

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

2014 Annual Report

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John Tenney, Don Warf, Nicole Tancreto

Pacific States Marine Fisheries Commission, Portland, OR, 97202

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Executive Summary

The Columbia Basin PIT Tag Information System (PTAGIS) is a coordination and data management project of the Pacific States Marine Fisheries Commission (PSMFC). Data are contributed from regional agencies and are accessible to all

entities. This project is an important, prerequisite component of all PIT Tag research conducted for the Fish and Wildlife Program. 2014 marks the 26th year of this program.

The PTAGIS program's responsibilities include direct operations and maintenance of 27 large scale interrogation sites throughout the Columbia Basin that provide the majority of 175 million observation events available in the database system. PTAGIS also maintains the Separation-by-Code (SbyC) systems at eight of these sites that selectively segregate individual PIT-tagged fish from other tagged and non-tagged fish.

Coordination and Data Management for RM&E

In addition to the on-going work described throughout this report, four significant milestones were delivered in 2014:

- Data loading processes, validation, and notifications were significantly enhanced
- Two new adult detection sites were installed at Little Goose and Lower Monumental dams
- Coordinated and planned 2015 PIT Tag Workshop
- Increased quality assurance sample rate to 3% for all PIT tags distributed to FWP

Operate and Maintain the PTAGIS System

In 2014, PTAGIS processed 538,249 interrogation files and 30,790 tagging files from data contributors. When a file is processed it is opened, the format is validated, the data are validated and if the file passes validation, the data is inserted or updated in the database. Notification emails are sent to data contributors with the final status of file load process.

2014 data contributions into PTAGIS were similar in terms of quantity and composition as compared to the past few years:

- ~2 million new tagged fish
 - 68% Chinook, 25% Steelhead, 4% Sockeye, 2% Coho, 1% others
 - 73% Hatchery, 24% Wild, 3% Unknown
- 12.6 million detections (observations) representing 927,189 unique fish
- 86K fish were reported as recaptured
- 36K recoveries/mortalities reported at year's end

Data validation procedures were enhanced to improve the quality of data being loaded into the database. Notifications to data contributors were enhanced to provide more information for verifying data and for correcting validation issues. Data loading processes were enhanced to improve error handling and notifications about unforeseen errors to the database administrator. Database backup processes were enhanced to streamline data recovery processes in the case of catastrophic failure.

Install, Operate and Maintain Interrogation System in Field Locations

The two new adult interrogation sites at Little Goose and Lower Monumental operated at 99-100% detection efficiency using the new *thin wall* antenna technology innovated by PTAGIS and are now considered permanent installations.

Established interrogation sites operated and maintained by PTAGIS had an overall 98-100% detection efficiency, with the exception of BCC. 89 transceivers (readers) at sites with adult fishways were upgraded to the FS2020 model that improved detection efficiency and require less on-site maintenance due to the auto-tuning capabilities.

Through rigorous testing and evaluation of various design builds in 2014, the FS3001 BCC transceiver was finally approved by PTAGIS as a production unit. Since acceptance, it has proven to be stable and reliable. The detection

efficiency is projected to be significantly higher than the previous generation reader. The efficiency was verified daily by the Kennewick staff by monitoring 10 independent online reports that monitor all aspects of the system performance. These reports were created by the PTAGIS Portland staff. Future live-fish testing will be needed however, to confirm the level of increased efficiency.

Staff coordinated and implemented 17 SbyC projects for various researchers in 2014. Overall SbyC diversion efficiency was 98-99%.

Administration, Management and Coordination

All funding packages and other contract-related deliverables were provided to BPA on schedule. The PTAGIS administrative assistant retired in May 2014 and a software engineer was hired in December 2014. The new engineer will work on next generation field software and internal development projects.

PTAGIS distributed over 1.4 million tags to various FWP in 2014 using an online request/approval service featured on the new website. The sample rate for quality assurance testing of those tags was increased to 3% from 1%.

The *PIT Tag Forecaster* application was beta-tested, completed and released in 2014. PTAGIS is providing the technical resources to maintain this application and the Action Agencies, NPCC and NOAA will provide the necessary technical coordination to ensure that regional entities update the forecasts annually.

Introduction

The Columbia Basin PIT Tag Information System (PTAGIS) has been established for 26 years and is the centralized database for PIT-tagged fish in the Columbia River Basin. PTAGIS provides custom software for contributors to collect tagging and interrogation data, manages the database, and coordinates with fishery agencies and organizations. In addition, PTAGIS collects automated detection data and designs, installs, and maintains the equipment that records those detections. All data contributed to and collected by PTAGIS are freely available through the PTAGIS website (www.ptagis.org).

The PTAGIS project is organized into data systems staff located at PSMFC headquarters in Portland, Oregon and field operations staff with an office in Kennewick, Washington. A PIT Tag Steering Committee (PTSC) provides program oversight, data standardization and technical coordination to the community.

Background

This section provides a broader context for the on-going coordination and data management efforts described subsequently as program objectives and deliverables. The two basic types of datasets contributed to PTAGIS from the region are summarized as:

- Mark Recapture and Recovery (MRR) Data
- Observation Data

To standardize the data contribution process within the region, validation codes and specifications are also described. Large and small scale interrogation sites are defined and a summary of the separation-by-code (SbyC) process is included as additional background.

Mark, Recapture and Recovery Data

The vast majority of PIT tag mark, recapture and recovery (MRR) data are contributed from researchers in the field using custom tagging software developed and supported by PTAGIS called P3.



Figure 1. PTAGIS tagging software being used inside a tagging trailer at a hatchery.

The regional-scale MRR dataset uniquely identifies the agency or individual responsible for the contributed data as well as a contact to provide a broader context for project-specific research. A date and a registered MRR site (see *Figure 2* for a map of registered MRR sites) specifying when and where the event occurred is also included.

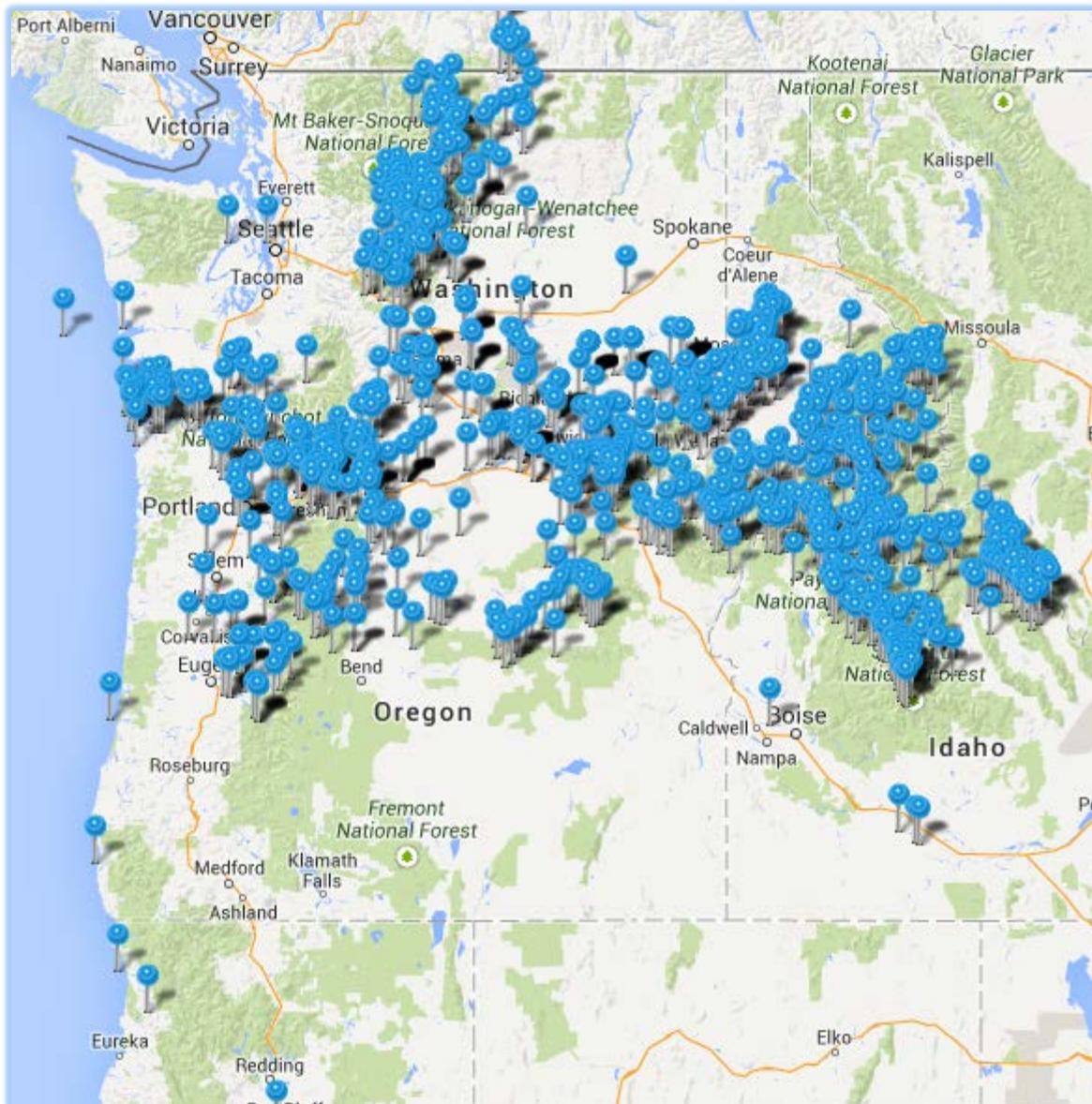


Figure 2: Map of MRR Sites¹ registered in PTAGIS.

The MRR dataset contains individual records for each fish marked or recovered by unique PIT tag code with the species, run, rearing-type designation and other standardized, codified fields to indicate the biological disposition of the animal. Salmon and steelhead represent the vast majority of all records submitted into PTAGIS but other species marked in the region can also be contributed such as lamprey, bull trout and sturgeon.

Observation Data

Observation data represent the passive detection of fish marked with a PIT tag at established interrogation sites within the Basin. The unique PIT tag code, location and the date/time is recorded for each passive detection. PTAGIS standardizes the reporting of all dates and time (MRR datasets as well) in Pacific Standard Time (PST).

¹ Interactive map of registered mark/recapture/release sites in PTAGIS: <http://www.ptagis.org/sites/map-of-mrr-sites>

Numerous detections can occur on a single antenna as a PIT tag passes through its field. An observation record represents the aggregation of all detections that occur within 1 second on a single antenna at a site. These observation records can be further aggregated to the site level, providing one record for each tag detected at a site, summarizing the first and last observation details (antennas and timestamps).

Observation and MRR data are collated in a high-performance reporting system to provide a complete record of fish migration. In rare situations, observation data may be contributed ahead of MRR data and the PTAGIS system temporarily identifies these fish as 'orphan' records.

Validation Codes and Data Specifications

PTAGIS uses the term *validation codes* to represent the standardized agency contacts, registered MRR sites, species, run and other codified data and metadata. A web-enabled workflow² allows researchers to request new validation codes, PTSC to approve the request, and staff to implement them in the database. The current validation codes can be updated in the tagging software with a push of the button and are also published on the website³.

An online data dictionary⁴ provides definitions for each type of validation code and other terms/attributes used throughout the system as well as an accompanying specifications document⁵. The specifications document also provides detail on creating tagging and interrogation data files to facilitate data submission from systems developed outside of PTAGIS.

Large Scale Interrogation Sites

Over 175 million observation records have been contributed to the PTAGIS system and an overwhelming majority of those come from large scale interrogation sites located at Federal Columbia River Power Systems (FCRPS) projects on the Columbia and Snake rivers. The electronic detection systems at these sites are operated and maintained by PTAGIS staff under a *Memorandum of Understanding (MOU)*⁶ between BPA and USACE. The locations of the large scale interrogation sites are displayed in *Figure 3* and the operations and maintenance (O&M) tasks performed by PTAGIS field staff are described subsequently in this report.

