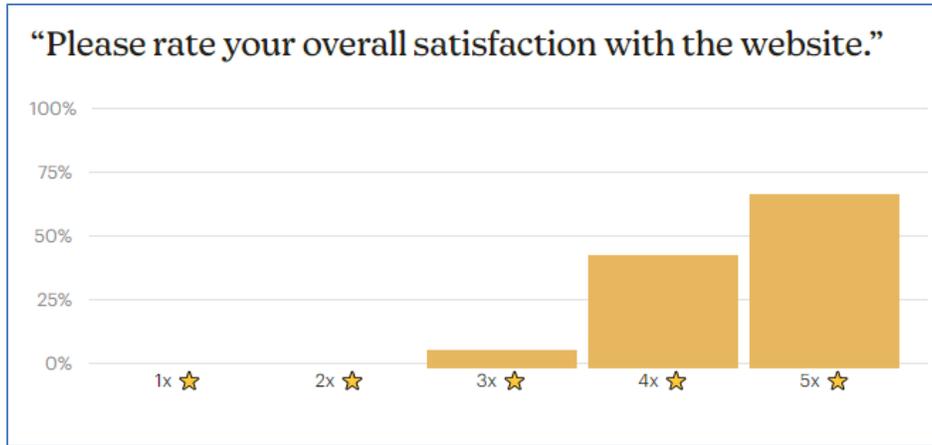


Figure 6. Respondents to survey question about level of satisfaction with the website.

A number of website features were refined based on feedback received from the user survey and emailed requests:

- Enhanced the site search features on the [Interrogation Site](#) and [MRR Site](#) metadata pages
- Improved the workflow on the Event Log submission page
- Increased Clip File Download performance
- Added a new [Observation Summaries](#) quick report
- Updated [PTSC](#) and [IPTDS](#) pages to better display member information
- Updated the [Map page](#) to clearly indicate interrogation sites that are no longer active
- Updated the [Observations quick report](#) to only show currently active interrogation sites

In addition to these enhancements, a new suite of tools was released to allow interrogation site stewards to manage the metadata for their interrogation sites directly through the PTAGIS website dashboard (Figure 7). Stewards can update the site description, site contacts, upload a new site diagram, change the site configuration, change the location, change the description of equipment used at the site, add photos, and change file load status notifications.

Website monitoring tools indicate that an average of more than 1,500 unique visitors come to the PTAGIS website and generate over 27,000 page views every month. The most visited pages on the website are:

- Interrogation Site Metadata
- Observations quick report
- Complete Tag History quick report
- MRR Sites Metadata
- Adult Ladders quick report

Request to Update Metadata for Site 30M - Thirtymile Crk John Day Basin

Use the sections on this page to request changes be made to metadata for the selected interrogation site. Most changes will be reviewed by PTAGIS before being implemented, but changes to Contacts and Operational Status are immediate.

Scroll to Section to Update

[↑ Operations](#)
[📄 Details](#)
[🗺️ Diagram](#)
[✓ Configuration](#)
[📁 Contacts](#)
[🔔 Submission Notifications](#)
[📷 Photos](#)
[📍 Location](#)
[🔧 Equipment](#)

OPERATIONS

[📄 Decomission Site](#)
[📄 Update Operational Status](#)

30M - THIRTYMILE CRK JOHN DAY BASIN

Status: ● Active - Operational

DETAILS

[📄 Update Details](#)

Site Type: Instream Remote Detection System | **Organization:** Oregon Dept. of Fish and Wildlife

General Operational Period: Year Round

This site is located at rkm 0.5 on Thirtymile Creek (30ML2C), a tributary to the John Day River. The 30M array consists of two 20 ft BioLite antennas which are spaced up and downstream by 10 m to provide directionality of detection. The antennas are driven by IS1001 ACNs, which are daisy-chained from one port of an IS1001-MC. The 30M array is powered by a bank of 6 solar panels tied to 4 250ah batteries (connected in series and parallel). The 30M array is manually downloaded at least monthly during the migration season (October to May), and at least every other month during June to September.

Figure 7. Interrogation site metadata management pages.

Enhanced the [PTAGIS Web API](#) (Figure 8):

- Added new endpoint to retrieve the latest software version to support enhanced PTAGIS software update process
- Added multiple endpoints to support viewing and submitting event logs
- Added endpoint to retrieve active interrogation sites based on an email address for a site steward or technician
- Added endpoint to retrieve advanced reporting subscription exports
- Updated transceiver specification endpoint to support versioning
- Updated M5 submission endpoint to record more details about submission request

PTAGIS API V1 OAS3
<https://api.ptagis.org/.swagger/v1/swagger.json>
 Terms of service
 Contact PTAGIS - Website

Data Provides MRR and observation data. See [Data Overview](#) topic in data specifications for more information.

EventLog Submission of event logs for PTAGIS-operated interrogation sites.

- POST** `/eventlogs/authorize` Authorization request to submit event logs
- GET** `/eventlogs/interrogation/{id}` Gets an interrogation site event log by unique identifier
- GET** `/eventlogs/interrogation/site/{siteCode}/year/{year}` Get a list of event logs for a site (or subsite) and year
- POST** `/eventlogs/interrogation` Submits an interrogation site event log
- GET** `/eventlogs/interrogation/sitecodes/ptagis` Gets a list of active interrogation site codes (and sub-sites) operated by PTAGIS
- GET** `/eventlogs/interrogation/comments/standard` Gets a list standard comments used for event logs at PTAGIS interrogation sites.

General General features of the PTAGIS.

- GET** `/general/software/releases/latest` Return information about the latest PTAGIS software releases

Figure 8. Enhanced PTAGIS Web API

2023 Plans

Continue refinement of the website and reporting system features as requested. In coordination with IPTDS Subcommittee: implement interrogation site request workflow that will allow users to request a new interrogation site be added to PTAGIS, send the request to the PTSC for review and implement approved requests. Monitor website to ensure high-availability and peak performance. Review advantages of MicroStrategy cloud offerings. In coordination with a successful migration of database server to the cloud, also lift-and-shift website and reporting system and engage enhanced security, performance, and other cloud-based features.

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.

