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

2015 Annual Report

BPA Project # 1990-080-00

Report covers work performed under BPA contract #(s) 68472

Report was completed under BPA contract #(s) 71755

1/1/2015 - 12/31/2015

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Report Created 7-2016

Table of Contents

Executive Summary

The Columbia Basin PIT Tag Information System (PTAGIS) is a coordination and data management project of the Pacific States Marine Fisheries Commission (PSMFC). PTAGIS develops and maintains software that can be used to collect and contribute PIT tag data. Data contributed by regional agencies are validated, loaded into a database system, and made available for download and reporting via the PTAGIS website. This project is an important prerequisite component of all PIT Tag research conducted for the Fish and Wildlife 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 188 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.

The use of PIT tags for monitoring fish migration is a popular and effective research and management tool. This was confirmed by the strong turnout at the *2015 PIT Tag Workshop* hosted at Skamania, WA earlier this year. PTAGIS provided the coordination for this 3 day event which included 70 presentations from experts using this technology

within the basin region and beyond. Vendor booths were packed with participants at an evening reception and during breaks. Staff also provided training on the advanced features of PTAGIS reporting system that was upgraded a few years ago.

The database system continues to expand with new data and usage. This year 2.15 million fish marked with a PIT tag were contributed to the database from 31 agencies. The marked fish were released to one of 341 known sites and as they migrated to and from the ocean they generated 13 million detections from the 269 established interrogation sites within the Columbia Basin. This data was submitted in 378 thousand data files generating 118 million database rows (either updated or inserted). There were 463 researchers who executed 225 thousand queries resulting in 8.5 billion rows of data returned.

The database, web and related field software systems continue to evolve as well. In coordination with the PIT Tag Steering Committee, a new data model was designed to improve support for additional mark/recovery scenarios. New fields requested by researchers provide additional scope to their studies and tie important research to other fishery databases. Implementation of this new model in the database will continue through next year in conjunction with the development of new tagging software called P4. PTAGIS coordinated a focus group of regional experts to help beta test P4 and the new data model. Tag distribution and tag model information as far back as 1999 was added to the powerful reporting system which was not possible with the legacy system replaced a few years ago. Researchers can now filter data by tag type (9mm vs. 12mm tag) or identify a specific study or project that received certain tags.

The detection efficiencies of antennas at interrogation sites managed by PTAGIS edged even higher (99+%) with the deployment of tag readers that auto-tune with changing environmental conditions and the increased usage of better performing tags. The diversion gate efficiencies at SbyC sites remain high due to in-year and off-season maintenance by PTAGIS and COE. Staff have played a pivotal role in the design and coordination of upcoming adult detections systems at John Day Dam which has been requested in the BiOP since the 1990s.

A staff member resigned this year with a highly specialized skillset to program the electronic automation equipment in the field. A replacement was hired a few months later with the hopes they can quickly come up to speed to continue this work.

Despite the setback due to staffing, 2015 was a very productive year for this program. Some of the more significant accomplishments won't be fully realized until next year when new tagging software and data model are operating in production and the new JDA adult interrogation site is fully operational.

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. Fish injected with this tag can be automatically recognized by detecting/recording devices strategically located within collection facilities at hydroelectric dams.

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 submitting 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.

The PTAGIS project is organized into data systems staff located at PSMFC headquarters and a complete Field Operations office centrally located in Kennewick, WA that 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 to the 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 2015 and further describes work elements of the PTAGIS project related to collection, management and web delivery of all PTAGIS data.

Over 2.15 million fish marked with a PIT tag were contributed into the PTAGIS database in 2015 (*Figure 1*) with a cumulative total of just over 40 million. Annual totals will trend slightly upwards as mark records are submitted later in the subsequent year. These records were contributed from 31 organizations and the fish were released into 341 known release sites locations throughout the Columbia Basin. The proportions of salmon and steelhead tagging in 2015 were similar to those species tagged in 2014 and 2013 (*Figure 2*) with the exception of sockeye having a 60% increase from the previous years.

Almost 100 thousand tagged fish were reported as recaptured and re-released. There were 93 thousand mortality/recovery events also submitted.

Figure 3 shows 781,129 unique tagged fish were detected at 273 interrogation sites this year. One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites. There were 13,285,831 detections reported to PTAGIS with a total of over 188 million cumulative detections since 1987 (*Figure 4*).

To give additional scope to data management efforts in 2015: PTAGIS processed 378 thousand data files with 118.6 million database rows updated or inserted; 463 users executed 225 thousand queries resulting in 8.5 billion rows returned.
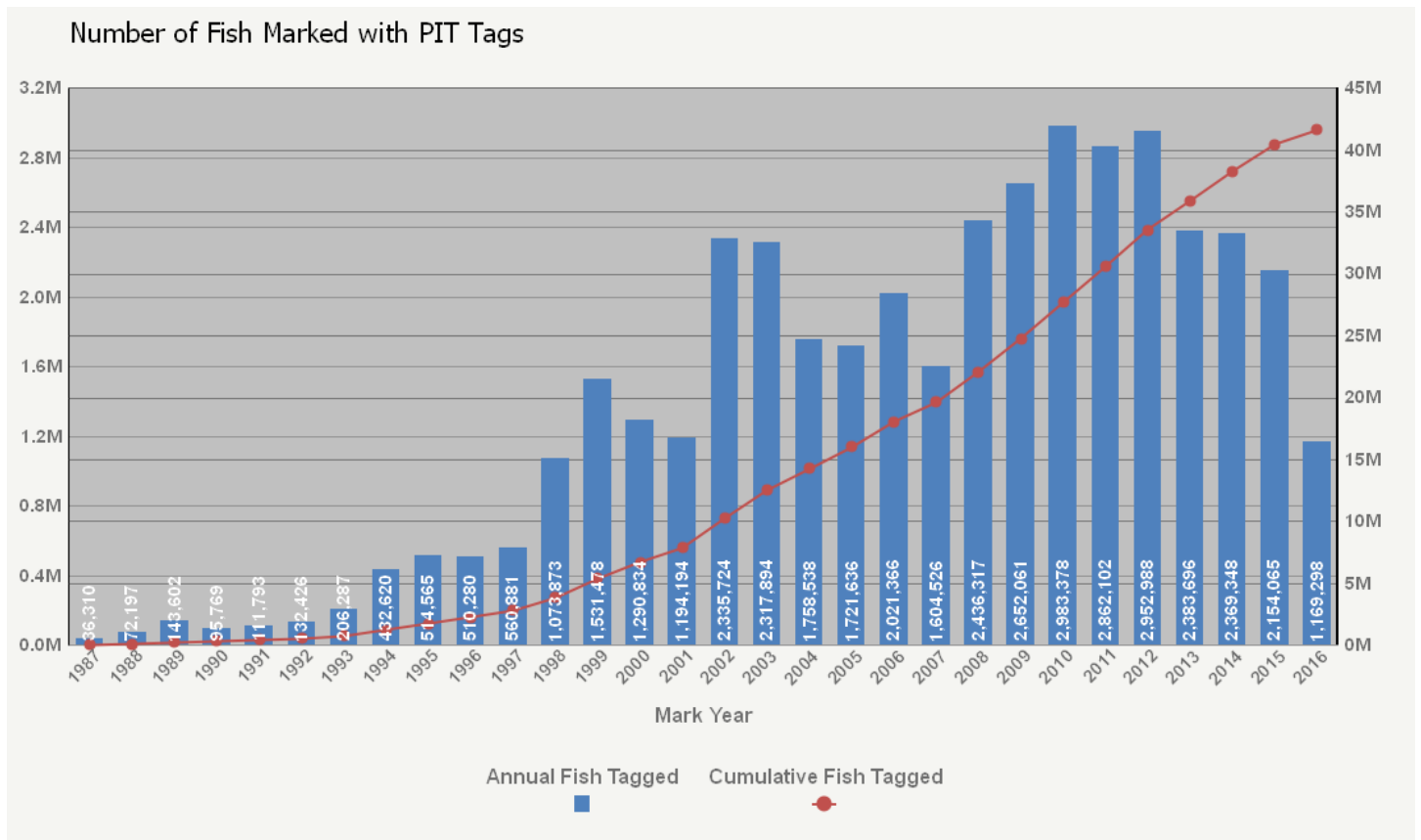