² Online service to request and approve new validation codes: <http://www.ptagis.org/services/request-new-validation-code>

³ Current PTAGIS Validation Codes: <http://www.ptagis.org/services/current-validation-codes>

⁴ Online PTAGIS Data Dictionary: <http://www.ptagis.org/data/data-dictionary>

⁵ 2009 PIT Tag Specification Document: <http://www.ptagis.org/docs/default-source/ptagis-program-documents/pit-tag-specification-document-2009.pdf?sfvrsn=12>

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

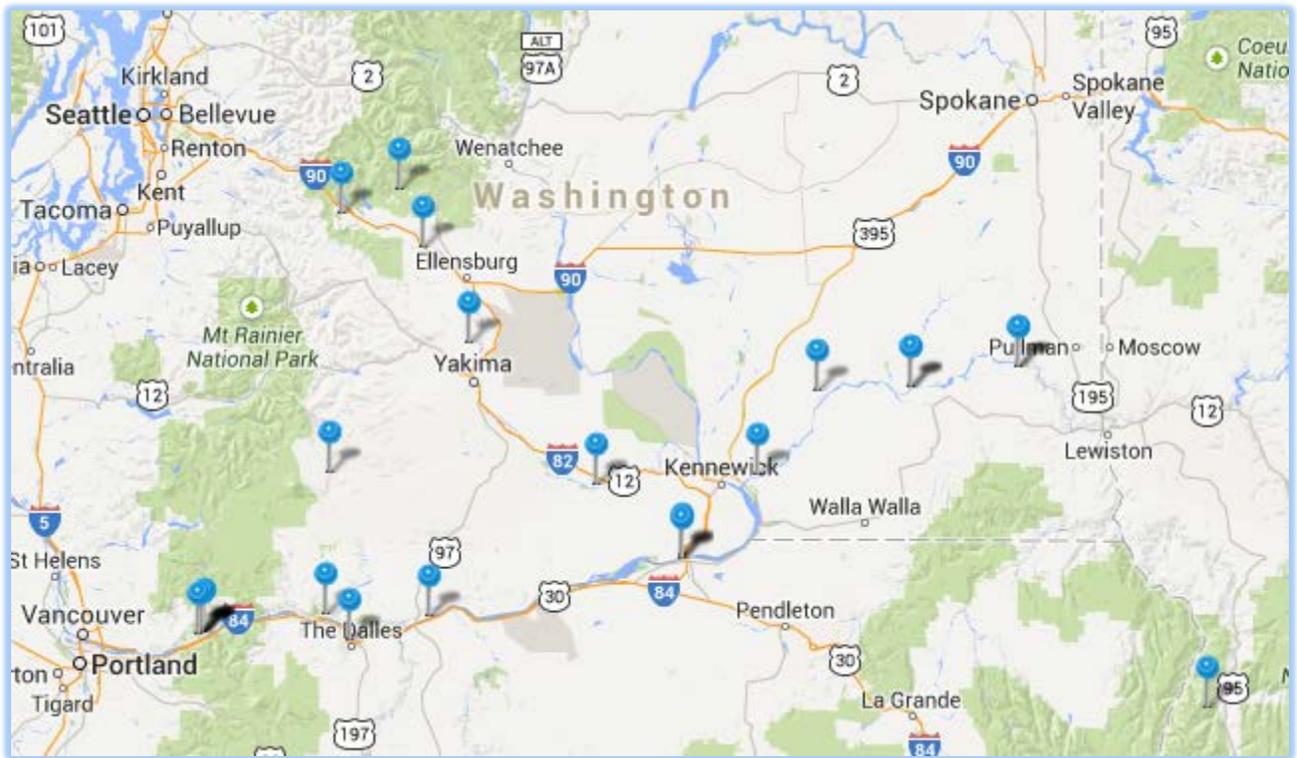


Figure 3. Map of Large Scale Interrogation Sites Maintained by PTAGIS

Juvenile bypass facilities require complex sets of redundant antennas to ensure a high probability of detection in conditions where fish move en mass and at high speeds. These antennas are identified in *Figure 4* as boxes with unique 2-digit identifiers. Sites with adult fishways require larger antennas designed to be retrofitted into ladders, weirs and counting windows.

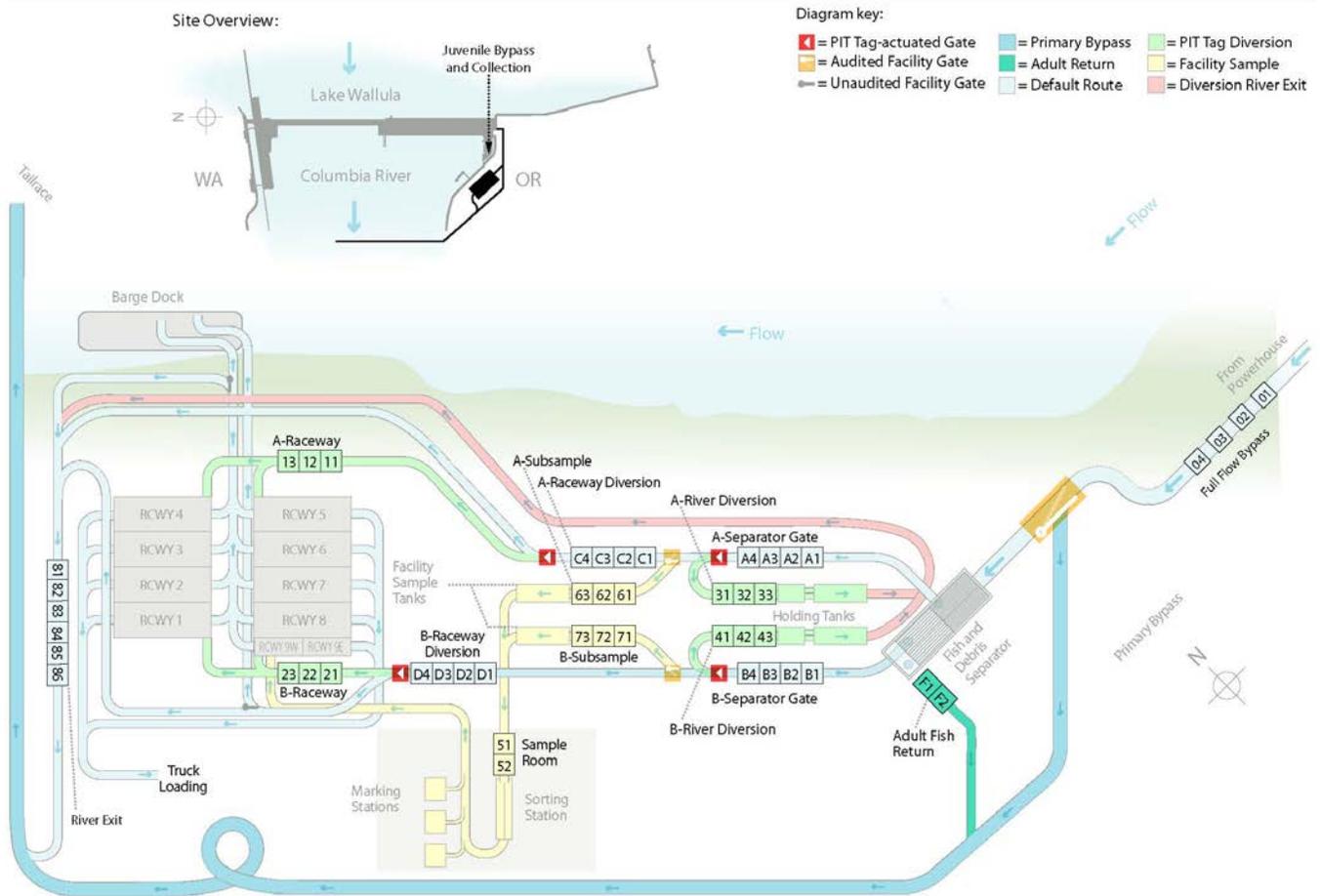


Figure 4. PIT Tag Interrogation Site Configuration for MCJ

Small Scale Interrogation Sites

Small scale interrogation sites are comprised of instream remote detection systems, instream juvenile fish traps, monitored fish releases/returns at hatcheries, and the trawl nets. They have fewer antennas than large scale detection sites and are installed, operated and maintained by various agencies outside of PTAGIS.

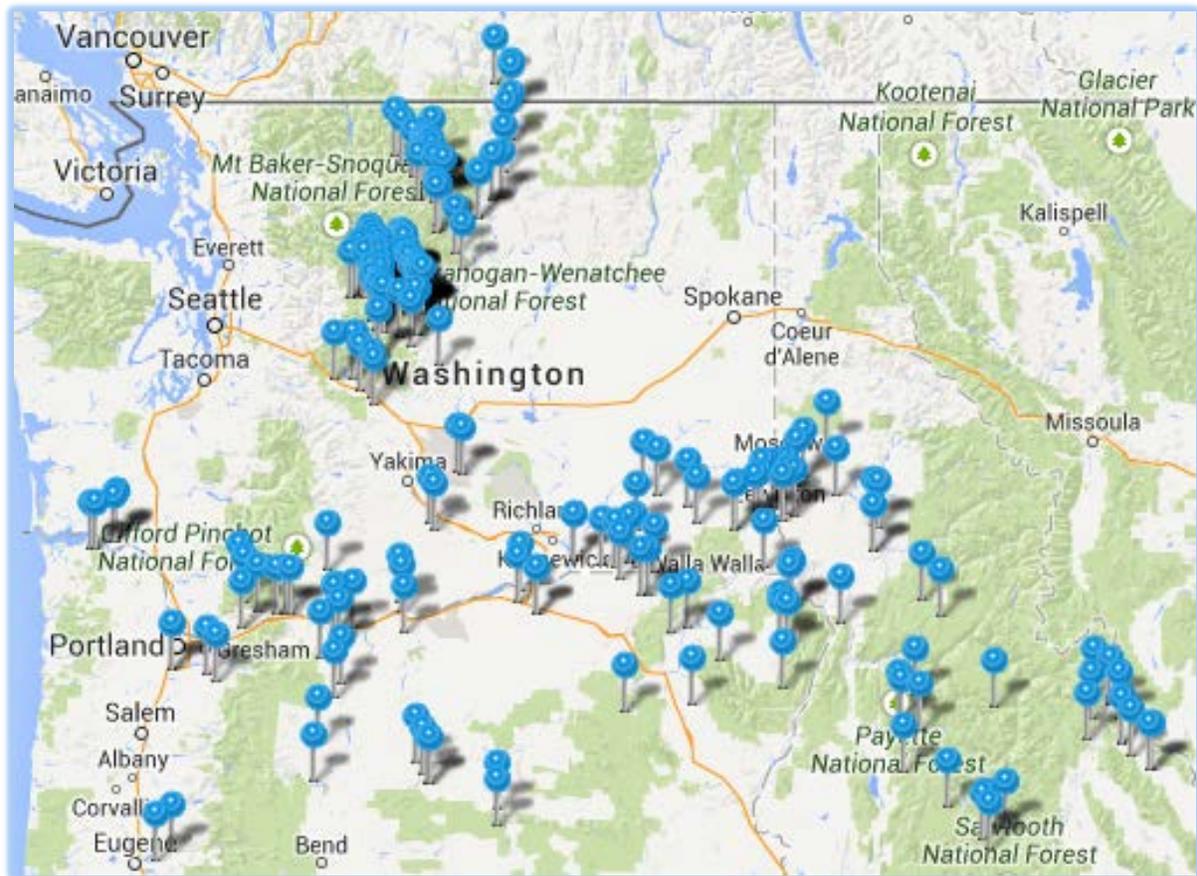


Figure 5. Small Scale Interrogation Sites Contributing Observation Data into PTAGIS

Interrogation site metadata⁷ are stored in the database that includes location, antenna configuration, operational dates, and contact information for the steward of each site. As with large scale sites, each antenna is identified and collated with the observation data in the PTAGIS system. The PTSC provides governance and PTAGIS provides technical coordination with the agencies that support and contribute data from these sites.

Small scale sites vary from their larger counterparts on the mainstem in terms of operating periods, frequency of configuration\location changes, and research purposes.

Separation by Code

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. By default, all PIT-tagged fish detected are returned to the river at each of the juvenile fish bypass sites, unless a researcher requests a different disposition for a particular group of fish. Target fish can be collected in a holding tank for hands-on sampling, or the default gate actions can be over-riden so that they follow the same route as the untagged population of fish. SbyC actions can be applied to an entire population of tagged fish, a proportion of that population, or a predefined number of individuals. Both daily and seasonal collection quotas can be set to limit the number of fish sampled. Each SbyC action can be scheduled for a specified number of hours or days, or a specified

⁷ Interrogation Site Metadata on the PTAGIS website: <http://www.ptagis.org/sites/interrogation-site-metadata>

pattern of days. Multiple populations can be identified and segregated at a given site, with unique SbyC actions assigned to each group at that site.

Through the use of well-designed SbyC instruction logic, frequent on-site inspections of the SbyC equipment components, and the methodical implementation and utilization of equipment diagnostic and alarm systems, PTAGIS has consistently provided effective selection and diversion of targeted PIT-tagged fish with no adverse impacts to non-targeted fish or to regular facility operations.