2022 Accomplishments

In 2022, 11 projects targeted 47 groups of fish totaling 762,620 tags to be separated by tag code for additional sampling or for different transportation outcomes. *Table 3* provides a summary of the 2022 projects. In addition, SbyC at Lower Monumental Dam Juvenile Bypass was operated in a dual system with both M4 and M5 in order to evaluate the performance of M5.

Agency	Project Title	Target Tags
FPC	Comparative Survival Study 2022	422,198
IDFG	Monitoring and evaluation of BY2020 Chinook Salmon smolts released from Idaho hatcheries	98,929
IDFG	Monitoring Upper Salmon River A-run Steelhead Reared in Circular Tanks	10,039
NOAA	Migration timing and parr-to-smolt estimated survival for wild Snake River spring/summer Chinook salmon smolts	6,232
NOAA	Investigating the origin and migration patterns of bull trout encountered at Lower Granite Dam	13
NPT	Nez Perce Tribe 2022 Separation by Code Request	18,726
ODFW	Wallowa and Imnaha Stock Steelhead Smolt Monitoring and Evaluation_2022 Releases	18,600
ODFW	Round Butte Pathogen Screening	14,662
ODFW	John Day Adult Steelhead Overshoot Investigation Phase 3	129,242
WDFW	2022 Lyons Ferry Hatchery Complex -Snake River, Steelhead Tributary Releases	18,979
WDFW	BY20 yearling and BY21 subyearling Lyons Ferry Hatchery FCH onstation release	25,000
	Total Target Tags	762,620

Table 3. Separation by Code request summary for 2022

2023 Plans

Continue processing SbyC Requests in a similar manner as this year, with both M4 and M5 sites managed through SbyC Configuration Manager. Upgrade to M5 SbyC configuration in support of M4 software retirement at each site. Review the online SbyC request/approval process with researchers and FPAC and refine as necessary.

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 hundreds of 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 9*). PTAGIS staff operate and maintain the electronic detection systems that collect this information under a *Memorandum of Understanding (MOU)*³ between BPA and USACE. Staff performing these tasks work out of a centrally located office in Kennewick, WA.

³ 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>

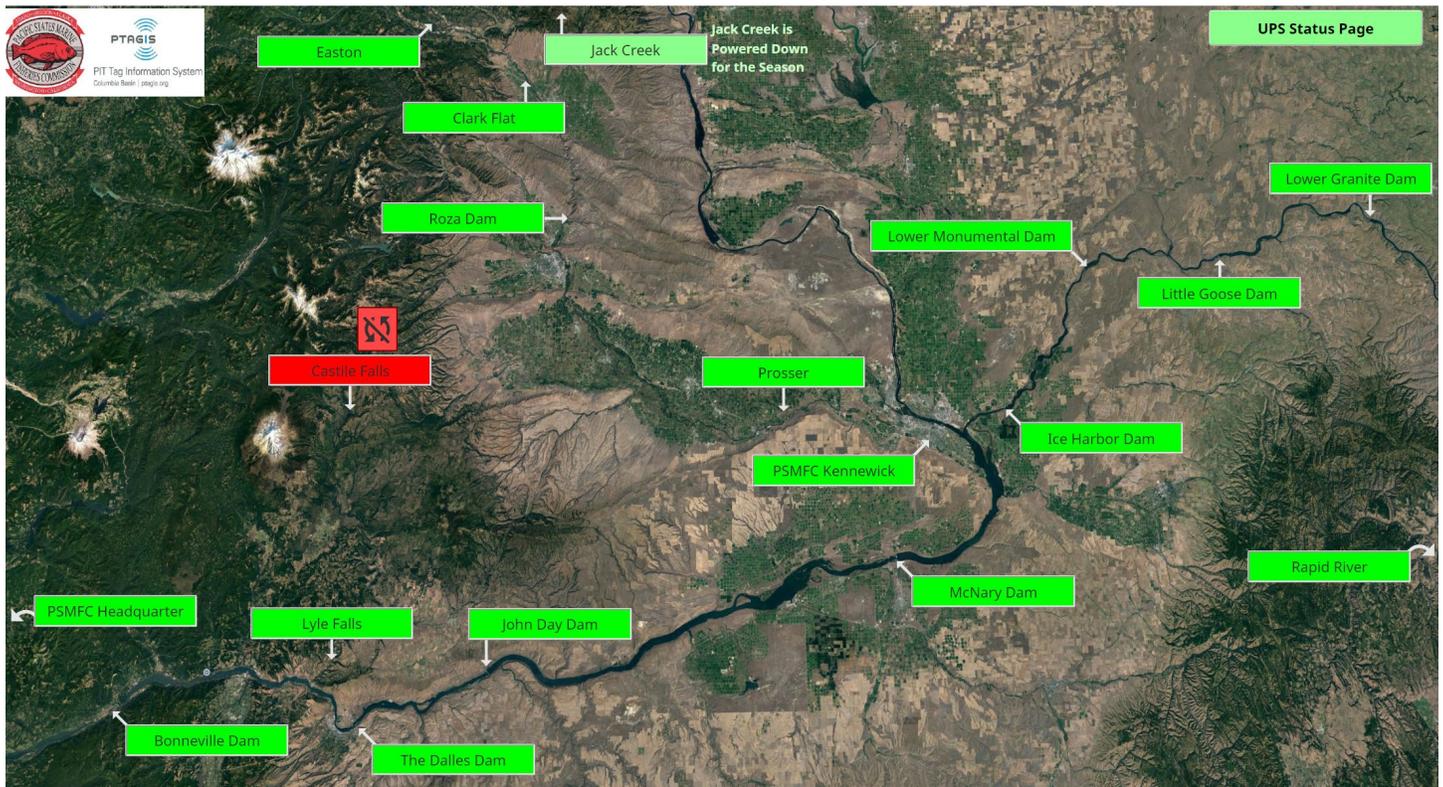


Figure 9. SCADA operational map of the mostly large-scale interrogation sites managed by PTAGIS

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 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 10) 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.

2022 Accomplishments

The diversion gate efficiencies at each SbyC site (*Figure 21*) remain high due to SCADA monitoring, upgraded electric slide gate at LMJ in 2020, and in-year and off-season maintenance programs by PTAGIS and USACE staff.