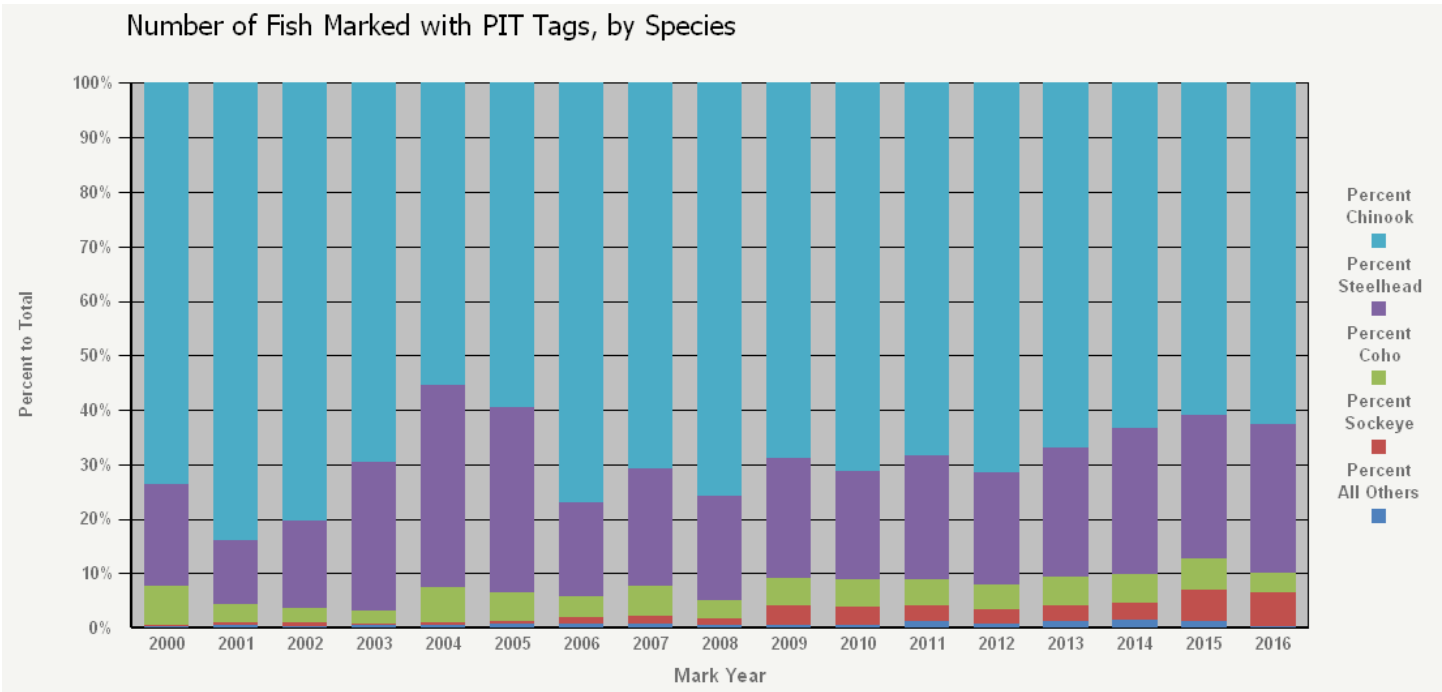*Figure 1. Annual and Cumulative Number of Fish Marked with PIT Tags*

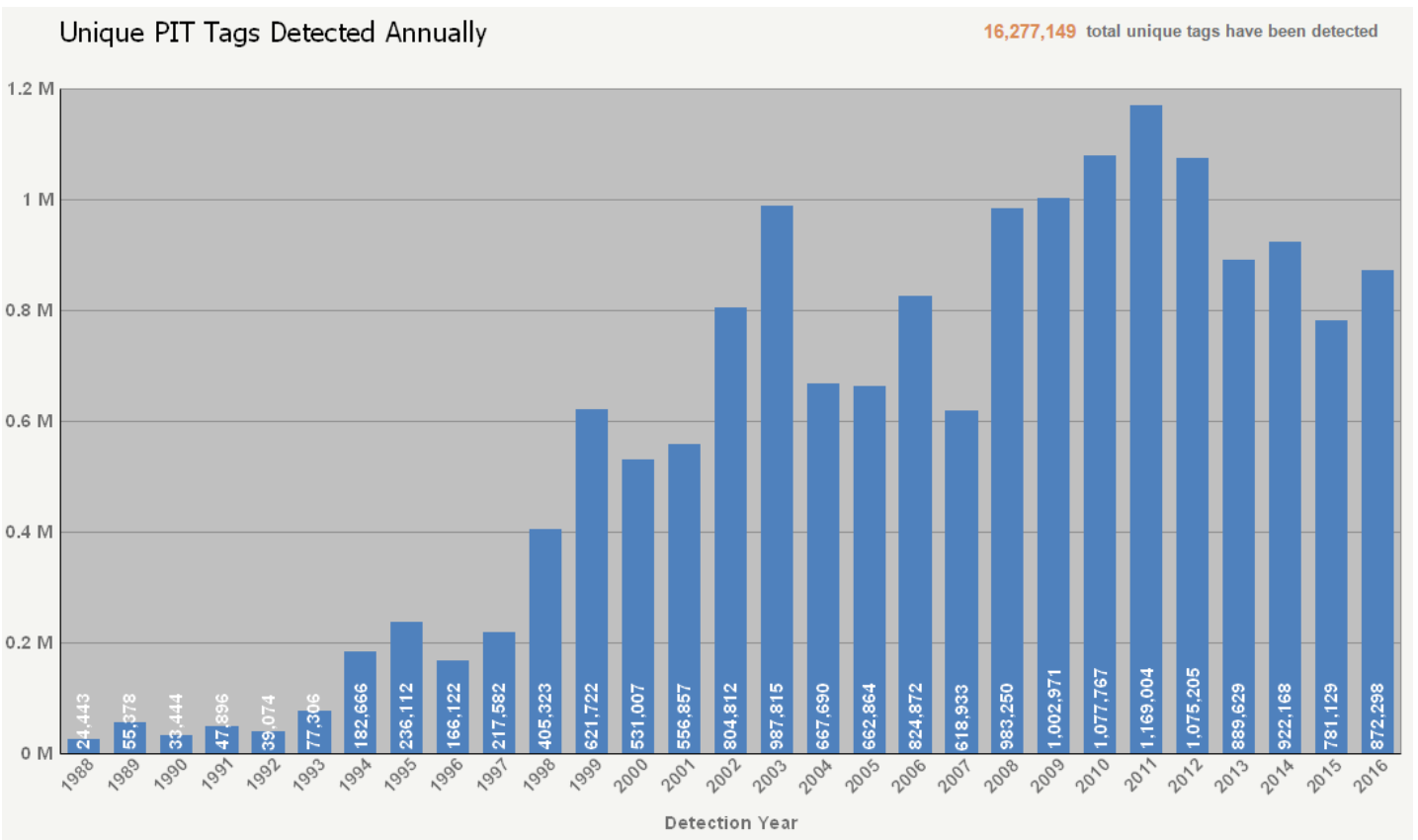Figure 2. Number of Fish Marked with PIT Tags, by Species