Coordination and Data Management for RM&E

The PTAGIS program provides a substantial effort to facilitate voluntary contribution of data from disparate agencies within the region including those outside the BPA Fish and Wildlife Program (FWP). These research contributions span across the 4H, Predation, Population, Status and Recovery management question boundaries. Data are processed and collated in near real-time and contributors are immediately informed of any validation errors. Once processed, the data are available to anyone through reporting and data extraction features of the website. A PIT Tag Steering Committee (PTSC) provides governance and additional coordination to ensure regional standardization and uphold the integrity of the data and metadata. A *Data Use Policy*⁸ is published on the PTAGIS website providing guidance to contributors and researchers using the data. PTAGIS is an independent entity and does not analyze or produce biological results from the data. The use of PIT tag data is integral to a large portion of the Fish and Wildlife Program's RM&E projects; PTAGIS FWP project 1990-080-00 is directly associated with *FCRPS 2008 BiOp*⁹ through RPA 50.1, RPA 72.1 and RPA 72.2

Operate and Maintain the PTAGIS System

This section describe portions of the PTAGIS project related to collection, management and web delivery of all PTAGIS data and metadata.

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

This objective delivers functioning systems for the collection and dissemination of near-real-time PIT tag data. Managed by PTAGIS staff in the Portland, OR office and occasional subcontractors working on-site and remotely, this objective is organized logically into three sections:

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

Field Data Collection Systems

PTAGIS develops, maintains and provides technical support for 3 basic types of field data collection systems:

- Tagging Software
- Interrogation Software
- Utility Software

⁸PTAGIS Data Use Policy: <http://www.ptagis.org/data-use-policy>

⁹ 2008 FCRPS BiOp RPA By Approach, Strategy:
<http://www.cbfish.org/Reports/ReportViewer.aspx?RptName=2008FCRPSBiOp&rs%3AFormat=PDF>

The software systems described in this section are used by many RM&E projects to collect and submit regionally standardized MRR and observation data into the PTAGIS system. The vast amount of PTAGIS data are contributed from these systems that can be downloaded from the PTAGIS website and installed on a researcher's PC.

Tagging software captures [MRR datasets](#) by interfacing with tag readers (transceivers) and other devices to provide an ergonomic and highly customizable data entry system. Robust validation alerts users to issues so they can be corrected in real-time while a fish is in-hand. Authorized users can easily submit their datasets to PTAGIS using the software. The datasets are uniquely identified and can be resubmitted to correct data anomalies that cannot be detected with software validation.

Interrogation software combined with communication networks provide unattended operation and continuous recording of [observation data](#) in real-time. The data collected in the field is automatically uploaded to the central database on the hour for processing in 'near real-time'. The sophisticated systems are used at all [large scale interrogation sites](#) combining high-availability technology with standard operating and maintenance procedures described in the [Field Operations and Maintenance](#) section to ensure seamless data collection throughout the year. The software can also *scale downwards* to collect data at [small scale interrogation sites](#).

Utility software is provided by PTAGIS 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.

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 data submitted through the field data collection systems. The deliverable of this objective is a highly functioning, cost-effective and extensible data management server and related systems.

Key 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.
- Automated alerting system to notify data stewards of anomalous events such as data validation failures or when remote interrogation sites fail to upload on schedule.
- System administration, tuning and capacity planning following industrial best practices.
- Development of new database schema and supporting infrastructure to support the evolving needs of the regional community.

A few of the RM&E projects, such as DART and Fish Passage Center, require a local copy of the entire PTAGIS database on a daily or weekly basis to perform their analysis with additional values. To support this, PTAGIS provides a nightly data extraction process that exports the entire database into a series of files partitioned by day, week and year. The files can be subsequently downloaded and imported into a local database system by project staff as needed. A separate automated system operating on the PTAGIS server also consumes the extracted files and compares the results on a nightly basis for quality assurance.

Web Data Management Systems

The PTAGIS website provides online access to PTAGIS data, metadata, content and services to the public. Most of the online resources can be browsed anonymously, but others needing identification and authorization require the user to create an account and login to the system. The deliverable for this portion of the objective is a highly functioning, cost-effective and extensible web server and related 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 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

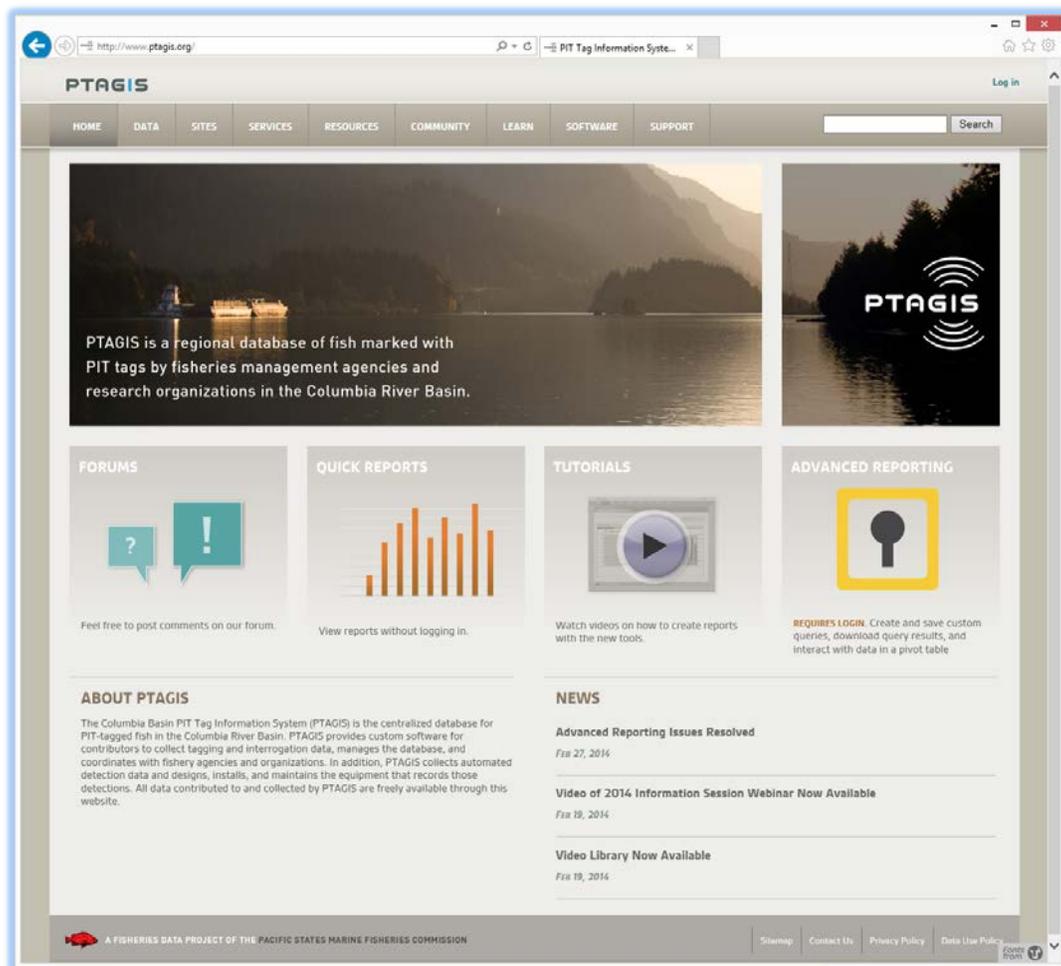


Figure 6. Home page of the PTAGIS website

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

Before a [SbyC](#) project can be implemented by PTAGIS, 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 mainstem FCRPS:

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

The agencies and researchers whom request SbyC vary year-to-year. The focal species are salmonids, but recently lamprey were also separated.

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 check list 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 (described in [Field Data Collection Systems](#)) 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 can be reviewed from the website. Researchers can use past requests to quickly populate new SbyC requests that are on-going.

Install, Operate and Maintain Interrogation System in Field Locations

A centrally located field operations office designs, installs, and maintains the equipment and software needed for automated PIT tag detection at [large scale interrogation sites](#), including systems for enabling individual fish segregation, examinations and relocation ([SbyC](#)).

This objective is comprised of the following contract work elements:

D: 70. Support Separation by Code Systems

The SbyC system is composed of fishways or flumes, diversion gates of all types (slide gates, rotational gates, side to side gates), air cylinders, solenoids, Programmable Logic Controllers (PLC), serial and Ethernet interfaces to PTAGIS data collection software, server side system diagnostics and more. This work element relates to work that must be done 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 operations and maintenance of the SbyC equipment and infrastructure to support this on-going process. The SbyC diversion gates are directly incorporated into complex passage fish structures and a malfunction or failure of the SbyC equipment can result in catastrophic consequences for smolts and adult fish routed through these facilities.



Figure 7. A slide gate diverting a test PIT tag.

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 as new detection data are received into the PTAGIS database. Staff review those efficiencies from a Web-accessible DGE report 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.

E: 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-qualifies 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 to install the electrical components of this system that include the transceivers, network, PLC, and the data collection computers.

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

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

The PTAGIS field staff utilize daily operational reports which are monitored multiple times each 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. In periods with lower migration, these maintenance checks were performed every other week. Site visits include tuning all readers, inspecting and adjusting the timing of diversion gates, data collection computer maintenance 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.

General maintenance and anomalous events are recorded by field staff in an event log¹⁰ for each site and are publically available on the PTAGIS website as metadata.

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

¹⁰ PTAGIS Event Logs for Interrogation Sites: <http://www.ptagis.org/services/event-logs/view-event-logs>



Figure 8. PTAGIS staff repairing a transceiver device.

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 either limited in scope or well-defined and do not need further introduction:

- J 132. Submit Annual Progress Reports
- K 132. Produce Other Report
- L: 165. Produce Environmental Compliance Documentation
- M: 185. Produce Pisces Status Reports – Periodic Status Reports for BPA

A: 119 Routine Administration of the Contract

This work element delivers general administration and on-going management of the 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 in the form of:

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

G: 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. This support is primarily focused on the publically accessible PTAGIS [Field Data Collection](#) and [Web Data Management](#) systems.

H: 122. Additional Support Actions

PTAGIS staff is often tasked to share their unique expertise with the regional community 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 can range from:

- Additional regional coordination
- Transceiver, antenna and PIT tag conformance testing
- Electronics, process and control engineering
- Electrical design
- Radio frequency identification (RFID) design
- Computer-aided design (CAD) detail
- Antenna design

I: 189 Coordination- Columbia Basinwide

This objective covers standard regional coordination activities such as:

- Participating and the hosting of PIT Tag Steering Committee meetings
- 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

Specific coordination activities are introduced in the following subsections.

Data Contributor Coordination

All MRR data and a good portion of observation data are contributed to PTAGIS by a diverse array of fisheries management and research organizations working in the Columbia Basin. 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 FWP projects funded by BPA. A web-enabled workflow is provided by PTAGIS 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
- Distribution and tag 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 (*Figure 7*) to verify PIT tags are manufactured according to specifications of the contract between BPA and the vendor, such as:

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

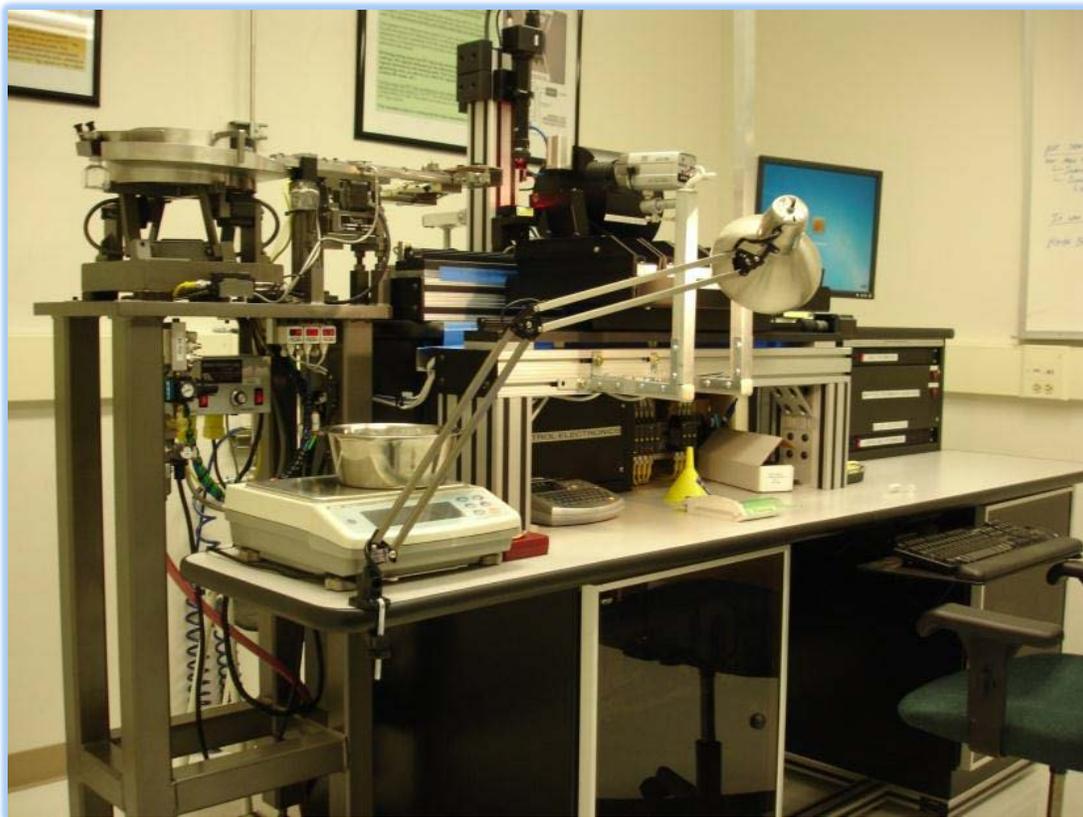


Figure 7. Automated PIT Tag Test System (APTTs) located in the PTAGIS Kennewick laboratory

PIT Tag Forecasting

In response to elements contained in the 2008 BiOp, the Action Agencies (AA), NOAA and the NPCC determined that a means to forecast future PIT-tagging effort would be instructive and should be established. Ideally, the forecast should extend several years into the future. A sub-group was formed that specified attributes to be included in a database that would inventory and forecast future tagging efforts. In December 2009 a template for a new PIT tag forecast-inventory was constructed and distributed to all agencies to populate. Until recently the database was resident at Columbia Basin Research in UW.