Diversion Gate Efficiency Summary					
({Divert Time} (Value) Between 1/1/2022 12:00:00 AM and 1/1/2023 12:00:00 AM)					
B2J - Bonneville PH2 Juvenile					
Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
B2J	SBYC SEPARATOR GATE	18,175	18,170	3	100.0%
GOJ - Little Goose Dam Juvenile					
Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
GOJ	A-SEPARATOR GATE	17,628	17,383	237	98.7%
	B-SEPARATOR GATE	18,904	18,655	231	98.8%
	DIVERSION SBYC GATE	18,107	18,071	30	99.8%
GRJ - Lower Granite Dam Juvenile					
Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
GRJ	A-SEPARATOR GATE	35,327	34,617	669	98.1%
	B-SEPARATOR GATE	21,721	21,348	353	98.4%
	DIVERSION / SBYC GATE	22,863	22,823	20	99.9%
	RCWY-10 GATE	24,853	24,402	439	98.2%
	SBYC GATE	149	0	0	
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	3,498	3,477	21	99.4%
LMJ - Lower Monumental Dam Juvenile					
Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
LMJ	A-SEPARATOR GATE	11,584	11,440	139	98.8%
	B-SEPARATOR GATE	19,395	19,055	330	98.3%

Figure 10. Diversion gate efficiency (DGE) summary for 2022

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 due to cessation of fish transportation.

Staff coordinated an evaluation of new M5 SbyC features deployed in-situ at LMJ interrogation site this year. The data collection platform was modified so both M5 and M4 could operate simultaneously on separate computers and submit redundant data to PTAGIS, allowing staff to use the server-based DGE system to compare the performance between the

two systems throughout the season. DGE compiles data events such as divert requests, downstream detections and facility gate operations to ensure successful SbyC operations throughout the year. DGE requires accurate timestamps for these data events or results would be skewed. The facility gate operations data events were recorded and transmitted via a third computer operating SCADA instrumentation at the site, independently of the M5 system that collects the other data events for divert requests and downstream observations. Using built in Windows features and off-the-shelf software, staff were unable to reliably synchronize the clocks of these two computers to ensure accurate timestamps. Therefore, a significant modification to M5 was required to also collect the facility gate operational data events similar to M4 to preserve timestamp fidelity. Once completed, M5 SbyC performance matched, and in some cases exceeded, the performance of M4 during the entire 2022 season.

2023 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, specifically at GOJ and GRJ sites. Continue upgrading data collection platforms at other SbyC interrogation sites.

Additional SbyC platform upgrades that include electronically-controlled diversion slide gates and new generation of PLC devices may be postponed until 2024 due funding issues and scheduling pressures. M5 was upgraded to support legacy PLC devices such as the Allen Bradley SLC5/05. This will allow M5 to replace M4 systems before a complete SbyC platform remodel can take place.

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.

2022 Accomplishments

Designing and prototyping new antenna systems was paramount in 2022. The completion of BO2's relocation was a top project. The following subsections provide detail about this work performed by Kennewick staff.

BO2 Cascades Island Relocation Project:

In 2021, staff installed PIT tag antennas at the entrance of the Upstream Migrant Tunnel (UMT) and at the Counting Window (CW) at Cascades Island (*Figure 11*). At the end of 2021, the USACE completed only 25% of the scheduled in-

ladder electrical work as part of their commitment to this project. When they completed the remaining work rescheduled to Q1 2022, PTAGIS staff completed the installation of the data collection platform equipment in the relocated PIT tag room and the system was brought online. The new system completely covers fish passage routes whereas the ladder system provided orifice detection only (fish going over the top of weirs are not detected). The original system installed in the ladder below this area is in danger of failure due to soil subsidence around the electronics building causing it to list and is a safety hazard to operate. This year, staff instrumented a new M5 data collection platform in the new PIT Tag Electronics Room at the counting window.

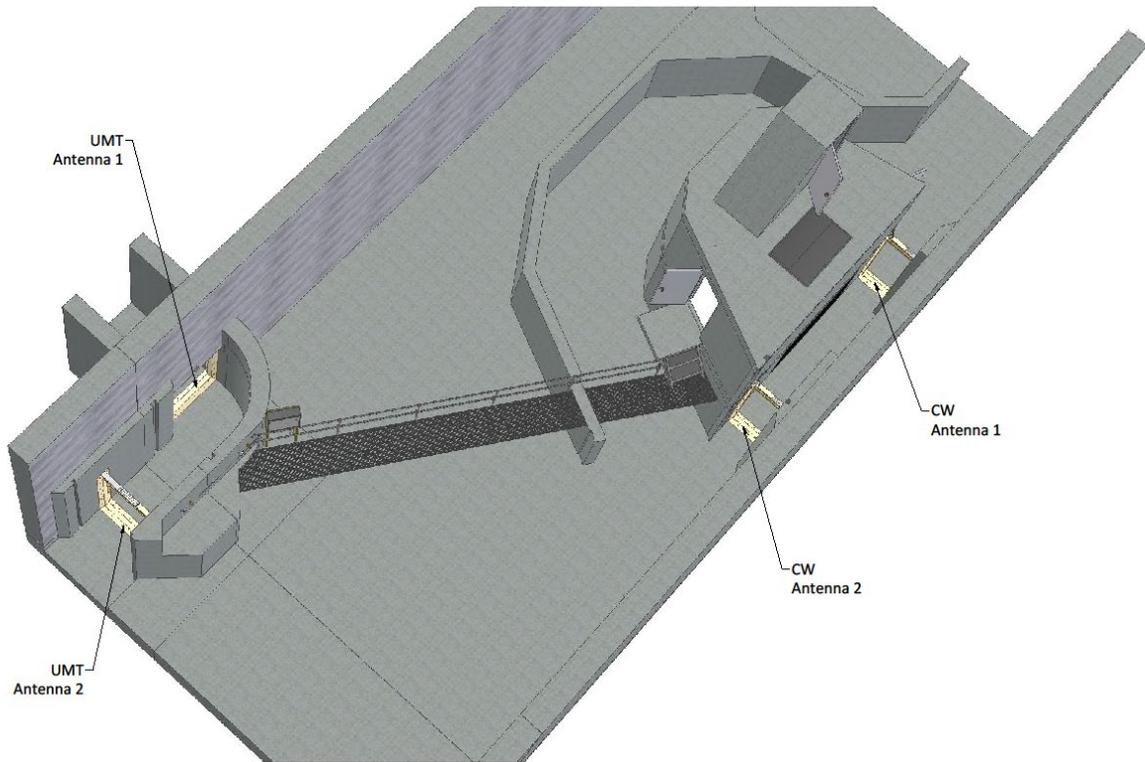


Figure 11. Overview of the BO2 Cascades Island Relocation Project at Bonneville Dam