Figure 3. Unique PIT Tags Detected Annually
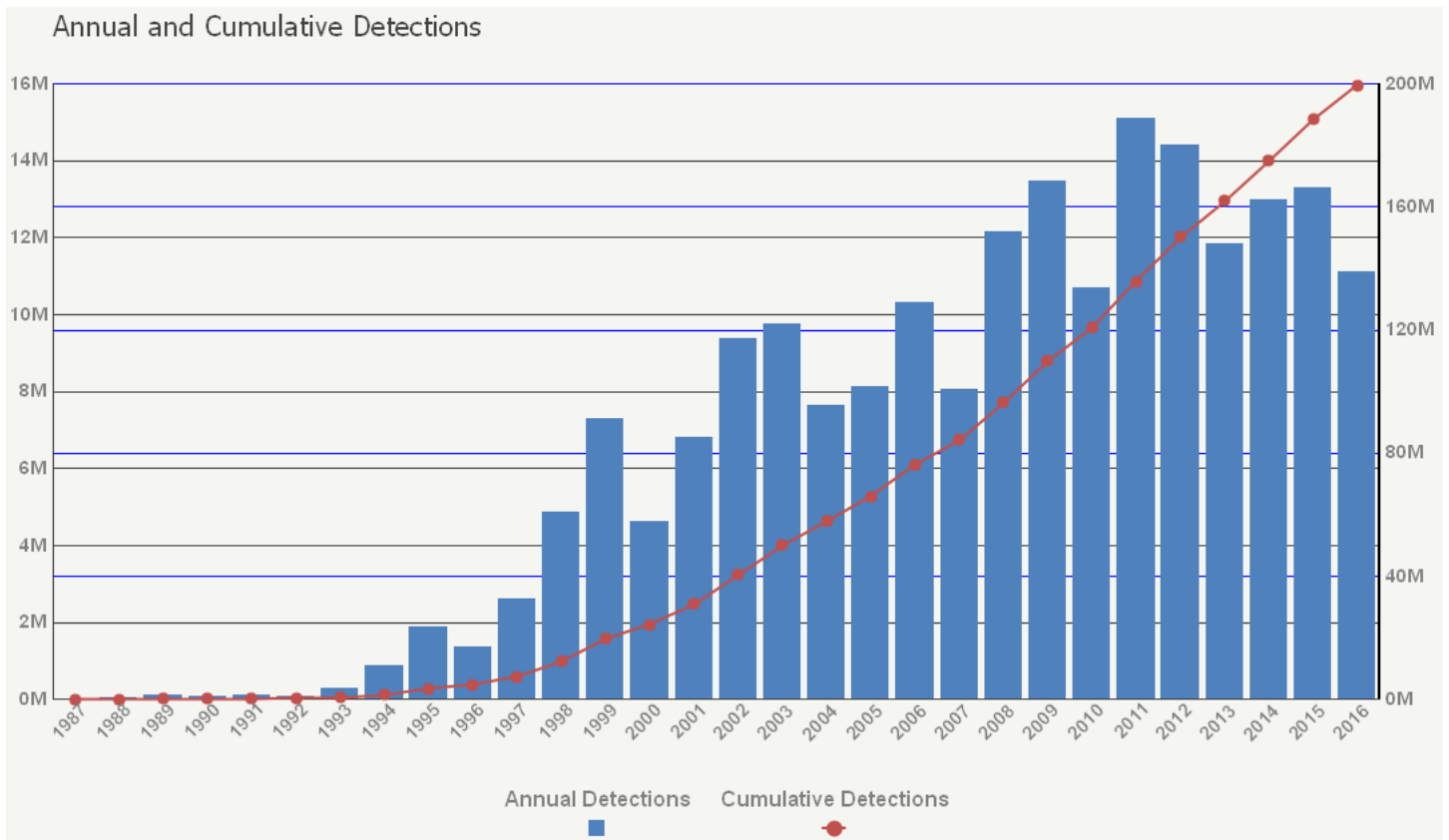
Figure 4. Annual and Cumulative Detections

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 subsystems:

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

The primary focus this year under this objective was to continue the enhancement of Mark-Recapture-Recovery (MRR) data model with additional fields to align PTAGIS with the current needs of the research community. The result of these efforts and others are described in the following subsections.

Field Data Collection Systems

PTAGIS develops, maintains 3 basic types of field data collection systems described in *Table 1.*

System Type	Software	Description
Tagging Software	P3, P4	Tagging software captures MRR data by interfacing with tag readers and other devices to provide an ergonomic and highly customizable data entry system. 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.

7

Interrogation Software	MiniMon, M4	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'. In some instances this software provides SbyC processing.
Utility Software	PIFF, LoadEmulator, Interrogation File Browser, Patch Manager	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.

Table 1. Types of PTAGIS Field Data Collection Systems

2015 Accomplishments

Most of the effort and resources in this area were dedicated to the on-going development of the next-generation tagging software P4 as a drop-in replacement for legacy P3 software. Much progress was made and the project is on track for a production release in mid-to-late 2016. The technologies decided upon for this project in 2014 proved to be productive and viable as development continues. The following summarizes some of the features implemented and tested in 2015:

- Backwards compatibility with P3 allowing the importing of legacy tag files and configuration
- Support for standard tag readers, digitizer tablets, balances and new length board devices
- Incorporates new MRR data model and additional project-defined fields
- Flexible layout and 'repeating values' for customizable data entry by the end user
- Advanced data management features allow post data collection QA before data is submitted to PTAGIS
- XML data file format with published XSD schema (data specifications) support extensible data submissions from P4 and other entities/systems
- Standard downloadable deployment technology with upgradable database features

A focus group of 30+ tagging experts from various organizations were identified to beta test P4 (this technical coordination is described in a related section of this report). Note: early beta releases of P4 will not be made public to prevent inadvertent production data collection.

Two releases of M4 interrogation software were created and deployed this year to support the following enhancements:

- Added support for transceiver models FS2020 firmware 2.x and IS1001 firmware 1.5.2
- Provide ability to automatically sync transceivers internal clocks from PC system time
- Allow for remote, concurrent downloading of transceiver buffers during data collection to facilitate patching data and maintain continuous datasets during infrequent outages
- Upgraded underlying .NET framework and deployment technologies

2016 Plans

Continue development and testing of P4 with a production release later in 2016. On-going efforts will be required for this and future years to support and enhance P4 when fully adopted by the community. Consider porting P4 to other platforms (*i.e.* tablets) based upon community needs.

Staff will begin scoping M5 (the next generation interrogation software) to align with community needs. This includes enhancing client/server architecture to reduce maintenance efforts; incorporating metadata and other features to support small-scale interrogation sites.

PIFF file transform will be eventually replaced with online data upload features to allow end user to submit observation data into PTAGIS originating from a variety of systems/formats.