The agencies felt it would be advantageous to integrate the Forecaster into PTAGIS and make it more user friendly. BPA approached PTAGIS to take on this additional scope of work in the summer of 2013. PTAGIS has been coordinating the development of this application as part of the [Web Data Management System](#). The AA, NOAA and NPCC agreed to coordinate the participation of FWP, AFEP, HCP and BOR funded projects.

For populations, the ESU or MPG is the target unit. Spatially, an established PTAGIS release site and/or HUC4 scale is the focal point. The forecaster focuses on anadromous salmonids and other species may be added such as lamprey, bull trout and sturgeon.

PIT Tag Recovery Rewards Program

This incentive program was established in 2006 to encourage people to report PIT tags recovered in commercial or sport fisheries. The program rewards fishers who find and turn in PIT tags with a pocket fish scale (with measuring tape) to encourage the recipient to give us weight and length measurements from recovered PIT tags, a PTAGIS test-tag key chain with an active PIT tag imbedded in it, and a reward letter with detailed information and history on the host fish from which the PIT tag was recovered.

Results

Coordination and Data Management for RM&E

As an independent entity, PTAGIS does not analyze or produce biological results from data collected and managed by this project. As a measure of annual performance for this contract, the results summarized in this section are for on-going technical activities and accomplishments structured by scope of work elements introduced in the previous section.

Operate and Maintain the PTAGIS System

Around 2 million fish marked with a PIT tag were contributed into the PTAGIS database in 2014 (*Figure 8*). The proportions of salmon and steelhead tagging in 2014 were similar to those species tagged in 2013 and 2012 (*Figure 9*). In 2014, 927,189 unique tagged fish were detected at one or more locations (*Figure 10*). One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites. In 2014, there were 12,652,493 detections reported to PTAGIS with a total of over 174 million cumulative detections since 1987 (*Figure 11*).