Bonneville Powerhouse One Ice and Trash Sluiceway PIT Tag System

In 2019 a USACE Portland District Engineering Decision Report was released that chose the B1 I&T Sluiceway as the best location to increase juvenile detections at Bonneville Dam. This was partly based on PTAGIS conceptual designs. A 90% design was submitted to the USACE by PTAGIS in December of 2022 for the auto-gates that feed the sluiceway.



Figure 12. Bonneville P1 I&TS PTAGIS Conceptual Design

B04 Weir Wall Replacement Project

PTAGIS has been invited to be a part of the Bonneville Washington Shore Serpentine Section Remodel design team. The remodel is meant to improve lamprey passage. Replacing the current configuration of four weir walls with one antenna each will be four new weir walls with three antennas each. The remodel is scheduled for the winter of 2024/2025.

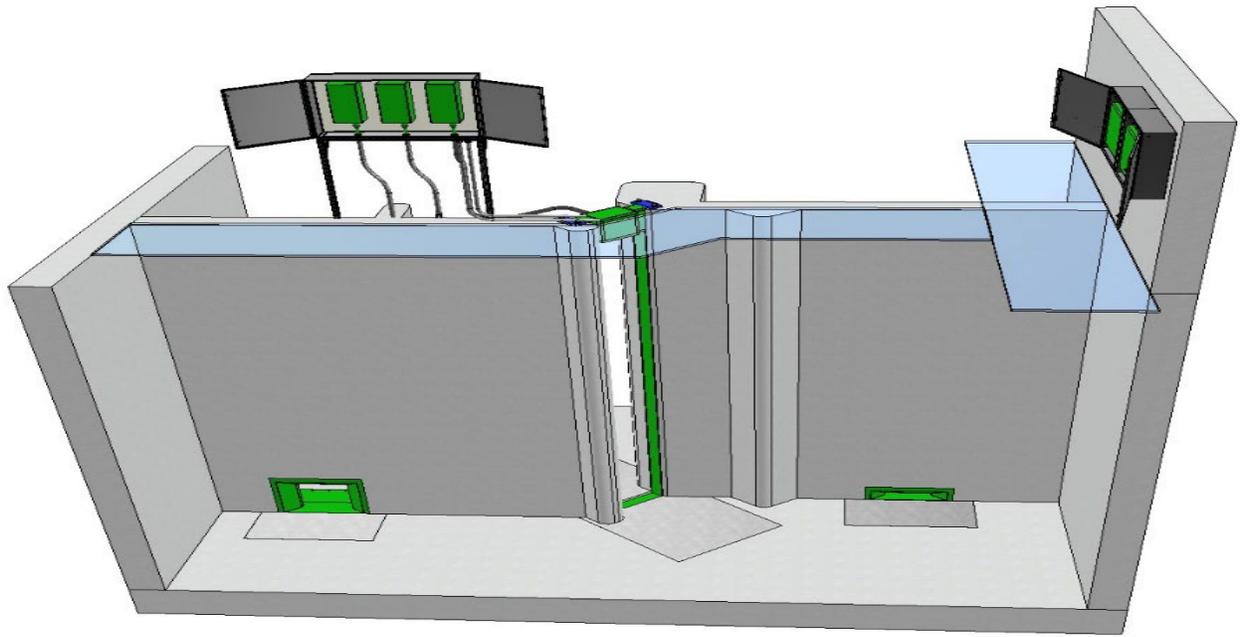


Figure 13. Overview of the Washington Shore BO4 Remodel at Bonneville Dam

Easton Dam Project

PTAGIS was asked by the USBR to investigate the possibility of adding PIT tag detection at the adult ladder and juvenile bypass at Easton Dam. Design of the system was completed to a 95% level for both locations in 2022. This included three adult ladder orifice antennas and two overflow antennas. Two thin body surface mount antennas were designed for the juvenile bypass.

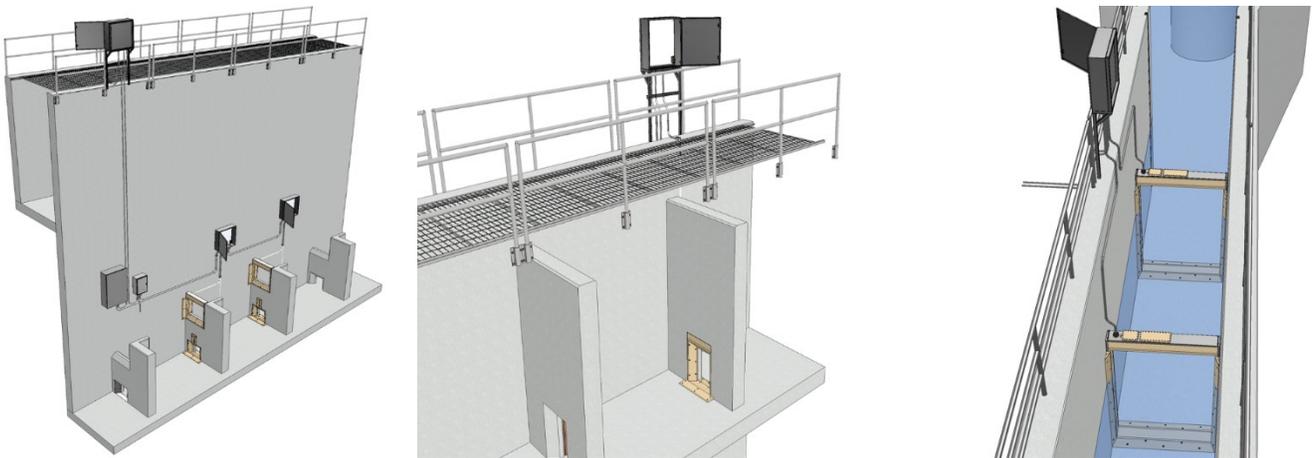


Figure 14. PIT tag antenna locations for Easton Dam

Klickitat Hatchery Remodel Project

PTAGIS was asked by the Yakama Nation and the BPA to design a PIT tag detection system for the adult ladder and juvenile bypass. This will support the remodel of the Klickitat Hatchery. Design of the system was completed to a 95% level for both locations in 2022. This included two adult ladder surface mount antennas and three juvenile bypass antennas.