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/available, 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
- Maintain processing of periodic data file extracts to support large scale data users (FPC, Dart)
- Support high-availability goals of the program

2015 Accomplishments

In addition to on-going maintenance of the server data management systems, much of the effort in this area was dedicated to the design and implementation of the new MRR data model in coordination with the P4 tagging software development. These accomplishments are summarized as:

- Implementation of new database schema to support new MRR data model. This simplified schema will replace the antiquated PTAGIS3 database schema that was ported to the new system.
- Implementation and regression testing of new Extract-Transform-Load (ETL) processes to load data from the new P4 and legacy P3 tagging file formats; creation of test platform in coordination of beta release of P4.
- Published documentation for supporting durable, extensible Electronic Data Interchange (EDI) for third-party contributors to submit MRR data into the system
- Enhanced validation and email notifications
- Production database server and related systems had zero non-scheduled downtime (excluding IT network and office power outages)
- Provided documentation and access to support PSMFC's enhanced data security process

2016 Plans

Continue maintenance and refinement of server infrastructure in support of production release of new MRR data model and P4 tagging software. An existing development server was upgraded with SSD hard drives and will be transitioned into the production database server with enhanced performance, storage space and high-availability features. Database

backup procedures and hardware support will be transferred to PSMFC IT systems and staff as part of the Commission's overall security policy. Continue to audit server processing and document. Verify backup procedures and dispose legacy server hardware. Perform any necessary upgrades to Tag Distribution and Inventory (TDI) application in support of new online tag distribution request workflow.

Web Data Management Systems

The PTAGIS website (www.ptagis.org) 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/available, cost-effective and extensible web server and reporting systems providing public access to PTAGIS data and related resources.

Key tasks related to this portion of the objective include:

- Development and refinement of online functionality such as:
    o Online request/approval workflow services, such as PIT tag distribution for all FWP
    o Content management
    o Community outreach features to support technical coordination
    o 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
- Support high-availability goals of the program

2015 Accomplishments

The website continued to function with limited downtime and adequate performance. This year 11,753 new users were added to the system with 55,586 total visits from 12,731 unique visitors. In addition to typical maintenance and administrative tasks involving the web, reporting, and API systems, the following accomplishments were also completed:

- Evaluation of using industry standard Model-View-Controller (MVC) architecture with existing SiteFinity content management system to upgrade existing website to increase rollout cadence of new features and fixes
- Coordinated with consultants to ensure SiteFinity product is still a viable platform after corporate merger; obtained bids for outside contractors perform a complete upgrade/redesign of the website
- Implemented a secure MRR data upload mechanism via the PTAGIS Web API (api.ptagis.org) to support P4 and eventually other field software; replaced archaic FTP uploading with an industry standard, firewall-friendly HTTP system
- Incorporated tag distribution and tag type information for 21 million tags going back to FY99 into the reporting system
- Enhanced performance of TASS reporting system vital to interrogation site O&M efforts using MVC and fully utilizing database components
- In collaboration with PSMFC GIS Data Center, PTAGIS published a spatial dataset[1] for interrogation and MRR site locations
- Updated Request New Validation Code and Clip File Downloads web features

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[1] Spatial Data for PTAGIS Interrogation Sites and MRR Locations: http://www.ptagis.org/sites/gis-data

Upgrade reporting system to [MicroStrategy 10](#) utilizing a new hardware and new dimensional model schema to support new MRR data model and P4 tagging software. Continue development and upgrading of PTAGIS website with SiteFinity CMS, MVC architecture, and a consolidated and more responsive look-and-feel. Complete online SbyC request workflow with requests from FPAC. Complete the much needed enhanced online Tag Distribution Request form and P4 landing page. Begin the design of a new interrogation site metadata portal and ad hoc field data submission features.

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

Before Separation-by-Code (SbyC) projects 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 in 2014 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](#) 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.

2015 Accomplishments

This year 21 projects were coordinated and implemented by PTAGIS staff using existing database and web infrastructure. These projects requested a total of 2.7 million tag codes to be separated.

Agency	Project Title	Target Tags
FPC	Comparative Survival Study 2015	451,974
IDFG	Measure Dworshak steelhead returning to LGR in Fall 2015	421
IDFG	Monitoring and evaluation of Brood Year 2013 Chinook salmon smolts released from Idaho hatcheries	84,140
IDFG	Monitoring Upper Salmon River A Steelhead reared in circular tanks	12,235
IDFG	Radio tagging adult spring Chinook at Lower Granite Dam to determine migration timing and behavior in the Lemhi River, Idaho	24,426
IDFG	SY2016 Lochsa River Adult Radio Telemetry	70
IDFG	SY2016 Potlatch River Adult Steelhead Telemetry	65
NMFS	Evaluation of Modified Gatewell at Bonneville Dam Second Powerhouse	6,700
NMFS	Migration timing and parr-to-smolt estimated survival for wild Snake River spring/summer Chinook salmon smolts	26,163
NMFS	Transportation and survival research	1,945,923
NPT	B-Run Steelhead Evaluations - #201005700	159
NPT	Nez Perce Tribe Emergency Coho Broodstock	55
NPT	Nez Perce Tribe 2015 Separation by Code Request	20,197
ODFW	Imnaha Stock steelhead_2015	8,000
ODFW	Wallowa stock steelhead_2015	19,701
USFWS	Effect of Early Spring Release from the Pelton Ladder on C. shasta Infection Rate in Spring Chinook salmon	1,500
USFWS	Fish Health of the Returning Adult Spring Chinook salmon from the Deschutes River Basin	14,955
WDFW	2015 Lyons Ferry Hatchery Complex -Snake River, Steelhead Tributary Releases	25,952
WDFW	Performance Evaluation of PIT tagged subyearling Chinook released at Lyons Ferry Hatchery 2015	20,000
WDFW	Performance Evaluation of PIT tagged yearling Chinook released at Lyons Ferry Hatchery 2015	28,400
WDFW	Snake River Hatchery Fall Chinook Fidelity and Fallback Study 2015	434
	Total	**2,719,171**

Table 2. Summary of 2015 Separation by Code Projects

2016 Plans

Release a new online SbyC Request/Review workflow that supports new requirements requested by FPAC. Continue utilizing existing infrastructure to implement SbyC requests. Scope new features for improved management of the entire SbyC process in coordination with new M5 interrogation software design.

Interrogation Site System O&M and Installation

This section provides additional background about the on-going efforts by PTAGIS related to interrogation site operations, maintenance and installation. The objectives and accomplishments related to this effort are described further in subsections identified as work elements from the program's contracted statement of work.

Over 188 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)[2] between BPA and USACE. The locations of the large scale interrogation sites are displayed in *Figure 5* and the operations and maintenance (O&M) tasks performed by PTAGIS field staff are described subsequently in this report.