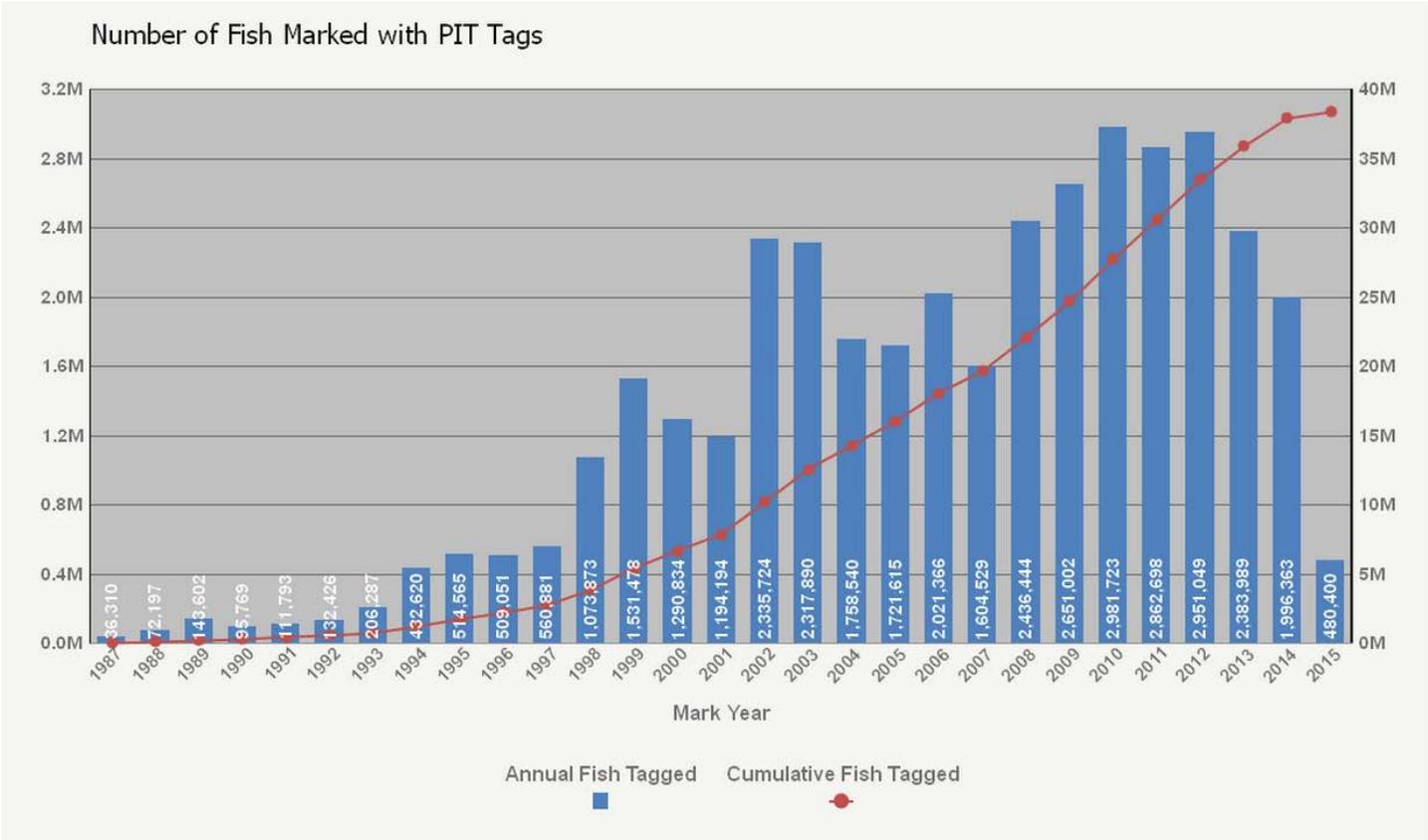


Figure 8. Annual and Cumulative Number of Fish Marked with PIT Tags

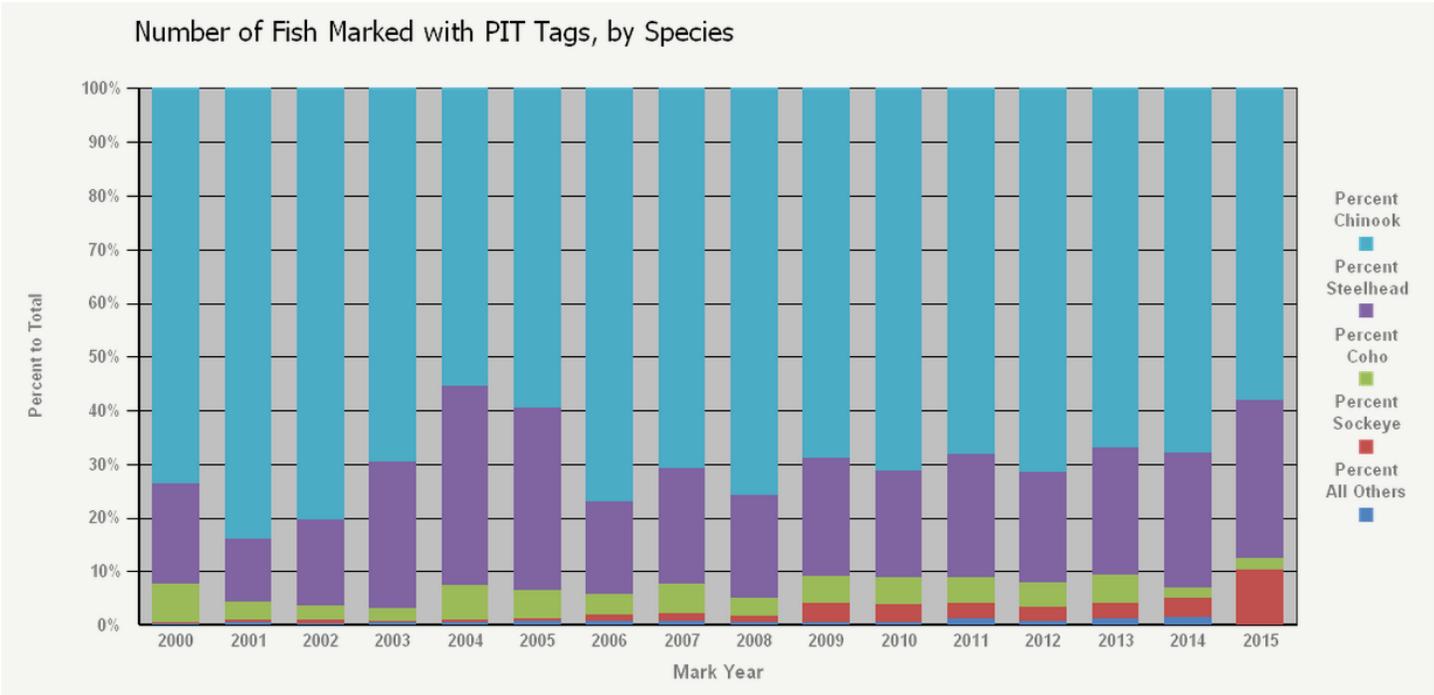


Figure 9. Number of Fish Marked with PIT Tags, by Species

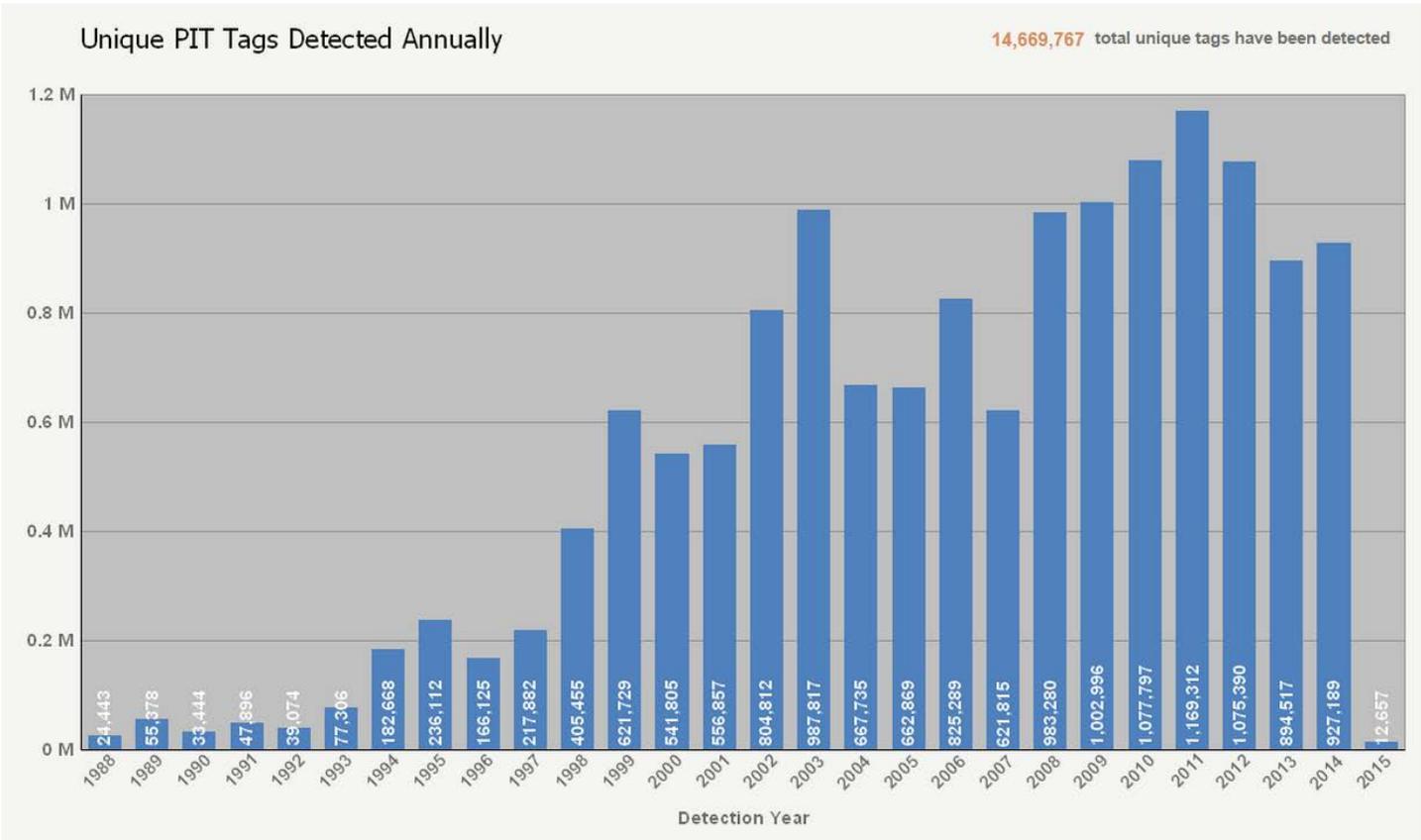


Figure 10. Unique PIT Tags Detected Annually

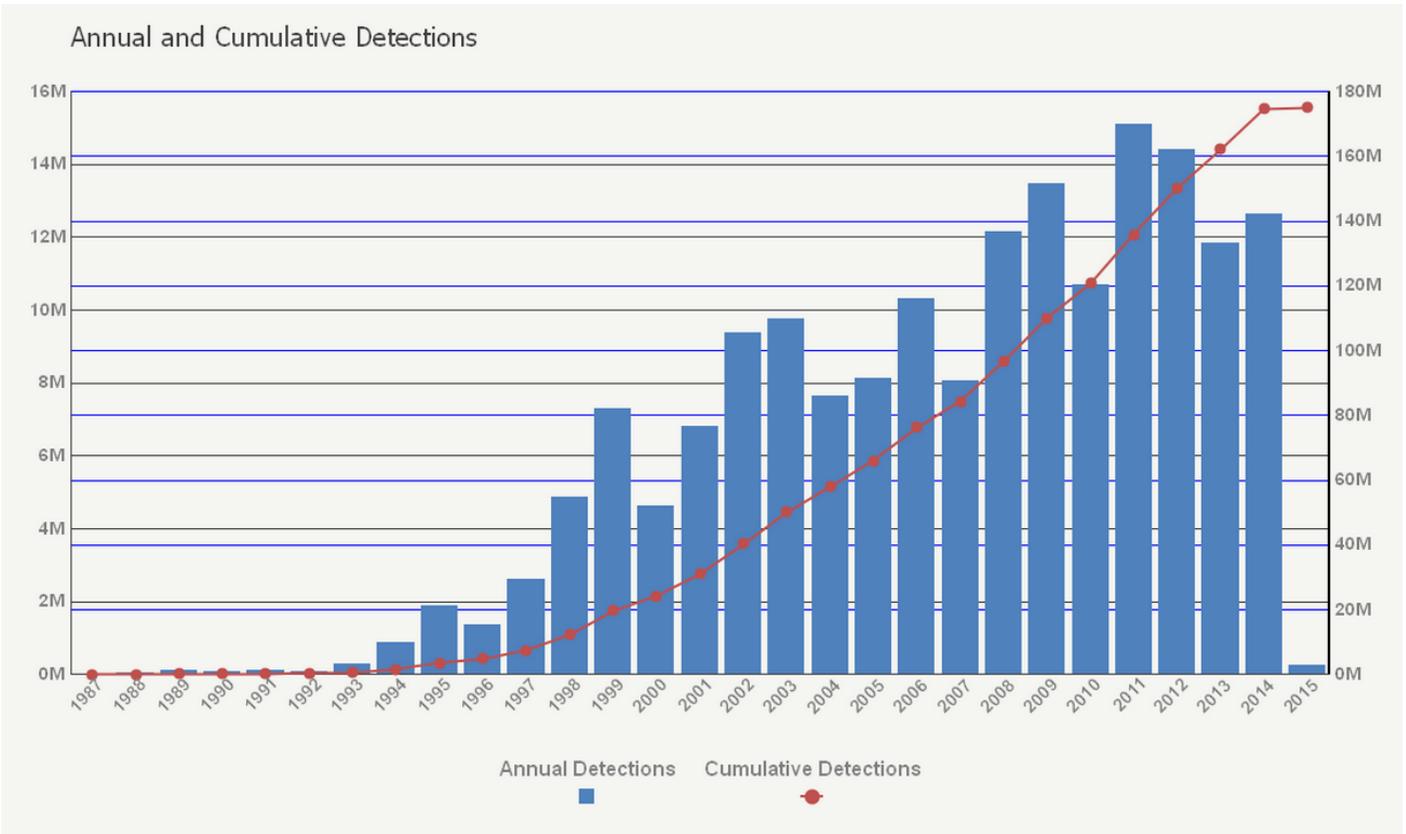


Figure 11. Annual and Cumulative Detections

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

The results in this section are focused on software, database, and system engineering/administration efforts to support the PTAGIS system in 2014. Some of these efforts directly support other work elements and are described in those sections for context.

Field Data Collection Systems

PTAGIS tagging software, called P3, is the remaining system component that has not been upgraded and continues to be widely used throughout the region to submit MRR data into PTAGIS. This software is stable and was declared end-of-life years ago. Considerable progress was made in the development of next generation tagging software to replace P3, called P4:

- Training on Microsoft Windows Presentation Foundation (WPF), MVVM and related .NET 4.5 Framework as target development technology
- Evaluation and adoption of third-party development products (Telerik, DevExpress) and open source systems to enhance delivery
- Migration of Source Code Repository from on-premise to cloud-based product facilitating working with outside contractors
- Coordination with PTSC and community to revise and enhance MRR data model used by this system; a large portion of which was approved by PTSC
- Mitigated compatibility issue with legacy digitizer tablet devices and modern (Win8) platforms
- Development of page-driven navigation application shell, database and data model, and validation code management components
- Recruitment of additional staff with specific skills to work on this project and other field software systems
- Additional features relating to Configuration Profile, Templates, Tag Actions, and Data Entry were designed and will be demonstrated at 2015 PIT Tag Workshop

PTAGIS interrogation software, called M4, was maintained at all [large scale interrogation sites](#) for the duration of 2014 providing a stable and reliable platform for observation data collection and Separation by Code operations. No significant changes to M4 were made in 2014.

Minimon and PIFF continue to provide the means for agencies operating small scale interrogation sites to collect and format interrogation data for submission to PTAGIS.

Server Data Management Systems

The usage results of the PTAGIS server reporting system can be summarized as:

Data Loading

- **569,039** data files processed
- **126.8 million** database rows updated or inserted

Reporting

- **491** users ran at least one report
- **242,706** queries were executed
- **5.2 billion** rows returned

The primary focus for 2014 was to refine, enhance, and document the new processes and systems that were implemented on a tight deadline in 2013. The following deliverables summarize this effort:

- Improved Interrogation Data Load (IDL) and Tag Data Load (TDL) processes handling and notification of unforeseen errors
- Enhanced TDL notification emails to include the following information:
 - Summary of records loaded
 - List of tags that do not match known tag masks (indicates misread or tags new to the PTAGIS system)
 - List of test or timer tags
 - List of duplicate tag records
- Enhanced IDL notification emails to provide a more user friendly error message
- Enhanced TDL data validation:
 - Brood Year and Migratory Year are validated against Tag Date
 - Tag codes are validated against Tag Masks known to be in use in the Columbia Basin
 - Species-Run-Rear Type combinations are checked against list of valid combinations
- Continued support for data submissions via email
- Refined and enhanced internal Operations and Maintenance (O&M) reports:
 - Diversion Gate Efficiency (DGE)
 - Cumulative Efficiency Analysis (CEA)
 - Timer Tag Report
 - Transceiver Annunciator Service (TASS)
- Developed new O&M reports to provide details about interrogation equipment status and operating efficiency
- Refined data extraction system for large data consumers and added automated QA
- Refined and enhanced QA/QC data reports for external data management and quality assurance
- Reviewed and refined internal backup and recovery procedures for database and related systems to ensure high-availability.

Web Data Management Systems

The PTAGIS website remains the primary interface for researchers to download PIT tag data, review metadata, communicate with PTAGIS staff, and learn about PTAGIS features. Usage of the website increased in 2014, summarized by these numbers:

- Total Visits: **55,139**
- Unique Visitors: **12,073**
- Page Views: **174,514**

Existing website features were maintained and development was begun on replacements for two web applications:

- Request new Validation Code
- Request new Separation by Code Project

The RESTful API¹¹ was further refined in 2014 and integrated into M4, P4 and web application development projects.

¹¹ Wikipedia definition for REST: http://en.wikipedia.org/wiki/Representational_State_Transfer

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

In 2014, 17 SbyC projects were implemented and coordinated by PTAGIS staff as shown in the table below. These projects requested a total of **3,334,085** tag codes to be separated.

Organization	Project	Target Tags
Biomark, Inc.	Lower Granite Dam Juvenile Fish Collection Channel Prototype Overflow Weir and Enlarged Orifice Biological Evaluation	8,100
	LGR JBS Prototype Overflow Weir and Enlarged Orifice Biological Evaluation: Specific Details of Lamprey in the Study Design	1,200
Fish Passage Center	Comparative Survival Study 2014	403,937
Idaho Department of Fish and Game	Radio tagging adult spring Chinook at Lower Granite Dam to determine migration timing and behavior in the Lemhi River, Idaho	30,210
	Monitoring and evaluation of Brood Year 2012 PIT tagged Chinook salmon smolts released from Idaho hatcheries	95,576
	2014 Known Repeat Spawning Adult Steelhead Scale Collections	20,596
	Potlatch River Adult Steelhead Telemetry	50
Nez Perce Tribe	Nez Perce Tribe 2014 Separation by Code Request	19,821
	B-Run Steelhead Evaluations - #201005700	74,329
NOAA Fisheries	Transportation and survival research	2,552,284
	Migration timing and parr-to-smolt estimated survival for wild Snake River spring/summer Chinook salmon smolts	25,060
Oregon Department of Fish and Wildlife	Wallowa Stock Steelhead Smolts	15,455
	Imnaha Stock Steelhead Smolts	14,972
Washington Department of Fish and Wildlife	Lyons Ferry Hatchery Complex -Snake River, Steelhead Tributary Releases	21,983
	Performance Evaluation of PIT tagged yearling Chinook released at Lyons Ferry Hatchery 2014	30,000
	Performance Evaluation of PIT tagged subyearling Chinook released at Lyons Ferry Hatchery 2014	20,000
	Snake River Hatchery Fall Chinook Fidelity and Fallback Study	512
TOTAL		3,334,085

Figure 12. SbyC Projects Implemented in 2014

A new SbyC data management system was implemented that links with the SbyC request web form to streamline management and updating of the SbyC platforms at the dams. This system includes semi-automated import of target tag codes and web-based reports to monitor target tags passing through the SbyC system. This new system and the promotion of M4 into production at all SbyC sites made for a smooth year. No significant issues or problems were encountered.

Install, Operate and Maintain Interrogation System in Field Locations

As in previous years, the juvenile fish bypass facilities on the Snake and Columbia Rivers began operating around April 1st. Prior to these operations, the PTAGIS Kennewick staff performed all the necessary pre-season tuning and maintenance to ensure peak performance of the juvenile fish detection and diversion equipment. Detection and diversion efficiency rates for 2014 were good as or better than previous years. No data losses or diversion gate failures occurred in 2014.

D: 70. Support Separation by Code Systems

The efficiency of operating the SbyC diversion gates was 98-100%. A DGE report (Figure 13) breaks down the efficiency for each of the 17 diversion gates operated at juvenile bypass facilities by PTAGIS in 2014.