Figure 15 Overview of the Klickitat Hatchery

2023 Plans

- With USACE approval, PTAGIS will install a prototype antenna system at Bonneville B1 I&T Sluiceway.
- With USBR support, proceed with antenna installations at Easton Dam Adult Ladder. This will include 5 antennas on the ladder. Once complete PSMFC will take over O&M of the system.
- Join the USBR design team for adding PIT tag antennas to the new Cle Elum Dam facility and the Clear Creek Dam remodel project.
- Work with the USACE and NOAA to increase juvenile detections at McNary Dam.
- Continue to work with the BPA and USACE to renew the expired MOU to facilitate new installations

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.

2022 Accomplishments

System-Wide Data Collection Platform Upgrade

Completed the data collection platform upgrades at 25 interrogation sites operated by PTAGIS that are not performing SbyC. M5 deployments continued in 2022. The remaining four M4 sites operating SbyC will be upgraded to M5 in 2023. M5 interrogation software was also deployed and is operating at all of these sites (see [M5 Software Internal Release](#)).

The ongoing data collection platform upgrades include:

- Replacement of consumer-grade PCs with industrial PCs running Windows 10 Enterprise LTSC
- Replacement of serial communications equipment with Ethernet-based counterparts
- Replacement of lead-acid UPS systems with SCADA-ready lithium battery models
- SCADA real-time monitoring integration

The SCADA system continues to be enhanced from year to year. The SCADA UPS system (*Figure 16*) alerts staff in advance of a failure and will track environmental changes as needed. It also tracks the opening and closing of the Lower Granite tainter gate that feeds the GRS spillway.

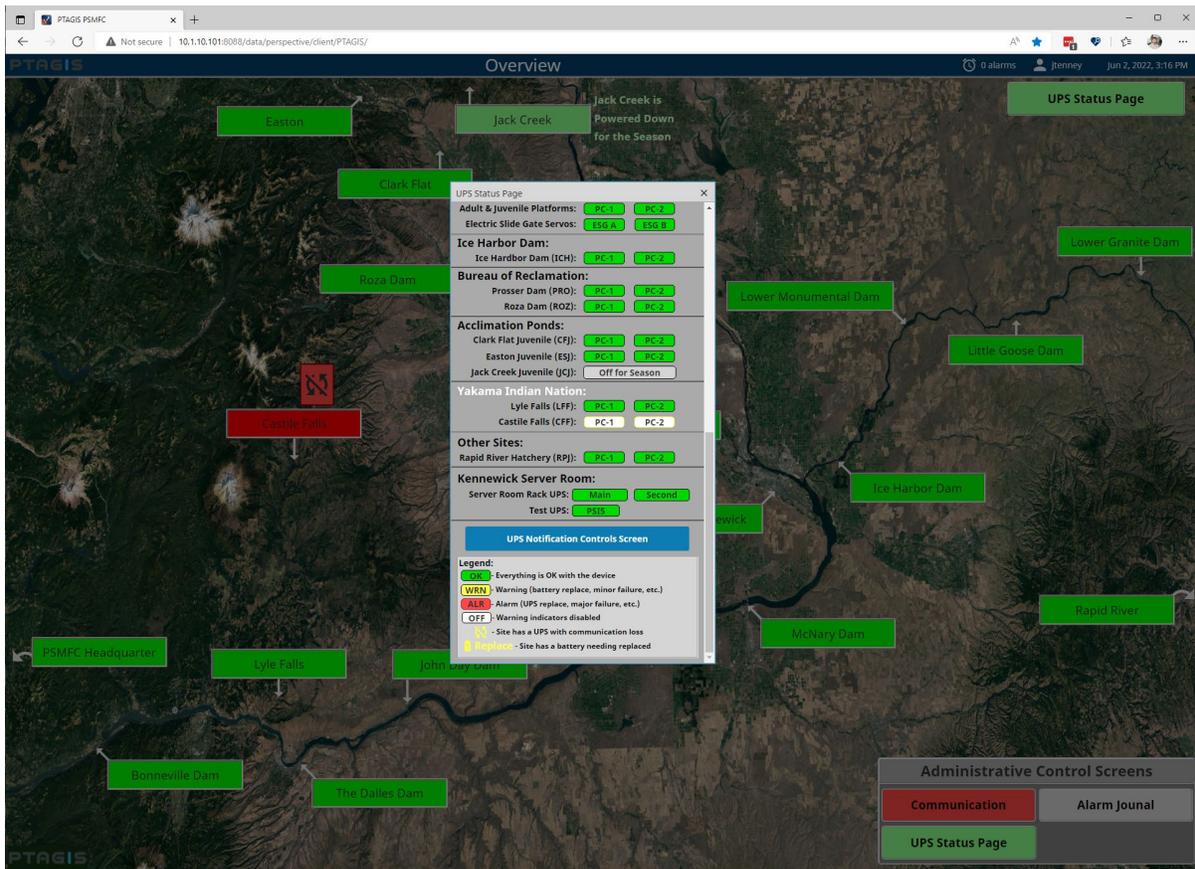


Figure 16. SCADA system monitoring of systems deployed at PTAGIS interrogation sites

Juvenile Bypass O&M

Juvenile fish bypass facilities (JFF) on the Snake and Columbia Rivers began operating in March and April. Detection efficiency rates for 2022 were maintained at or above previous year's detection efficiency rates of greater than 99%. The single antenna in the Bonneville Corner Collector (BCC) is the exception to this with an estimated efficiency rate in the seventies based on NOAA live fish testing using 12mm tags. BCC detected 47,149 PIT tags during 2022.