A centrally located field operations office designs, installs, and maintains the equipment and software needed for automated PIT tag detection at these large scale interrogation sites, including systems for enabling individual fish segregation, examinations and relocation (SbyC).
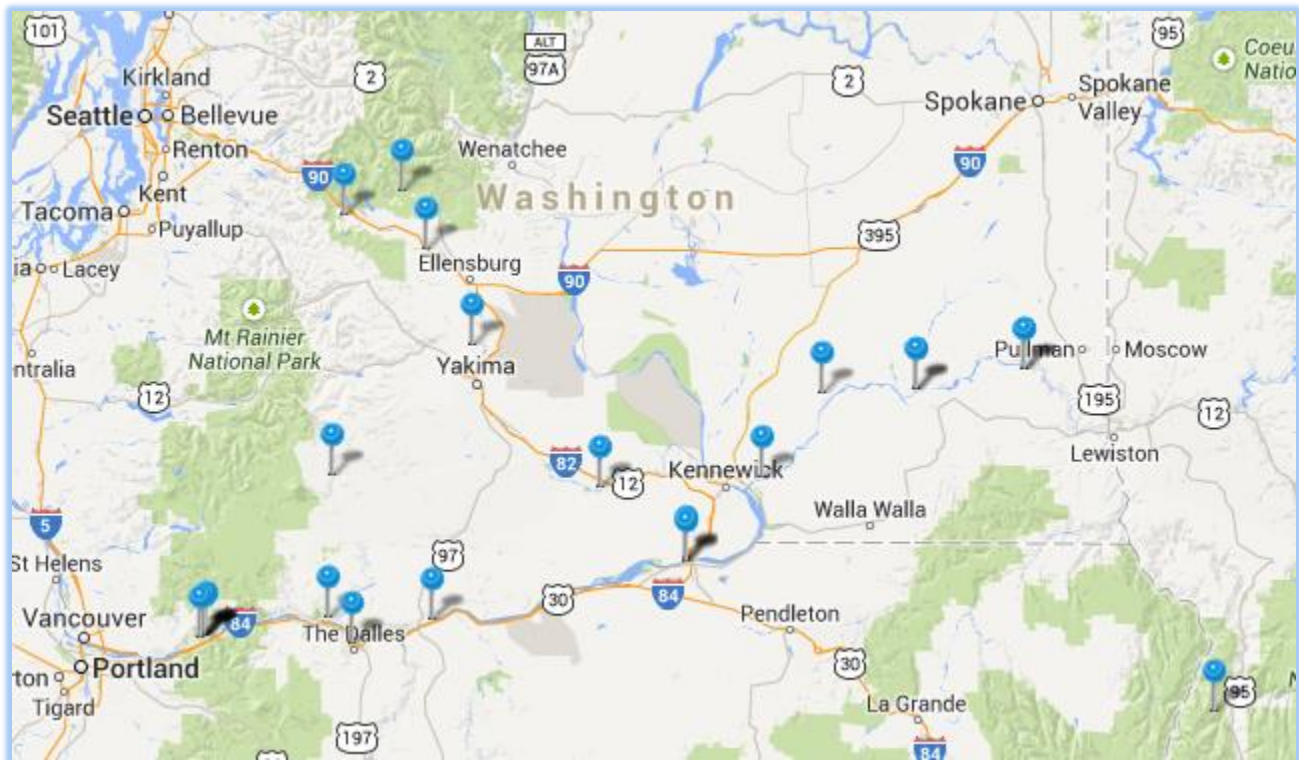
Figure 5. Map of Large Scale Interrogation Sites Maintained by PTAGIS

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.

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[2] 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

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 6. 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.

2015 Accomplishments

As *Figure 7.* shows, the diversion gate efficiencies at each SbyC site remain high due to PTAGIS and COE in-year and off-season maintenance programs.

B2J - Bonneville PH2 Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
B2J	SBYC SEPARATOR GATE	35,808	35,495	290	99%

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GOJ - Little Goose Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
	A-SEPARATOR GATE	31,865	31,501	334	99%
GOJ	B-SEPARATOR GATE	28,003	27,598	382	99%
	DIVERSION SBYC GATE	27,202	27,187	0	100%

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GRJ - Lower Granite Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
	A-SEPARATOR GATE	36,828	36,347	443	99%
	B-SEPARATOR GATE	22,048	21,847	193	99%
GRJ	DIVERSION / SBYC GATE	22,449	22,419	17	100%
	RCWY-10 GATE	31,728	30,564	1,127	96%
	SBYC GATE	210	0	0	

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JDJ - John Day Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
JDJ	SBYC GATE	2	2	0	100%
	SBYC SEPARATOR GATE	22,295	22,151	142	99%

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LMJ - Lower Monumental Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
LMJ	A-SEPARATOR GATE	8,309	8,212	93	99%
	B-SEPARATOR GATE	9,833	9,677	148	98%

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MCJ - McNary Dam Juvenile

Site Code	Diversion Gate Antenna Group	Total Fish	Success Count	Failure Count	Percent
	SBYC A-RACEWAY RIVER GATE	20,088	20,071	0	100%
MCJ	SBYC A-SEPARATOR GATE	20,272	20,263	0	100%
	SBYC B-RACEWAY RIVER GATE	15,735	15,730	0	100%
	SBYC B-SEPARATOR GATE	15,895	15,893	0	100%

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Figure 7. Diversion Gate Efficiency Summary for 2015

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

PTAGIS completed the design and installation of a manual SbyC system (*Figure 8*) at the new Ice Harbor South Ladder Trap.

Figure 8. Manual SbyC System at Ice Harbor South Shore Ladder

2016 Plans

The primary goal for 2016 and beyond is to get a newly hired instrument technician up to speed on the Programmable Logic Controller (PLC) code base and related technology that controls the PIT-tag actuated gates so that it can be enhanced and maintained over time. The PLC models in the field are several years old and will be evaluated to

determine if upgrades are needed. In addition, the overall SbyC process will be reviewed and potentially enhanced with scoping of the next-generation interrogation software M5.

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 or other agency to install the electrical components of this system that include the transceivers, network, PLC, and the data collection computers.

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

2015 Accomplishments
- Worked as consultants to the COE for adding new thin-body ferrite-tile antennas at the Lower Granite Adult Ladder
    - The antennas followed the PTAGIS designs developed for the John Day adult ladder project
    - Installation started in December of 2015
- PTAGIS designs for the John Day Adult Ladder PIT Tag Detection System were accepted by FDDRWG and will be installed in the winter of 2016-2017
- The replacement of aging FS1001A transceivers, at critical locations, was completed
    - The transceivers were upgraded to the FS2020 which has the added function of auto-tuning
- New data collection computers were deployed in 2015
    - The new computers replaced PCs running the Vista operating system
    - The new PCs have reliable solid state hard drives.
- A low cost method for repairing the first generation fiberglass orifice antennas was developed
    - The antennas were first installed at Bonneville and McNary dams in 2002
    - These antennas have the added functionality of detecting lamprey
- A new SbyC system was developed and installed at the Ice Harbor South Ladder Adult Fish Trap
    - This work was conducted at the request of the COE Walla Walla District

2016 Plans
- PTAGIS will administer a BPA contract that is outside of the PTAGIS operating contract
    - This contract is to build the PTAGIS-designed John Day ladder antennas
    - The QA for these antennas will be conducted by PTAGIS and then delivered to the COE for installation
    - Installation will start on 12/1/16
    - PTAGIS will provide QA services to the COE to administer their installation contract.

- Continue as part of the design team for the GRJ Full Flow PIT Tag system
- Continue to act as design team members for the Lower Granite Ogee Project
- Continue to develop designs for the B1 Ice & Trash Sluiceway PIT tag system
- PTAGIS will partner with NOAA to design a second antenna at BCC
- Continue to work with the COE to resolve the sinking PIT Tag Room at BO2
- Continue to monitor for RFID interference from the US Navy Dixon radio broadcasts
- Continue to partner with the COE on the Lower Granite juvenile full flow PIT tag detection system
- Complete the data collection platform upgrades at all sites

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 log[3] 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 *(Figure 9)*.

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

Figure 9. PTAGIS staff repairing a transceiver device.