Diversion Gate Efficiency Summary

({Divert Time} (Value) Between 1/1/2014 12:00:00 AM and 1/1/2015 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	27,945	27,925	15	99.9%

GOJ - Little Goose Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
GOJ	A-SEPARATOR GATE	67,300	65,968	1,282	98.1%
	B-SEPARATOR GATE	42,239	41,690	525	98.8%
	DIVERSION SBYC GATE	61,546	61,489	2	100.0%

GRJ - Lower Granite Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
GRJ	A-SEPARATOR GATE	111,380	108,791	2,386	97.9%
	B-SEPARATOR GATE	60,204	59,243	851	98.6%
	DIVERSION / SBYC GATE	83,125	82,113	885	98.9%
	RCWY-10 GATE	59,689	58,752	851	98.6%
	SBYC GATE	8,939	0	0	0.0%

JDJ - John Day Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
JDJ	SBYC GATE	2	1	1	50.0%
	SBYC SEPARATOR GATE	86,001	85,548	441	99.5%

LMJ - Lower Monumental Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
LMJ	A-SEPARATOR GATE	34,570	33,923	640	98.1%
	B-SEPARATOR GATE	37,347	36,711	625	98.3%

MCJ - McNary Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
MCJ	SBYC A-RACEWAY RIVER GATE	28,281	28,269	0	100.0%
	SBYC A-SEPARATOR GATE	29,509	28,449	0	100.0%
	SBYC B-RACEWAY RIVER GATE	26,526	26,498	0	100.0%
	SBYC B-SEPARATOR GATE	26,715	26,679	0	100.0%

Figure 13. DGE report for 2014

Note: the diversion efficiency cannot be computed for the gate labeled *SBYC GATE* at GRJ because it does not have a downstream detection point.

E: 70. Install Interrogation Systems in Field Locations

Little Goose and Lower Monumental adult ladders are now equipped with thin body ferrite tile PIT tag antennas. The goal of these antennas is a detection rate of near 100% and an uptime of near 100%. The system at Little Goose Dam

(GOA) became operational on March 28, 2014. The system at Lower Monumental Dam (LMA) started operations on January 27, 2014, without fiber connectivity to the data collection platform. For the entirety of 2014, PIT tag detections at LMA were downloaded from transceiver buffers by staff during regular maintenance visits and uploaded to PTAGIS manually.

Detection efficiency at these two sites is similar to other adult ladder interrogation sites maintained by PTAGIS.

Adult Ladder Interrogation Site Efficiency for 2014

BON Adult Ladders	Fish Released Below BON and Detected Above BON	Fish Released Below BON and Detected at BON and Above	BON Missed Tags	Percent Tags Detected at BON
	1,893	1,860	<u>33</u>	98.3%
TDA Adult Ladders	Unique Tags Detected at BON and ICH Ladders	Unique Tags Detected at BON, TDA and ICH Ladders	TDA Missed Tags	Percent Tags Detected at TDA
	13,671	13,626	<u>45</u>	99.7%
MCN Adult Ladders	Unique Tags Detected at BON and ICH Ladders	Unique Tags Detected at BON, MCN and ICH Ladders	MCN Missed Tags	Percent Tags Detected at MCN
	13,671	13,605	<u>66</u>	99.5%
ICH Adult Ladders	Unique Tags Detected at MCN and GRA	Unique Tags Detected at MCN, ICH Ladders and GRA	ICH Ladders Missed Tags	Percent Tags Detected at ICH Ladders
	12,198	12,123	<u>75</u>	99.4%
LMN Adult Ladders	Unique Tags Detected at MCN and GRA	Unique Tags Detected at MCN, LMA and GRA	LMA Missed Tags	Percent Tags Detected at LMA
	12,198	12,095	<u>103</u>	99.2%
LGO Adult Ladders	Unique Tags Detected at MCN and GRA	Unique Tags Detected at MCN, GOA and GRA	GOA Missed Tags	Percent Tags Detected at GOA
	12,198	12,086	<u>112</u>	99.1%

Figure 14. PIT Tag Detection Efficiency at Adult Ladder Interrogation Sites in 2014

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

All SbyC PIT tag rooms were renovated at the main stem sites in 2014 following the removal of redundant legacy systems. These sites included GRA, GRJ, GOA/GOJ, LMA/LMJ, MCJ, JDJ, B2J and BO3. Besides the removal of the legacy system, all networking equipment was routed through proper networking enclosures with full documentation recorded. New larger UPSs were installed to back up the data collection platform with a full redundancy schema that follows the PTAGIS philosophy that no single component failure would stop data collection.

To upgrade the aging FS1001A transceivers, PTAGIS continued to deploy FS2020 transceivers, installing (8) in 2014 for a total of (84) transceivers currently operating in the field, as summarized below:

Site	Monitor	Number 2020s Deployed
GRA	Ladder	8
GOJ	Full Flow	4
GOA	Counting Window	2
LMJ	Full Flow	4
LMA	Counting Windows	4
ICH	Full Flow	4
MC1	Counting Window	2
MC2	Counting Window	3
MCJ	Full Flow	4
JDJ	Full Flow	4
TD1	Counting Window	2
TD2	Counting Window	2
BO1	Slots	4
BO4	Slots	4
B2J	Full Flow	4
CFF	Bypass Channel	3
LFF	Channel and Wet Lab	15
PRO	Ladders	6
ROZ	Ladder and Flat Plates	5
TOTAL:		84

Figure 15. FS2020s Deployed as of 2014

The following reports (*Figure 16*) provide examples of cumulative efficiency analysis (CEA) for each antenna at different three types of sites managed by PTAGIS.

JCJ - Jack Creek Acc. Pond

Subsite	Antenna Group	a	Tags	Tags	Detected by	Missed	Tags	Missed per	Tags
JCJ	NORTH RIVER EXIT	A1	11,687	5,686	5,650	36	99.37%		
		A2	11,687	5,686	5,662	24	99.58%		
	SOUTH RIVER EXIT	B1	11,687	6,001	5,975	26	99.57%		
		B2	11,687	6,001	5,981	20	99.67%		

B2J - Bonneville PH2 Juvenile

Subsite	Antenna Group	a	Tags	Tags	Detected by	Missed	Tags	Missed per	Tags
B2J-FF	FULL FLOW BYPASS	01	34,845	34,845	34,564	281	99.19%		
		02	34,845	34,845	34,628	217	99.38%		
		03	34,845	34,845	33,814	1,031	97.04%		
		04	34,845	34,845	34,628	217	99.38%		
B2J-JFF	SBYC SEPARATOR GATE	A1	33,720	33,718	33,604	114	99.66%		
		A2	33,720	33,718	33,646	72	99.79%		
		A3	33,720	33,718	33,649	69	99.80%		
		A4	33,720	33,718	33,651	67	99.80%		
	RIVER EXIT	81	33,720	29,526	29,444	82	99.72%		
		82	33,720	29,526	29,482	44	99.85%		
	SAMPLE ROOM	51	33,720	624	622	2	99.68%		
		52	33,720	624	623	1	99.84%		
	SBYC EAST TANK	E1	33,720	3,467	3,461	6	99.83%		
		E2	33,720	3,467	3,457	10	99.71%		
	SBYC WEST TANK	F1	33,720	95	95	0	100.00%		
		F2	33,720	95	94	1	98.95%		
	SAMPLE / SBYC EXIT	91	33,720	3,481	3,207	274	92.13%		
		92	33,720	3,481	3,230	251	92.79%		
		93	33,720	3,481	3,238	243	93.02%		

GRA - Lower Granite Dam Adult

Subsite	Antenna Group	a	Tags	Tags	Detected by	Missed	Tags	Missed per	Tags
GRA-LDR	WEIR 733	01	19,180	19,160	3,052			20	99.90%
		02	19,180	19,160	17,397			20	99.90%
	WEIR 732	03	19,180	19,131	4,037			49	99.74%
		04	19,180	19,131	16,245			49	99.74%
	WEIR 731	05	19,180	19,127	5,906			53	99.72%
		06	19,180	19,127	14,440			53	99.72%
	WEIR 730	07	19,180	19,112	6,170			68	99.65%
		08	19,180	19,112	14,157			68	99.65%
GRA-TRP	ISO WEST	12	8,527	7,916	7,897	19	99.76%		
		14	8,527	7,916	7,864	52	99.34%		
		16	8,527	7,916	7,852	64	99.19%		
		18	8,527	7,916	7,900	16	99.80%		
	ISO EAST	22	8,527	715	715	0	100.00%		
		24	8,527	715	715	0	100.00%		
		26	8,527	715	715	0	100.00%		
		28	8,527	715	711	4	99.44%		

Figure 16. Example CEA Reports for Acclimation Pond, Juvenile and Adult Interrogation Sites

In 2014, the average detection efficiency for the 414 detectors maintained by PTAGIS was 98.3% (Figure 17). Sites such as BO2 utilize overflow weirs and fish have the opportunity to travel over PIT tag detectors reducing the site efficiency.

Site Code	Average Detection Efficiency per Site
B2J	99.4
BCC	N/A
BO1	98.9
BO2	88.8
BO3	91.3
BO4	98.6
CFF	100.0
CFJ	99.2
ESJ	99.4
GOA	99.8
GOJ	99.0
GRA	99.8
GRJ	99.2
ICH	99.6
JCJ	99.4
JDJ	99.2
LFF	96.7
LMA	98.2
LMJ	99.2
MC1	98.5
MC2	98.0
MCJ	99.3
PRO	97.9
ROZ	98.6
RPJ	97.1
TD1	99.8
TD2	99.9
Overall Average	98.3

Figure 17. Average Detection Efficiency for PTAGIS Interrogation Sites in 2014

Administration, Management and Coordination

A: 119 Routine Administration of the Contract

The objectives and deliverables described in this report were performed under a contract submitted as a funding package in 2013. All contract-related deliverables such as annual and periodic status reports were completed on schedule. The new funding package for FY15 was developed, reviewed and submitted in 2014.

The PTAGIS administrative assistant retired in 2014. Her duties were absorbed by PTAGIS staff and PSFMC administrative staff. In December a software engineer was hired to assist with development of high priority PTAGIS field software. Performance reviews were completed and submitted on schedule per PSMFC guidelines.

Staff performed an annual inventory audit and the product was loaded into Pisces for the FY15 funding package.

In 2014, subcontracts were extended from FY13 or were created for follow-on work with the same entities as described in *Figure 18*.

Subcontractor	Performance Period	Description of Work
Field Trip, Inc.	December 2014-January 2015	Poster development for 2015 Workshop
Falafel	FY2014	Development of PIT Tag Forecaster, refine CSS for PTAGIS website, general mentoring
Stuart Semon	January-February 2015	Develop USB interface using WinTAB library to allow P4 to access legacy digitizer tablet hardware
Biomark	March 2014-February 2015	Maintain the detection equipment at Rapid River Hatchery

Figure 18. Summary of subcontracts used by PTAGIS related to technical activities

G: 122 Technical Support and Training Assistance to Field Users

Users of all PTAGIS field software, web and reporting systems were supported with technical support and training assistance. Staff are responsive to ad-hoc support requests that can range from simple to complex coordination requirements. Complex requests are routed to the expertise within the staff. In combination of traditional methods such as phone and email, staff also incorporated online webinar, video tutorials and forum (*Figure 28*) technology. Five new video tutorials were produced and made available on the PTAGIS web site Tutorials¹² page.

H: 122. Additional Support Actions

The following actions occurred in 2014 related to support on-going PIT tag detection activities Basinwide:

- Continued coordination and evaluation of the Biomark FS3001 transceiver development project as replacement for first-generation transceivers at the Bonneville corner collector interrogation site (BCC) and for use in the Lower Granite Ogee Project.
- Participate in USACE design team for installing thin-body antennas at counting windows at Lower Monumental, Little Goose and the adult fish trap at Ice Harbor.
- Evaluation with USACE personnel to determine if hydrofoil antenna prototype at BCC will impact existing antenna as well as those at the BO4 slots.
- Participate with NOAA to design a low-cost yet efficient antenna system for the John Day adult ladders.
- Evaluation of new PIT tags for USACE procurement.

I: 189 Coordination- Columbia Basinwide

Staff coordinated and participated in the *Annual PIT Tag Steering Committee* meeting in January 2014. The meeting notes for this and past meetings are available online¹³. Ad-hoc teleconference meetings and email coordination also occurred throughout the year in 2014, primarily concerned with planning for the 2015 PIT Tag Workshop, the evolution of the MRR data model, and implementing PIT tag code masks as new validation codes.

The following planning and coordination activities were completed in 2014 to support the 2015 PIT Tag Workshop:

- RFP to determine lowest cost venue
- Venue and vendor booth coordination
- Call for presentations and posters
- Established a committee to review presentation abstracts and group them logically

¹² PTAGIS Tutorials: <http://www.ptagis.org/support/tutorials>

¹³ Annual PTSC meeting notes: <http://www.ptagis.org/resources/document-library/meeting-notes>

- Online registration and payment processing

Coordination and collaboration on proposed changes to the MRR data model was conducted through shared Excel spreadsheets and the PTAGIS forums. PTAGIS staff and the PTSC enumerated changes in the shared Excel spreadsheet and invited the PTAGIS community to comment on them or propose additional changes via online forum.