Lower Granite Spillway O&M

The spill gate for GRS was opened in the spring of 2022, operating under the [Flex Spill](#) pattern schedule. The Lower Granite Spillway (GRS) PIT tag detection system continues to detect PIT tags at an exceptional rate. All 11 antennas exceeded detection rate expectations throughout the duration of the spill and operated without issue. The spill season ended in September, although the spillway is periodically opened and closed for various reasons. The GRS system detected 195,714 unique tags in 2022 (Figure 17).

GRS - Lower Granite Dam Spillway

Species Breakdown

Subsite	Antenna Group	Antenna	Unique Tags Detected by Subsite	Unique Tags Detected by Antenna Group	Unique Tags Detected by Antenna	Tags Missed per Antenna	Percent Tags Detected by Antenna	Tags Missed per Antenna Group	Percent Tags Detected by Antenna Group
GRS	Upstream	01	195,714	112,180	13,718	98,462	12.23%	83,534	57.32%
		02	195,714	112,180	36,106	76,074	32.19%	83,534	57.32%
		03	195,714	112,180	35,074	77,106	31.27%	83,534	57.32%
		04	195,714	112,180	27,295	84,885	24.33%	83,534	57.32%
	Middle	05	195,714	122,774	37,286	85,488	30.37%	72,940	62.73%
		06	195,714	122,774	42,982	79,792	35.01%	72,940	62.73%
		07	195,714	122,774	42,517	80,257	34.63%	72,940	62.73%
	Downstream	08	195,714	123,456	24,908	98,548	20.18%	72,258	63.08%
		09	195,714	123,456	46,746	76,710	37.86%	72,258	63.08%
		0A	195,714	123,456	39,888	83,568	32.31%	72,258	63.08%
0B		195,714	123,456	11,930	111,526	9.66%	72,258	63.08%	

Figure 17. GRS antenna detection efficiency for 2022

A work barge access platform is being constructed by NOAA Pasco to provide safe and secure access to the OGEE surface for inspection and maintenance of the GRS antennas embedded in the surface. All of the platform components have been procured and are awaiting assembly. The platform should be ready by the end of the 2023 spill season.

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

Adult Ladder O&M

Adult ladder detection efficiency remains high in dam-to-dam comparisons. All sites maintained an approximate 97 to 100% detection efficiency over a 12-month rolling report period (Table 4). Heavy shad traffic seems to have slightly reduced detection efficiency at JDA. A new noise source was detected and traced to the variable frequency drives (VFD) controlling the lock gates at Ice Harbor Dam (ICH). The USACE looks to resolve this issue in 2023.

Ladder Location	Bracket Tags	Ladder Tags	Missed Tags	Percent Detected
BON	4,181	4,180	1	100.0
GOA	5,267	5,251	16	99.7
GRA	1,319	1,316	3	99.8
ICH	5,640	5,543	97	98.3
JDA	11,965	11,796	169	98.6
LMA	5,327	5,271	56	98.9
MCN	5,727	5,689	38	99.3
TDA	11,902	11,833	69	99.4

Table 4. 2022 adult ladder efficiencies in dam-to-dam comparisons

2023 Plans

- Continue working with site personnel at ICH to mitigate noise from VFDs operating the lock gates.
- Coordinate with NOAA and USACE staff to complete construction of access barge before the 2024 season in support of GRS O&M.
- Install NOAA-funded remote controllable power supplies at GRS and integrate into SCADA system.
- Continue to monitor and refine remote sensor on the GRS tainter gate to record spill operations in support of O&M and researchers.
- Continue upgrades of entrance and exit antennas at GRA to bring this system up to PTAGIS O&M standards.
- Investigate installing water-level sensors to provide better information about full-flow pipes and adult ladders to support researchers and PTAGIS O&M.
- Continue to enhance the SCADA monitoring system for all 31 remote interrogation sites and Kennewick lab.

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
- Loaning and troubleshooting HPR hand readers
- 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*

2022 Accomplishments

Bonneville I&T Sluiceway R&D

Staff collaborated with NOAA’s R&D project to develop a prototype detection system for the Ice and Trash Sluiceway at the first powerhouse of Bonneville Dam per request of BPA. From this collaboration, conceptual drawings (*Figure 18*) were presented at FFDRWG for feedback and a prototype antenna system is being developed to fast-track this project for installation in 2022.

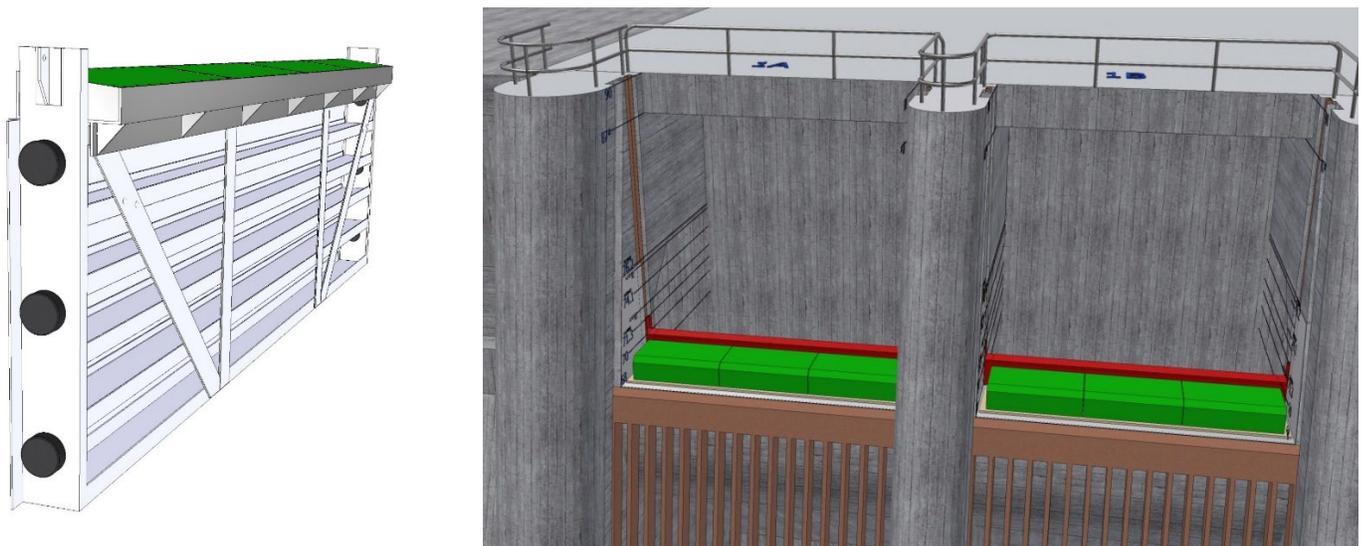


Figure 18. Conceptual designs for antenna installation at Bonneville Ice & Trash Sluiceway, Power House 1