2015 Accomplishments

Already high antenna efficiencies were edged slightly higher for 2015 partly due to more FS2020s in the system and better performing tags being used. The average detection efficiency for juvenile fish facilities, maintained by PTAGIS was near 100%. Average detection efficiencies for adult ladders were 99.4% (Table 3).

Ladder Site	Bracket Tags	Ladder Tags	Missed Tags	Percent Detected
BON	4,348	4,341	7	99.8
TDA	16,423	16,378	45	99.7
MCN	10,016	9,981	35	99.7
ICH	9,779	9,718	61	99.4
LMA	9,236	9,191	45	99.5
GOA	9,094	8,964	130	98.6
GRA	1,769	1,760	9	99.5

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

Table 3. Adult ladder efficiencies in dam-to-dam comparisons

Other accomplishments:

- Final FS2020 deployments to replace the aging FS1001A transceivers
- New data collection platform installations with security enhancements
- BCC FS3001 performance evaluation for supporting the Lower Granite Ogee Project
- Low cost repair of failed orifice antennas at Bonneville and McNary dams

2016 Plans
- Continue deployment of new data collection platforms
- Lower Granite Juvenile Full Flow PIT Tag system design team and start of installation in December
- Continue to monitor radio interference from the US Navy facility at Dixon California
- Design team member for the Lower Granite Ogee Project
- Develop designs for B1 Ice & Trash Sluiceway
- Partner with NOAA to design second BCC antenna
- Continue to work with the COE on resolving the ground erosion under the BO2 PIT Tag Room

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

2015 Accomplishments
The objectives and deliverables described in this report were performed under a contract submitted as a funding package before the FY15 performance period. All contract-related deliverables such as annual and periodic status

reports were completed on schedule. The new funding package for FY16 was developed, reviewed and submitted before December 1, 2015 deadline. Staff performed an annual inventory audit and the product was loaded into Pisces for the FY16 funding package.

A long term instrument technician on the Kennewick staff announced they were seeking other employment in April. This was concerning because the program was losing a highly specialized skillset to program the electronic automation equipment (PLC, HMI) vital for SbyC and other data collection efforts. Recruitment began immediately and a replacement was hired in July. A multiyear plan was made to get the new hire fully acclimated to the specific requirements of this position as soon as possible.

Staff performance plans and reviews were completed and submitted on schedule per PSMFC guidelines. A revised line item budget was submitted in October 2015 to PSMFC fiscal, BPA CO and COTR due to significant unplanned events during FY15:

- Staff changes noted in this section
- Dell underestimated the costs of a database licensing conversion (sockets to core) required by the vendor
- Out of warranty replacement of undersized UPS equipment at field sites due to manufacturer's defect
- Upgrading of firewall network equipment at field sites to comply with new BPA/PSMFC FISMA requirements
- Modifications of FS3001 transceivers at BCC due to poor performance (detailed in F:160)
- Postponement of web development project due to unplanned expenses noted above and concerns about the long term viability of the underlying SiteFinity CMS system after a corporate merger

The following subcontracts were performed during FY15:

Subcontractor	Performance Period	Description of Work
Falafal Software	FY15	Major web design and development postponed to FY16; a smaller amount of interim consulting hours were purchased instead to cover maintenance/upgrading efforts
Biomark	FY15	Maintain the detection equipment at Rapid River Hatchery
Apollo	FY15	RF Barrier installation for Kennewick Antenna Room. This completed the BCC antenna simulator.
Biomark	FY15	Modify 2 FS3001 transceivers for detection improvements at BCC. This modification included upgrading components in the transceivers to higher amperage ratings and standardizing both transceivers to make them identical in performance.

Table 4. Summary of subcontracts used by PTAGIS related to technical activities

2016 Plans

Tasks will be realigned/reprioritized to ensure funding packages are submitted earlier in the year as requested by the funding agency and any unplanned contracting requirements are always a concern each year. This annual report will be postponed a few months due to staff workloads in maintaining the schedule of the P4 production rollout. Concern has been expressed to BPA regarding the readability of this report due to a mandate the RME template be used. PTAGIS supports RME but does not perform any biological analysis that would make the RME template useful as a reporting structure. This year, as requested by R. Golden at BPA, this report will not use the RME template and instead follow a structure more conducive to the work performed.

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.

2015 Accomplishments

In addition to ad-hoc technical support provided by staff throughout the calendar year:

- In depth training for the Advanced Reporting system[4] as well as a presentation on the P4 software project was given by staff at the *2015 PIT Tag Work Shop* and was well received based upon survey responses
- A *P4 Orientation Webinar* was conducted for a focus group in conjunction with a beta release of the software
- A private, online forum (Basecamp) was created for the P4 focus group allowing members to easily posts questions and bugs via email or online with threaded follow up responses
- Online video tutorials were published on the PTAGIS website to help with complex Advanced Reporting features and the P4 beta rollout

2016 Plans

Conduct an evaluation of various online defect tracking systems and help documentation tools to ensure responsive technical support for the rollout of P4 tagging software. Ideally a forum-style system combined with concise help documentation will allow users to identify commonly answered questions to reduce support efforts. The existing online forums on the PTAGIS website may be used but are underutilized and need revision/promotion. Online video tutorials can be effective but may need promotion to get the community to use them. Training sessions at central locations in combination with webinars are planned to ensure adoption and a smooth transition to the new P4 tagging software.

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 including FPOM and FFDRWG
- Transceiver, antenna and PIT tag conformance testing
- Electronics, process and control engineering
- Electrical design for PLC controls at sampling facilities
- Radio frequency identification (RFID) design
- Computer-aided design (CAD) detail
- Antenna design for the COE and others
- Cost analysis for installing PIT tag systems for the COE, NOAA and other various agencies

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[4] PTAGIS Advanced Reporting: http://www.ptagis.org/data/advanced-reporting