PIT tag masks consist of the first three characters before the period and the next four characters after the period in a hexadecimal-formatted tag code. For example, a standard PIT tag code is 3D9.1BF27710BF and the tag mask is 3D9.1BF2. The PTSC is now responsible for maintaining a list of the known tag masks in use in the Columbia Basin. If MRR or interrogation data are submitted that do not match any of the masks on that list, the tag code is marked as *Unknown* and is automatically filtered from the reporting system. Researchers may request that new tag masks be added to the list, similar to other validation codes such as Species or MRR Site, and any tags matching those new masks will be recast as *Known* tags, and will become available for reporting. The PTSC reviewed and approved requests for two new tag masks in 2014.

Staff coordinated and conducted six information sessions to update PTAGIS users about the new features of the website, reporting system, architecture and software that were implemented. The events were held in locations around the Columbia Basin and via webinar to try to reach as many PTAGIS users as possible (Figure 19). Collectively the sessions were attended by 269 current PTAGIS users. A video was recorded during the online webinar and is available to view from the Video Library¹⁴ on the PTAGIS website. A follow up survey¹⁵ indicated that information sessions were positively received.

Date	Location
January 28	Boise, ID
January 29	Lewiston, ID
January 31	Portland, OR
February 2	Pasco, WA
February 6	Wenatchee, WA
February 12	Online Webinar

Figure 19. Dates and Locations of 2014 Information Sessions

Kennewick staff participated in FPOM, FFDRWG, AFEP, and AFS meetings.

Two newsletters were published in 2014 providing insight and technical coordination to 1500 subscribers within the region. All newsletters are available online¹⁶. The public can easily subscribe to receive the newsletter from a service¹⁷ on the PTAGIS website. Anyone receiving the newsletter electronically can unsubscribe by clicking a link embedded in the distribution email.

The PTAGIS website contains a *News and Announcement* feature on the home page and 17 items were published throughout 2014. Past news items are accessible through the *Resources*¹⁸ section of the website.

¹⁴ PTAGIS Video Library: <http://www.ptagis.org/resources/video-library>

¹⁵ 2014 Information Session Follow-up Survey: <https://www.surveymonkey.com/results/SM-8P9RSCN7/>

¹⁶ PTAGIS newsletter archive: <http://www.ptagis.org/resources/document-library/ptagis-newsletter-archive>

¹⁷ Subscription service for newsletter: <http://www.ptagis.org/resources/subscribe>

¹⁸ News and announcement archive: <http://www.ptagis.org/resources/news-and-announcements>

Data Contributor Coordination

Data are only accepted from tag data project and interrogation sites that have been registered with PTAGIS and have current contact information. Over 30 organizations contributed MRR data for 119 different projects and observation data from 218 small-scale interrogation sites to PTAGIS in 2014. Coordination with data contributors requires keeping contact information up to date for existing projects and sites and working with the PIT Tag Steering Committee to review and register new projects, sites and validation codes. Additionally, staff review data submission and data quality issues and work with data contributors to resolve those issues.

Data Contributor Coordination Summary	Tag Data Projects	MRR Sites	Small-scale Interrogation Sites
Total Registered in PTAGIS	285	1077	267
Submitted Data in 2014	119	392	218

Figure 20. Summary of Data Contributor Coordination in 2014

In 2014 the conversion of Tag Data Coordinators to Tag Data Projects was completed. This allows MRR data to now be linked to a project instead of an individual. Each project has an individual who is the coordinator, but if that person moves on, a new coordinator can be assigned. This allows for long-lived projects to retain the same project code in PTAGIS.

PIT Tag Distribution and Quality Assurance

Staff coordinated the distribution of 1,362,700 PIT tags to 70 unique FWP's in 2014. The following table shows the number of tags of each type that were distributed in this year.

Tag Type	Total Shipped
12mm	928,500
12PL	378,800
9mm	45,400
9PL	10,000
Total:	1,362,700

Figure 21. Summary of PIT Tag Distribution by Tag Type in 2014

Researchers provided forecasting for PIT tags and requested distributions using the Tag Distribution and Inventory (TDI) application developed and released in 2013 (Figure 22). Additional reports were developed for 2014 to assist the BPA tag distribution manager with monitoring tag requests.

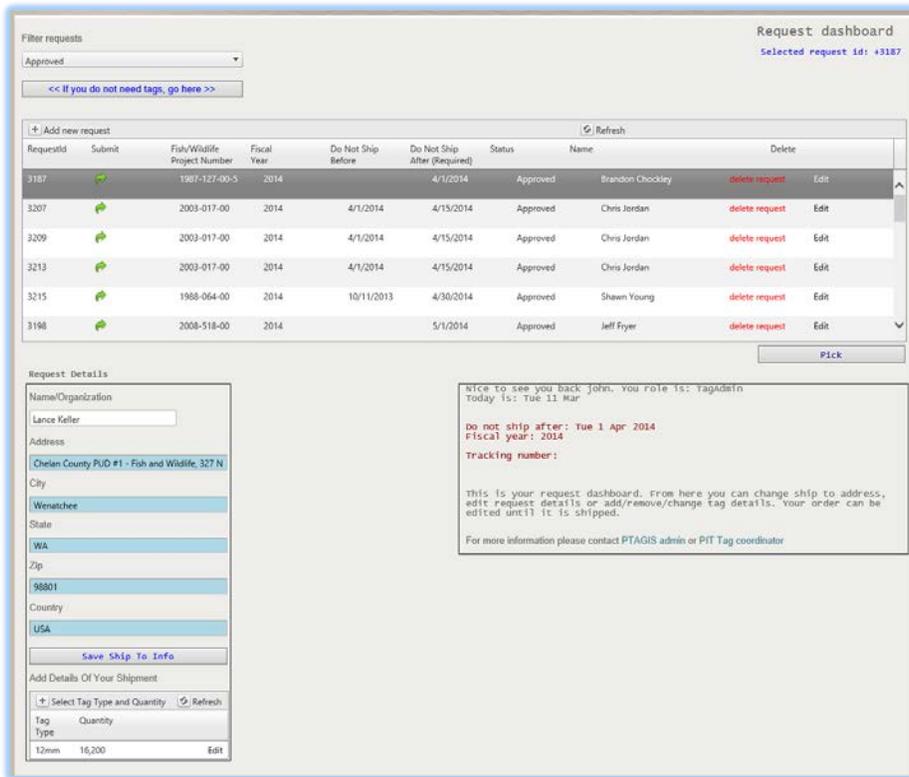


Figure 9. Tag Distribution and Inventory Service on PTAGIS Website

The PIT Tag Sorter (Figure 23) was completed in 2014, allowing PTAGIS staff to increase the quality assurance sample from 1% to 3%. No significant defects were detected in 2014. The Tag Inventory Manager software was updated to automate batch sorting of tags and replacement of bad or damaged tags.



Figure 23. New PIT Tag Sorter automation (left) and the Automated PIT Tag Testing System (APTTs) automation (right).

PIT Tag Forecasting

The new online *PIT Tag Forecaster* tool was completed and released in 2014. Staff managed development, which was conducted by a contractor, coordinated stakeholder meetings to review progress, coordinated beta testing and application revisions, and provided overview and training to prospective users of the system.

PIT Tag Recovery Rewards Program

In 2014, PIT Tag recovery reward letters were distributed to 44 individuals who returned their recovered PIT tags to PTAGIS or other fishery management agencies. Tag data coordinators who submitted the initial mark records for these tags were also notified.

Synthesis of Findings: Discussion/Conclusions

Coordination and Data Management for RM&E

Operate and Maintain the PTAGIS System

As stated in last year's annual report, PTAGIS completed a major system upgrade in 2013. For 2014 the focus was moved to refining, enhancing and documenting the new system and processes, along with initiating field data collection changes that are possible now that the technology on which PTAGIS runs has been upgraded.

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

As mentioned in previous reports, the PTAGIS infrastructure was largely upgraded over the last few years. Much of the effort in 2014 and going forward will be directed towards refining the new infrastructure and aligning systems to meet the needs of researchers.

Security of these systems is always a priority and staff follows PSMFC and industry-standard recommendations to limit opportunities for compromise. Even though the database is deemed publically accessible and most likely would not be a target for compromise, the systems have high-availability requirements and any long-term outage could impact research. In addition, PSMFC has announced an internal security audit to ensure all systems meet established Federal security guidelines.

Field Data Collection Systems

Development was begun on software to replace the P3 tagging software which is the last large piece of the legacy system that needs updating. Staff also worked closely with the PTSC to propose and gain community input on possible changes to the data model into which that software will feed information. Collecting tagging data has a complex workflow and must meet the needs of a wide variety of users – fisheries biologists tagging juvenile fish at a hatchery have different data collection needs than those working on an adult trap. Significant progress was made in identifying and defining additions to MRR dataset and solving technical problems to include those in the next tagging software. The goal for 2015 is to produce a beta version of P4 which can be tested by a focus group made up of PTAGIS data contributors. The addition of a software engineer to PTAGIS staff makes this goal more than attainable.

The interrogation software M4 is stable and performs well at the [large scale interrogation](#) sites for which it was exclusively developed. MiniMon will continue to be supported for those data contributors managing [small scale interrogation sites](#). The transceiver models supported by MiniMon have been recently retired and a suitable replacement for this software is needed now more than ever. The next major release of M4 is scheduled after the delivery of P4 and will focus on supporting new transceiver models, making features more user-friendly and well-documented. Once completed the MiniMon software will be retired and small scale interrogation sites will transition to

M4. The data file format used by M4 is available for data contributors to use to submit interrogation data. A revision to the M4 application architecture will take the complex data parsing dependent upon frequent changes to transceiver firmware and migrate it to the ETL processing on the central server. This will promote application stability and decrease the need to update software in the field.

Server Data Management Systems

Refinements to the database and related ETL systems were made to increase the quality of data being loaded into PTAGIS. Changes were also made to the notifications data contributors received upon submission of data so that they receive more feedback now than ever. The end result is high quality, valid data entering the system even before data contributors perform QA procedures. The backup and recovery processes were reviewed and enhanced to ensure the high-availability of the database and related systems.

Data extract maintenance has been simplified and access is monitored and given only to those projects with a demonstrated need to have access to the entire PTAGIS dataset. They must also have the in-house database expertise necessary to properly use the extract files.

The Microstrategy reporting system was also very stable and handled increasing loads of concurrent users even with a license limiting processing to a single CPU core. Licensing was recently changed by the vendor so that number of active accounts no longer needs to be kept below 500.

Reporting system objects were updated and new reports were produced to assist data contributors with ensuring that the MRR and interrogation data they intended to load into PTAGIS was actually loaded successfully and correctly.

New quality assurance procedures were initiated in 2014 to verify that all data has been loaded into PTAGIS as received. This will be completed in 2015 for all data received since the system upgrade was completed. Once that is completed, data submitted prior to the upgrade will be similarly validated. This is where the bulk of data anomalies are expected to be encountered, as much of these records were loaded before automated validation processes were implemented. PTAGIS will work with the PTSC to resolve those anomalies that are possible to correct, and will publish information about known anomalies that are not possible to resolve.

Web Data Management Systems

The PTAGIS website was stable and effective and handled increasing traffic without issue. Sitefinity¹⁹ remains the content management system on which the site is based, and significant progress was made on migrating the custom web application architecture from *ASP.NET Web Forms*²⁰ to the more efficient ASP.NET MVC²¹ architecture. Other backend enhancements were also made to button up some of the fast and furious development that occurred in 2013. Staff are monitoring the strategic roadmap of the SiteFinity CMS system as it has been recently acquired by another technology company.

The website is in need of a complete usability redesign due to the fast-paced nature in which it was developed. The goal of this usability redesign is to promote productivity features that are currently underutilized by the community. An RFP to subcontract this work was postponed to next fiscal year due to the performance period constraints.

¹⁹ Sitefinity website: <http://www.sitefinity.com/>

²⁰ Microsoft ASP.NET Web Forms: <http://www.asp.net/web-forms>

²¹ Microsoft ASP.NET MVC: <http://www.asp.net/mvc>

The ASP.NET Web API²² system will be fully utilized with advancements to PTAGIS field software. Currently a project with IDFG and another with Sitka are using the API to support their web service needs. The system will be refined and promoted to others as staff workload allows.

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

Operation of SbyC in 2014 was streamlined with a new database management system that better links to the web-based request system. Promotion of the new SbyC software (M4) into production and no longer running in parallel with the legacy system also increased efficiency and simplified coordination and management. No issues were encountered during the 2014 SbyC season.