Little Goose North Entrance Antenna

A low-cost system (estimated at \$30K) for antenna installation at the north entrance of Little Goose ladders was presented to the Walla Walla District FFDRWG. The design (*Figure 19*) is possible due to low water speeds and limited debris. The antenna was prototyped at the Kennewick lab and projected to read the entire cross-section of the water column. The antenna can be dropped flat to clear debris if necessary, and then raised back into position. The antenna frame would be constructed out of a fiberglass housing, wrapping a single NOAA antenna cable.

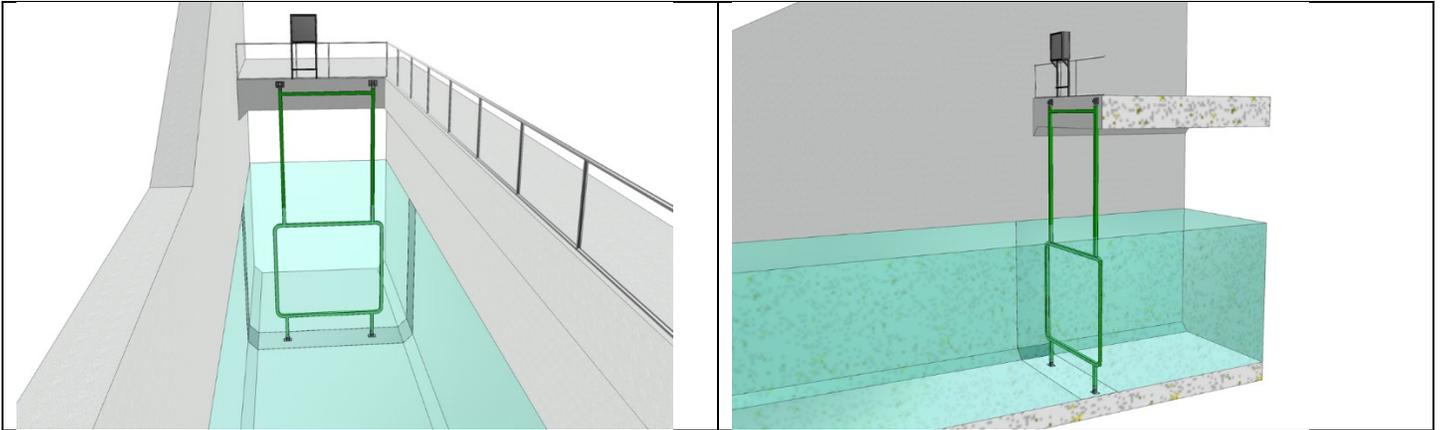


Figure 19. Conceptual designs for antenna installation at north entrance of ladder at Little Goose Dam

Easton Dam PIT Tag Project

Staff presented designs to the Bureau of Reclamation for instrumenting the adult ladder and juvenile bypass system at Easton Dam (*Figure 20*). After a walkthrough of the site, staff delivered 90% design set comprised of 56 pages to BOR. The design set included antenna designs (*Figure 21*), electrical infrastructure, panel placements, fiber optic communications and a room to house PIT tag data collection platform and related electronics.