- Completed phase one of the BCC Antenna Test Room
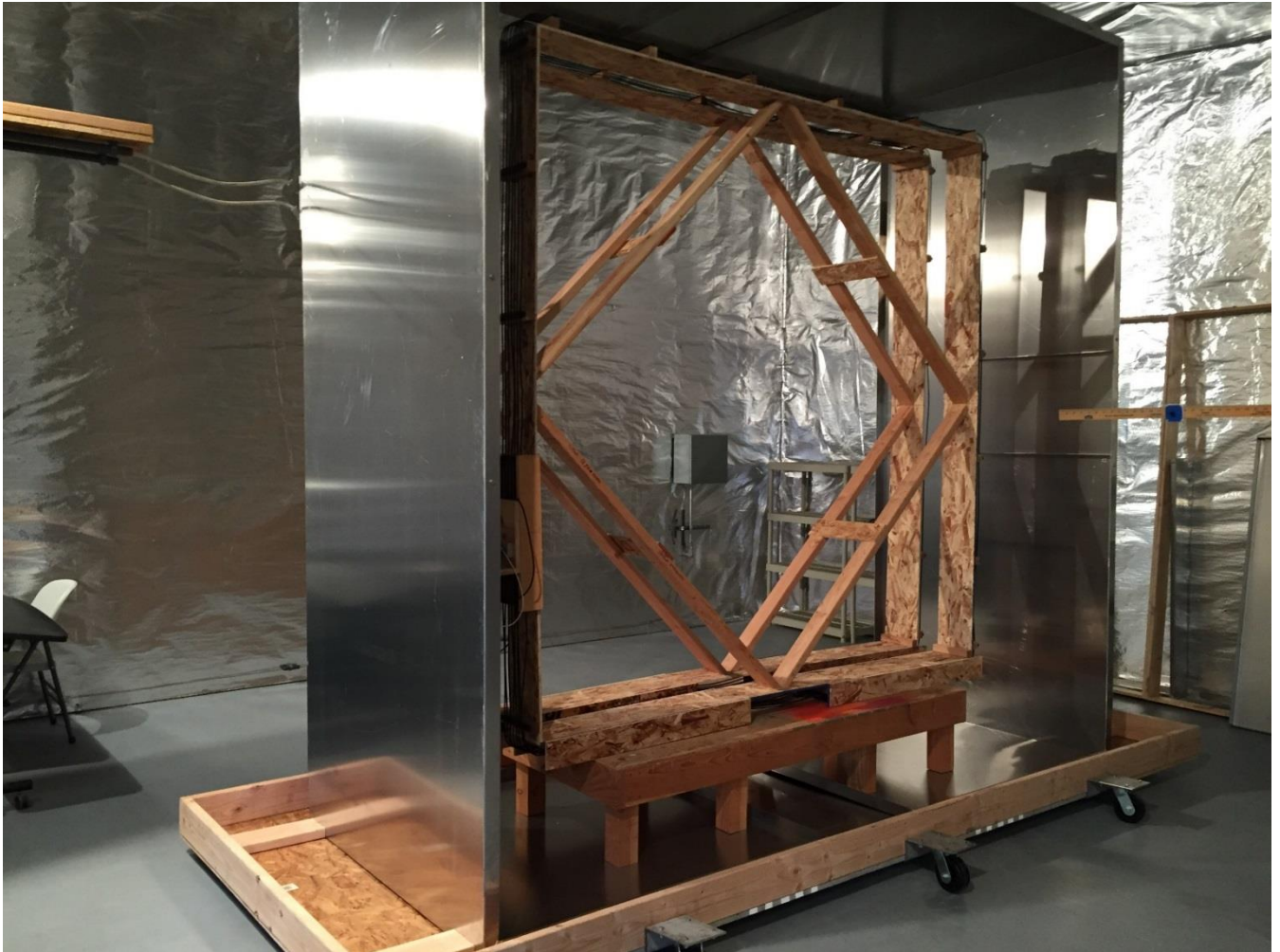
Figure 10. Kennewick Field Office antenna room completed with BCC antenna simulator

- Completed CAD designs of the upcoming John Day Ladder installation. These included over 300 CAD sheets and numerous three-dimensional presentations. Two Examples:
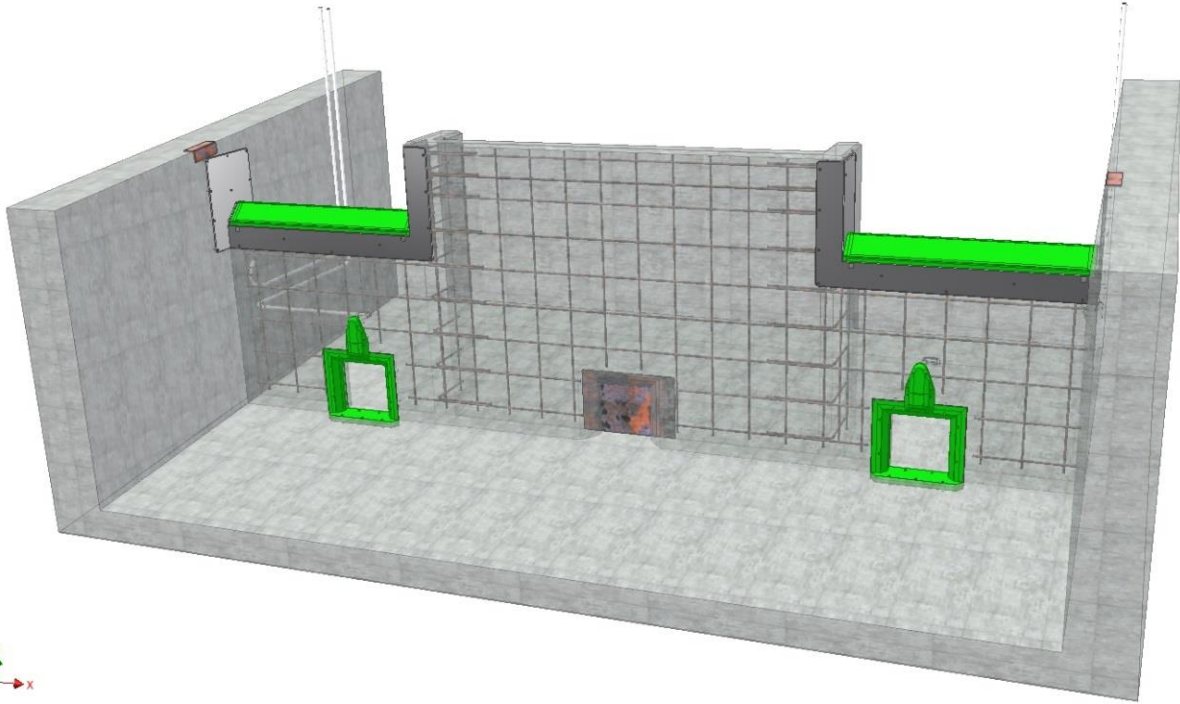

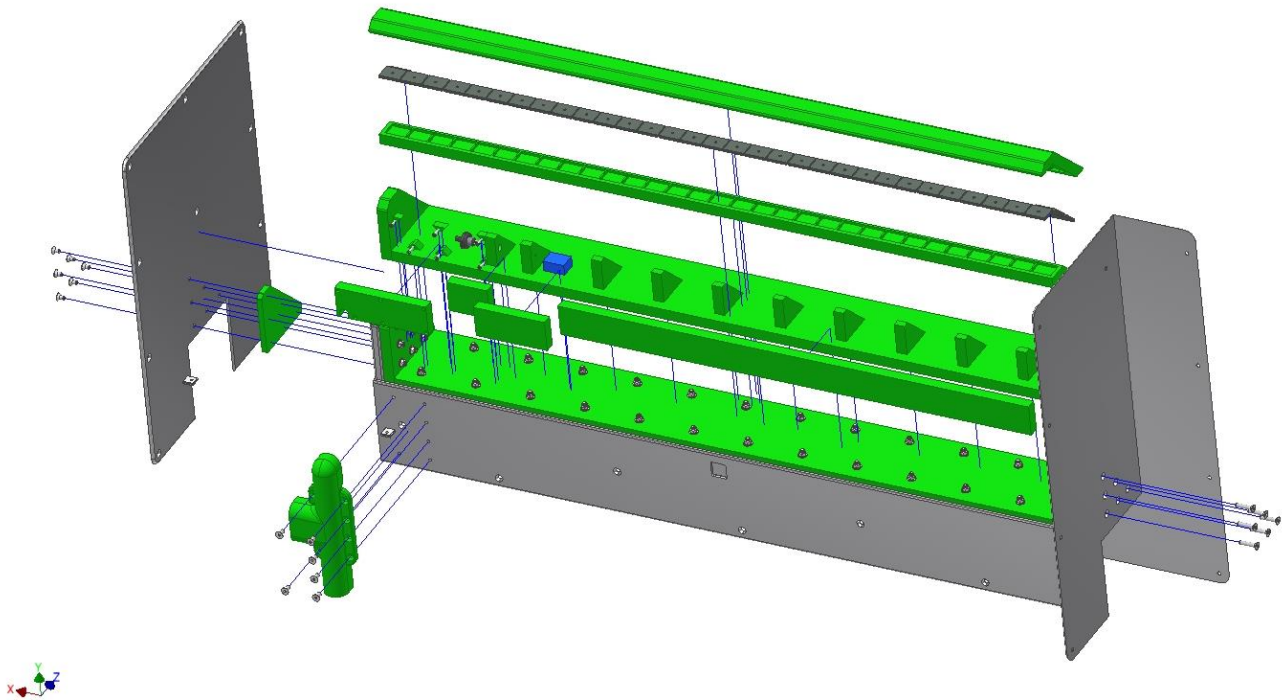*Figure 11. John Day Weir Wall with Four Antennas*