Install, Operate and Maintain Interrogation System in Field Locations

D: 70. Support Separation by Code Systems

The M4 platform performed all tasks with a high degree of detection/diversion efficiency and no data losses. The decision to retire the Multimon SbyC platforms in 2013 was a clear choice and was proven again in 2014 by operating flawlessly. Developed by the PTAGIS Portland group, M4 raises the O&M capabilities of the Kennewick group to a new level of efficiency with up to the minute reader statuses and instant email alerts to problems within the fish facilities.

The legacy platforms are now fully removed from SbyC sites and staff will continue to deploy the M4 platforms that include solid state hard drives and industrial grade power supplies to promote high availability. These platforms will also include uninterruptible power supplies (UPS) that self-diagnose and have email capabilities. New high speed network interface panels have consolidated the networking features. The enhanced platforms have continued operation through frequent power-related issues where the legacy platforms did not. The M4 equipment layouts were standardized across all the SbyC PIT tag rooms for ease of use and maintenance and were configured to allow future expansion without the need for additional wall mounted enclosures.

The M4 platforms communicate with programmable logic controllers (PLCs) to activate SbyC gates, control sample gates, collect site operational statuses, and gather environmental data. These PLCs are aging, but still perform well. The PLC programs, including associated human machine interfaces (HMIs) are programmed in house by PTAGIS Kennewick engineers. Upgrading the PLCs and HMIs to newer technology may become necessary within the next 5 to 7 years.

During 2013 the GRJ RCW-10 SbyC gate was lower in efficiency than other gates due to the flume design and site operational procedures. PTAGIS worked with the site operators to improve these conditions in 2014.

A new TASS program/report was created in 2014 by the Portland staff that reports all transceiver alerts. This report has performed exceptionally well and is used daily by the Kennewick staff to quickly identify problems. Faster repairs or adjustments to the transceivers are now possible.

E: 70. Install Interrogation Systems in Field Locations

A technological jump in PIT tag antenna design was accomplished by R&D efforts at the PTAGIS Kennewick lab in 2012 and 2013.

Since the beginning of the Basin-wide adult ladder PIT tag detection project, one of the most costly components of these projects was mining enough concrete to install the standard body antennas in the existing ladders. With costs in mind, the Kennewick staff embarked on an effort to reduce the thickness of the antenna bodies. The first target was both

²² Microsoft Web API: <http://www.asp.net/web-api>

ladders at The Dalles. After prototyping these in 2012, the first production antennas were installed at The Dalles in 2013. At only two inches thick, the TD1 and TD1 antennas were able to be surface mounted into the counting window slots. Hydraulic disruption within the slots is minimized by constructing the antennas into a “speed bump” design. The thin body antenna was installed at much lower cost compared to installing standard body antennas that require extensive concrete remodeling and removal of metallic structure.

Ferrite tile is what makes the thin body antennas possible. This technology was first pioneered by Destron Fearing (now Biomark) engineers for use in trench style antennas. The trench style antennas are targeted for embedding in spillways. The PTAGIS Kennewick staff has taken this technology and applied it to flat plate and thin body pass through antennas. The ferrite tile that makes the thin body antennas possible also allows for them to be installed on metal surfaces, something not possible with the older standard body antennas.

Thin body antennas were installed at the Little Goose adult ladder, both adult ladders at Lower Monumental in 2014 and a single antenna at the Ice Harbor adult fish trap will be installed in 2015. The single antenna at Ice Harbor will be implemented as a new SbyC system to target specific fish for trapping and transport. Other possible projects being discussed are both adult ladders at John Day.

The results of the Kennewick staff efforts will provide regional fisheries researchers with valuable, low cost, reliable and efficient PIT tag monitoring sites for years to come.

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

The already high antenna group efficiencies were edged slightly higher for 2014 partly due to the deployment of FS2020 transceivers. This upward trend in detection efficiency will continue with the additional deployment of the FS2020 transceivers planned for the next few years at critical detection locations. The FS2020 has an advantage over older units due to its auto-tuning capability. The planned deployment of FS2020s and those already in service are listed in *Figure 24*.

Site	Monitor	Number 2020s Deployed	Number 2020s Needed	Total for Site
GRA	Ladder	8	0	8
GRJ	Full Flow	0	3	3
GOJ	Full Flow	4	0	4
GOA	Counting Window	2	0	2
LMJ	Full Flow	4	0	4
LMA	Counting Window	4	0	4
ICH	Ladders and Full Flow	4	16	20
ICT	Adult Trap	0	1	1
MC1	Counting Window	2	0	2
MC2	Counting Window	3	0	3
MCJ	Full Flow	4	0	4
JO1	South Ladder	0	8	8
JO2	North Ladder	0	8	8
JDJ	Full Flow	4	0	4
TD1	Counting Window	2	0	2
TD2	Counting Window	2	0	2
BO1	Slots	4	0	4
BO2	N/A	0	0	0
BO3	N/A	0	0	0
BO4	Slots	4	0	4
BCC	N/A	0	0	0
B2J	Full Flow	4	0	4
CFF	Bypass Channel	3	0	3
LFF	Channel and Wet Lab	15	0	15
PRO	Ladders	6	0	6
ROZ	Ladder and Flat Plates	5	0	5
JCJ	N/A	0	0	0
ESJ	N/A	0	0	0
CRJ	N/A	0	0	0
RPJ	N/A	0	0	0
Spares/Lab	N/A	16	7	23
TOTALS:		84	43	143
Note: Future and proposed main stem sites are in blue.		Available to be Deployed:	13	
		Ordered by PSMFC 2015:	30	
		Total Needed to be Ordered In 2016 to Complete Upgrade:	0	

Figure 24. FS2020 Deployment for Outgoing Years

The aging FS1001, FS1001A and FS1001B transceivers are repaired in house and are projected to last, at a minimum, another 5 to 7 years. The yearly failure rate for these transceivers has not risen since they were initially installed.

Administration, Management and Coordination

A: 119 Routine Administration of the Contract

The administration of this contract was business as usual this year with the exception of staffing changes. The part-time administrative assistant in the Portland office announced an early retirement at the beginning of 2014. This position managed subcontracts, budgets, procurement, and other routine program administration to allow the program manager to focus on infrastructure redevelopment the past few years. The number of future subcontracts should be limited now that the major redevelopment projects are mostly complete. Based upon this and the increasing software development/maintenance workload it was determined that an additional software engineer was needed most by this program. The new software position was recruited and hired later in 2014 to offset the difference in salary between the two positions. This position will substantially decrease subcontract costs going forward and improve deliverable schedules for related field software projects.

A concern mentioned in the last annual report about maintaining technical staffing in a competitive market proved to be valid this year. The software engineer responsible for the web site development announced they were leaving the program for a better paying job. Working with PSMFC HR and Executive Director, we determined the program could match the compensation of the competing offer and stay well within the pay band for this position. This proved to be a good decision given a very competitive recruitment for the additional software engineer position filled later in the year.

Upon the request of PSMFC Fiscal, a revised budget was delivered in December to better match staffing and other financial impacts throughout the year. This budget was uploaded to Pisces and approved by the BPA CO.

G: 122 Technical Support and Training Assistance to Field Users

Information sessions were held in the first quarter of 2014 at six locations around the Columbia Basin to update PTAGIS users on the results of the system upgrades. Staff also provided introductory training on the reporting system to session attendees. These types of opportunities to meet face-to-face are invaluable to both staff and users.

H: 122. Additional Support Actions

Destron / Biomark engineers in Minnesota have completed a new transceiver (FS3001) for the single, 17' x 17' Bonneville Corner Collector PIT tag antenna. Ongoing testing by PTAGIS field engineers at this site has confirmed that detection efficiency goals have been met. The stability and auto tuning of the FS3001 has now been refined and performed well throughout the operating season in 2014. The new transceiver was accepted by PTAGIS as production unit and it will be a prime candidate for powering embedded ogee antennas in spillways at Lower Granite. The effort to further improve the FS3001 to achieve detection efficiency goals at Lower Granite will result in those improvements being implemented at BCC.

The Kennewick PTAGIS staff has been invited to be part of a new team targeting spillway PIT tag detection at USACE dams on the Snake and Columbia. Since hydrofoil and embedded trench antennas both have significant design hurdles, a new effort is being discussed to use the flat plate antennas used at Roza Dam on the Yakima River that were designed by PTAGIS Kennewick staff.

For the past three years the Kennewick staff has struggled within limited lab space in an effort to build a reliable test antenna that effectively simulates the unique 17' x 17' Bonneville Corner Collector (BCC) PIT tag antenna. After exhausting all other options staff concluded additional lab space was needed to make a large, shielded enclosure to house a test antenna. Additional lab space was added at no extra charge by renegotiating and extending the lease of the Kennewick office building. A custom door had to be fabricated to allow the movement of large equipment in and out of

the enclosure without impacting the electronic shielding. The large test antenna will be constructed in 2015 and provide a more efficient and consistent testing environment to evaluate PIT tags, transceivers and large antenna designs.

I: 189 Coordination- Columbia Basinwide

Coordination between staff, PTSC and the regional community was excellent this year. The PTSC and PTAGIS staff worked closely together to revise the [Marking Procedures Manual](#), propose and review [changes to the MRR data model](#), plan the 2015 PIT Tag Workshop, and implement PIT tag masks as a new validation code. These tasks address coordination concerns and needs that were identified in 2013.

The Marking Procedure Manual was updated to include updated tagging technology, such as single use injectors, but also provided an opportunity to reiterate that the only recommend location for PIT tag implantation in a fish is in the abdominal cavity. This addresses concerns that were raised in 2013 when two separate incidents were reported by fishermen biting down on PIT tags from fish caught in sport fisheries.

One of the major goals of the database system upgrade completed in 2013 was to allow for changes to the MRR data model that have been requested by users for many years. The PTSC and PTAGIS staff enumerated these requests and created online forums to promote feedback from the PTAGIS community. The PTSC and PTAGIS will review and finalize changes in 2015 which will be implemented in the new tagging software, P4.

Planning and coordination for the 2015 PIT Tag Workshop was completed by the PTSC and PTAGIS in 2014. This involved issuing a call for presentations, reviewing presentation submissions, organizing presentations into cohesive groups and coordinating with the presenters. Workshop logistics were primarily handled by PSMFC administrative staff, with considerable oversight from PTAGIS staff. This event is expected to be attended by 270 PTAGIS users and will be an important method for sharing information about new PIT tag technology, data collection and analysis techniques, and PTAGIS functionality.

Tag mask validation codes were implemented to address concerns about new PIT tags being used in the Columbia Basin without any testing to understand how they will perform with existing PTAGIS infrastructure. If a researcher uses PIT tags that are new to the Columbia Basin without first working with the PTSC to add those PIT tags to the known tag mask validation codes, the data they submit will be quarantined from the reporting system. PTAGIS staff are working on a guidance document to provide researchers information about the performance characteristics of tags and how PTAGIS tests those characteristics. The goal of these two items is to inform researchers about the need to test PIT tag performance before deciding to use them, and to provide an incentive for them to coordinate with the PTSC and PTAGIS when selecting new tags.

PIT Tag Distribution and Quality Assurance

Staff continued to inventory and distribute PIT tags efficiently this year using the web and desktop based request and management software developed in 2013. Coordination between PTAGIS and BPA staff is excellent and no significant issues arose with distributions or inventories in 2014.

Tag Sorter hardware and software components were completed in 2014, allowing the sample size for PIT tag QA to be increased to 3%. Staff are confident that if any short-run manufacturing issues come up, this increased sample size will be able to detect them.

The web-based tag distribution software design review was deferred until 2015 to be completed as part of a site-wide design review of www.ptagis.org.

PIT Tag Forecasting

The PIT Tag Forecaster tool was developed, beta-tested, and released in 2014 by PTAGS working in conjunction with BPA and related subcontractor. It provides an efficient means for fisheries management agencies to enter projected PIT tag releases for ESUs that are tied to defined PTAGIS release locations. Early users have reported that the interface is easy to use, but some have expressed reservations about how the information will be used. The overall success of this project relies upon the effective coordination from the project proponents (BPA, NOAA and NPCC) to promote agencies to complete and maintain their forecasts.

Data Contributor Coordination

The number of data contributors continues to expand each year, necessitating improvements to efficiency and transparency. Implementation of a web-based workflow for the addition of new Tag Data Projects increased the efficiency for researchers, the PTSC and PTAGIS staff. A planned expansion of this web-form to include all of the PTAGIS validation codes in 2015 will only increase efficiency.

PIT Tag Recovery Rewards Program

This program relies on word of mouth and curious fishermen trying to discover the origin of the little glass tube they discovered in their fish. These opportunistic recoveries complete the life history of a very small number of PIT-tagged fish, yet provide valuable information. More recoveries could potentially be generated with some promotion and a well-defined process for submitting recovered PIT tags for a reward.