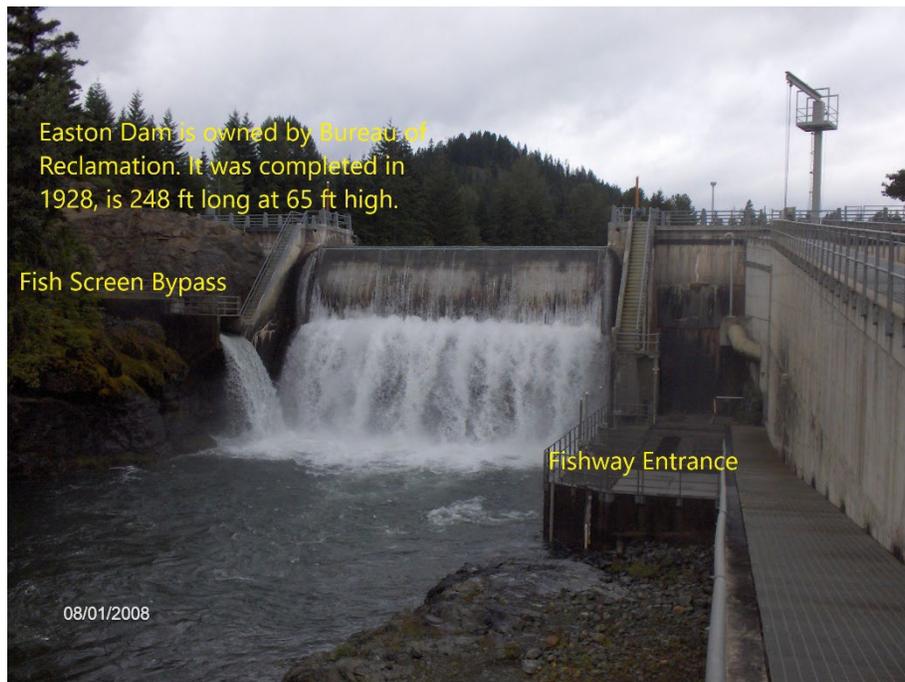


Figure 20. Easton Dam on the Yakima River

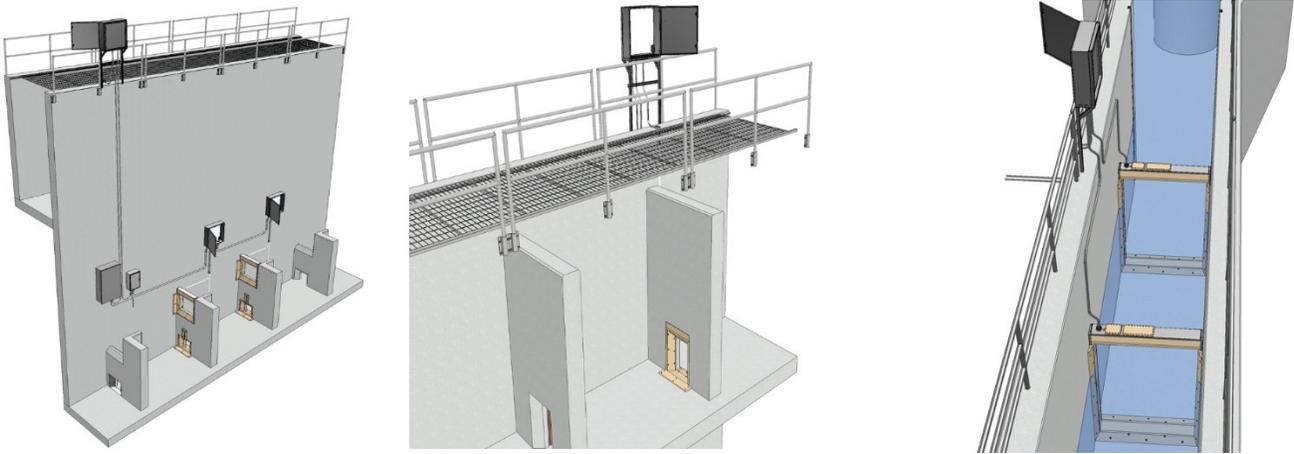


Figure 21. Conceptual antenna designs for Easton Dam entrance, exit, and juvenile bypass system

2023 Plans

Continue with design and development of new PIT tag infrastructure as requested by the fisheries managers. Focus will be on the Bonneville Ice & Trash Sluiceway project; if USACE funding is secured this project will most likely be fast-tracked for installation of a prototype antenna in 2023 or 2024. Partner with NOAA R&D to improve juvenile detections at McNary Dam. Partner with the USACE on the Bonneville Washington Shore Adult Ladder Lamprey design.

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

2022 Accomplishments

Completed all contract-related deliverables such as annual and periodic status reports on schedule. Submitted new funding package for FY23 in December 2022. Staff performance plans and reviews were completed and submitted on schedule per PSMFC guidelines.

Revised budget was submitted to BPA for the FY22 contract year using the *Line Item Transfer Budget Template*. The overall budget changes were less than 5% of the contract budget within existing top-level line items. The revision allowed the purchase of a CNC machine used for antenna fabrication from funds yielded due to the postponement of SbyC platform upgrades and inability to procure replacement vehicles for field technicians.

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.

2022 Accomplishments

Staff answered approximately 20 support and coordination-related requests a month for various field software and web/reporting systems. Staff recorded and published two I5 training videos to accompany the release of this new software utility. Staff produced online help system for the community release of M5 software. A user survey was conducted in 2022 and a few comments received initiated technical support requests.

2023 Plans

Complete video tutorials for advanced reporting techniques. Develop tagging software and reporting training to be delivered at the 2024 PIT Tag Workshop.

K: 189 Coordination- Columbia Basinwide

This objective covers standard regional coordination activities such as:

- Participating and the hosting of [PIT Tag Steering Committee](#) meetings⁴
- Participating and the hosting of [Instream PIT Tag Detection System \(IPTDS\) Subcommittee](#) meetings⁵
- 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 newsletter⁶

The following subsections describe additional coordination activities.

⁴ PIT Tag Steering Committee Meeting Notes Archive:

<https://www.ptagis.org/Resources/DocumentLibrary?filterDocumentsBy=Meeting%20Notes>

⁵ IPTDS Subcommittee Meeting Notes Archive:

<https://www.ptagis.org/Resources/DocumentLibrary?filterDocumentsBy=Meeting%20Notes>

⁶ PTAGIS Newsletter Archive: <https://www.ptagis.org/Resources/DocumentLibrary?filterDocumentsBy=Newsletter>

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

2022 Accomplishments

Participated in the PNAMP Fish Monitoring Workgroup meetings.

Distributed 1.12 million tags to 58 FWP in 2022. 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 5*. Staff provided year-end summaries to MRR and interrogation data contributors and coordinated resulting metadata and data corrections in

the database. Staff corrected several Transceiver/Antenna ID combinations in interrogation site configuration metadata to support enhanced validation implemented on the database server. Updated ODFW email addresses in bulk.

<i>Coordination Type</i>	Action	Count
<i>MRR Projects</i>	Added/Updated	41
<i>MRR Sites</i>	Added/Updated	33
<i>Interrogation Sites</i>	Added	10
	Decommissioned	9
	Updated	51
<i>Newsletters</i>	Published	2
<i>News Items</i>	Published	25
<i>Support Requests</i>	Fielded	~20/mo.

Table 5. Summary of on-going, general coordination activities performed in 2022

The subsequent sections describe other principal coordination activities completed in 2022.

PIT Tag Steering Committee Coordination

The annual PIT Tag Steering Committee (PTSC) Meeting was held via a virtual meeting on February 7, 2022. [Meeting notes](#) are available in the [PTAGIS document library](#). Staff provided a review of program accomplishments in 2021 and plans for 2022. 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 work accomplished in 2021.

PTAGIS coordinated and hosted Instream PIT Tag Data System (IPTDS) Subcommittee virtual meetings in April and August of 2022. The [April](#) and [August](#) meeting notes are available in the [PTAGIS document library](#).

The IPTDS Subcommittee completed new guidelines for instream and other small-scale interrogation sites to standardize the look and information included for these sites.

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 2022, the data specification was updated:

- Updated the software pages to provide links to newly released I5 and M5 software
- Updated the MRR Data Specification to clearly state that Release fields must be completed once fish are released

2023 Plans

Plan 2024 PIT Tag Workshop to be held January 2024. Coordinate annual meetings and related activities with the PTSC and IPTDS. Continue distribution, inventory and QA sampling of PIT tags to all FWP. Participate in other ad-hoc coordination efforts as requested. Continue refinement of metadata and *PTAGIS Data Specification*.