Figure 12. John Day Overflow Antenna Exploded Vie

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[5]
- Providing technical coordination for the PIT Tag Forecasting Service[6]

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 13*) to verify PIT tags are manufactured according to specifications of the contract between BPA and the vendor, such as:

- Turn-on voltage

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

[6] PIT Tag Forecaster Service: http://www.ptagis.org/services/forecaster

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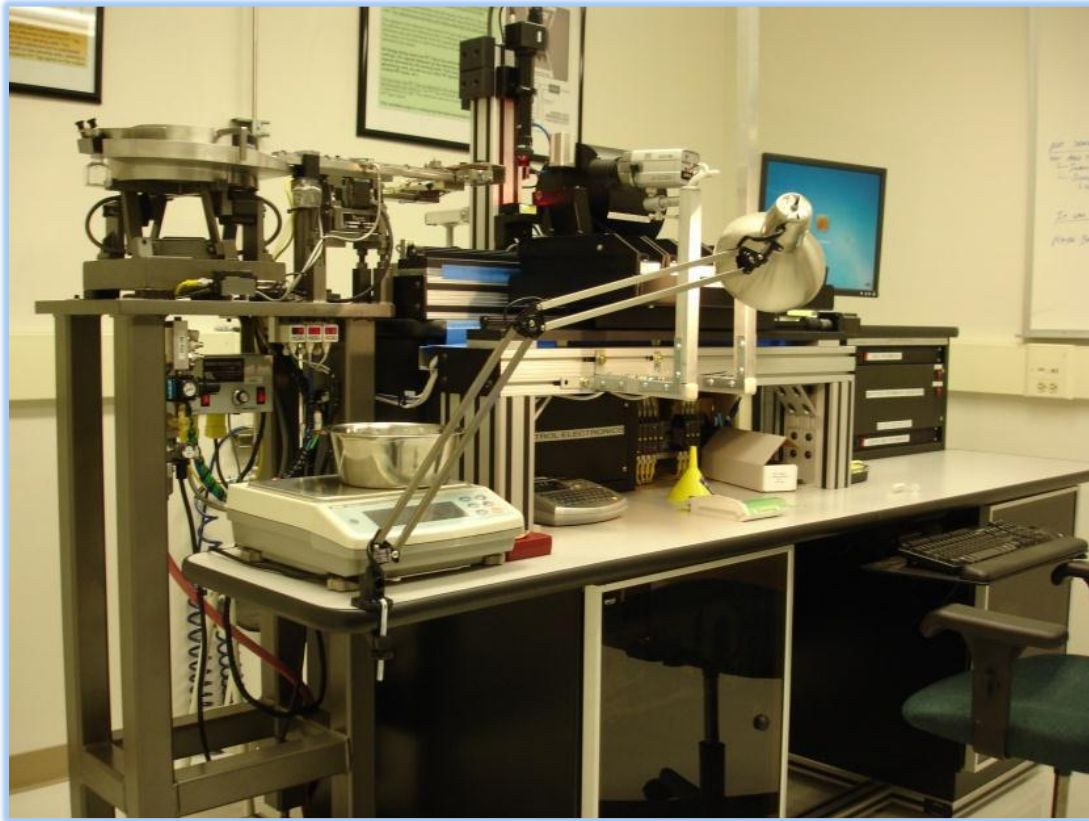- Resonant frequency
- Bandwidth/"Q"
- Size and weight

Figure 13. Automated PIT Tag Test System (APTTS) located in the PTAGIS Kennewick laboratory

2015 Accomplishments

The *2015 PIT Tag Workshop[7]* coordinated by PTAGIS staff was held in late January with 268 participants, 40 presentations, 11 posters and an overall satisfaction rating of 95% based upon a follow-up survey. This event was followed by the *Annual PIT Tag Steering Committee Meeting[8]*.

PTAGIS staff distributed 1.7 million tags to 76 BPA Fish and Wildlife Projects (FWP) in FY15. Of those tags, 3% (51K) were tested for quality assurance and no significant defects were found.

An additional 5 new tag data project codes were added totaling 164 active data projects submitting MRR data into PTAGIS. Twenty-one new MRR sites were added as potential mark/release sites. A total of 27 new instream interrogation sites were approved to submit observation data into PTAGIS this year, bringing the total number of active interrogation sites to 308. All but 3 of the 83 active projects updated their PIT Tag Forecasts this year[9].

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[7] Agenda and presentations for the 2015 PIT Tag Workshop: http://www.ptagis.org/resources/pit-tag-workshops/2015-workshop
[8] 2015 Annual PTSC Meeting Notes: http://www.ptagis.org/docs/default-source/meeting-notes/2015-annual-ptsc-meeting-notes-final.pdf?sfvrsn=2
[9] PIT Tag Forecaster Dashboard: http://www.ptagis.org/services/forecaster/forecast-dashboard

Other significant events involving technical coordination on behalf of PTAGIS staff:

- A newsletter article titled *PIT Tag Selection for Researchers*[10] was published by PTAGIS staff to give researchers guidance in selecting the appropriate PIT tag model based upon performance testing and analysis
- A forum was created and a newsletter article published to coordinate the changes to the new MRR data model with the research community
- PTAGIS was contacted by an individual whom had bitten into PIT tag causing a broken tooth while eating a smoked fish sample from a vendor outside of Hood River, OR
    - Staff were unsuccessful in obtaining the unique code from the damaged tag that might have helped track down how this happened
    - Most likely this was caused by marking fish in the dorsal sinus area
    - The PTSC has published guidance in the *2014 Mark Procedure Manual*[11] and recent PTAGIS newsletter strongly warning researchers not to mark fish in the dorsal sinus region for this very reason

2016 Plans

Staff will focus efforts on revising the PIT Tag Specifications Document[12] with updated MRR data model, field definitions, and references to new data file formats. Included with this effort is to make use of the recommendations of an ad hoc instream committee a few years back to update the interrogation site metadata.

A NOAA researcher discovered a beacon broadcasted from a Navy station was causing his PIT tag detection arrays to fail. Coordination with NOAA, USACE, PSTC and others will be required to determine if the Navy can broadcast in a frequency outside of PIT tags to prevent future conflicts.

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[10] PTAGIS Newsletter Volume 13 Issue 1: http://www.ptagis.org/docs/default-source/ptagis-newsletter-archive/ptagis-newsletter-february-2015-vol-13-issue-1.pdf?sfvrsn=4
[11] 2014 Mark Procedure Manual: http://www.ptagis.org/docs/default-source/ptagis-program-documents/2014-mark-procedures-manual.pdf?sfvrsn=2
[12] PIT Tag Specification Document 2009: http://www.ptagis.org/docs/default-source/ptagis-program-documents/pit-tag-specification-document-2009.pdf?sfvrsn=14