Administration and System Operation of the Columbia Basin PIT Tag Information System

2011 and 2012 Annual Report

Contents

ABSTRACT

The Columbia River PIT Tag Information System (PTAGIS) is a data collection, distribution and coordination project. This program *does not* perform any analysis or interpretation of the data we collect, other than the course aggregations noted here and for purposes of internal validation of the data, systems and equipment. Over 2.8 million juvenile salmonids were marked and released with passive integrated transponder (PIT) tags for the 2012 out-migration through the Columbia and Snake rivers (Table 1). The proportions of salmon and steelhead tagged in 2012 were similar to those species tagged for the 2010 and 2011 migration year (Table 2). In 2012, more than one million unique tagged fish were detected at one or more locations (Table 3). One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites. In 2012, there were 13,950,427 detections reported to PTAGIS with a total of over 149 million cumulative detections since 1987 (Table 4).

Table 1

Table 2

PIT Tag Release Composition by Species 2008-2012

	2008	2009	2010	2011	2012
Chinook	1,851,748	1,704,796	2,038,992	1,995,753	2,075,264
Steelhead	486,117	467,045	582,370	616,855	569,547
Coho	100,919	128,831	118,958	138,283	128,261
Sockeye	28,068	91,216	102,868	80,510	81,164
All Others	11,795	15,580	15,794	33,941	9,475
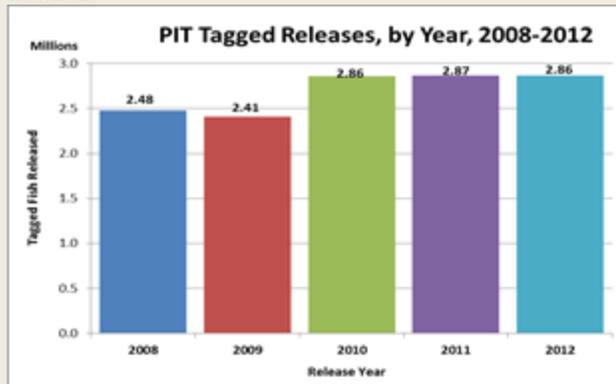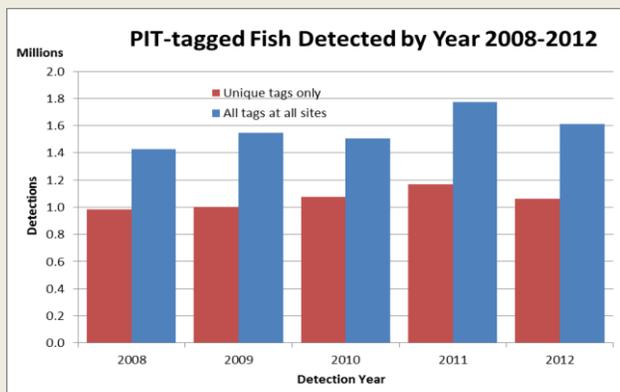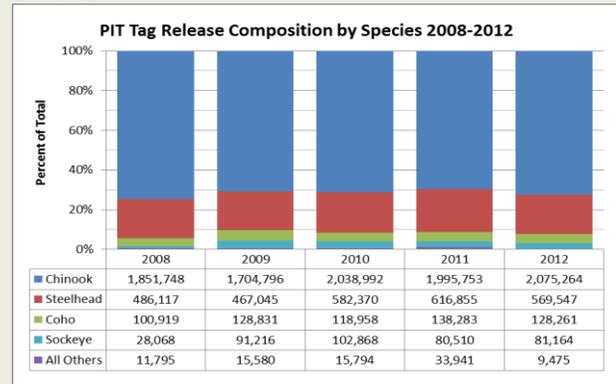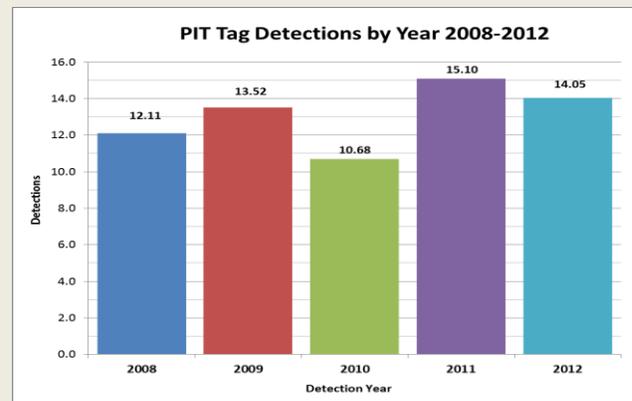
Table 3

Table 4

PTAGIS has continued to develop and maintain the software and systems used to collect and distribute PIT tag data. The project has made substantial progress in a complete system infrastructure upgrade despite unplanned funding cuts. By 2012 PTAGIS operated and maintained 23 interrogation sites (Figure 1), and took in interrogation data from another 160 sites , which include juvenile fish bypass facilities, in-stream juvenile fish traps, in-stream remote detection systems, monitored fish release sites, combined

dam locations (separate detections of upstream and downstream migrants), trawl net, adult fishways and hatchery returns. Combined these various sites contain more than 1,190 unique detection points (or antennas). In 2011 and 2012, the PTAGIS project implemented 35 Separation by Code projects for 13 agencies and distributed over 3.17 million tags to 83 unique BPA funded Fish and Wildlife Projects throughout the Pacific Northwest and Canada.

PREFACE

PTAGIS Program History

In 1984, Bonneville Power Administration (BPA) entered into an agreement with the National Marine Fisheries Service (NMFS) to develop a passive integrated transponder (PIT) tag for use in the Columbia River Basin (CRB) Fish and Wildlife (F&W) Program. The PIT tag system enables large amounts of data to be produced using relatively few tags, compared to traditional tagging and marking systems.

In 1988 and 1989, NMFS contracted with PSMFC to develop and operate a prototype database system to help NMFS meet, in a timely manner, its contractual and verbal agreements involving PIT tag data. The database was designed to meet immediate needs as well as provide a framework for a formalized database system for the Columbia River Basin PIT tag program.

In April 1989, NMFS announced its intention to phase out of the operation, maintenance and management of the PIT tag systems in the Columbia River Basin. Subsequently, BPA contracted with PSMFC to collect, distribute, and coordinate the data for the PTAGIS program. Formed by Congress more than 50 years ago, PSMFC helps resource agencies and the fishing industry sustainably manage our valuable Pacific Ocean resources in a five-state region. PSMFC was contracted because it was deemed the only agency experienced in data management with no vested interest in the interpretation of data generated from PIT tags, while being independent of water or fish and wildlife management responsibilities.

PSMFC was directed to implement the following actions under the PTAGIS contract:
1. Management of a long term Columbia River Basin-wide database system accessible to all entities;
2. Maintenance and documentation of fish tagging and interrogation software;
3. Operation and maintenance of equipment at the remote sites;
4. Provision of technical support for the software and hardware;
5. Provision of training to users
6. Purchase and distribution of PIT tags and associated equipment

In 1992, NMFS initiated the transfer of field operations and maintenance (O&M) to PTAGIS. This transition was completed in 1995 when the Columbia Basin PIT Tag Information System transitioned from a research and development (R&D) effort into an operations and maintenance effort. Note, that those R&D efforts by NOAA Fisheries continue in collaboration with the PTAGIS project staff and other contractors.

The PTAGIS project covered by this report has been part of the Northwest Power and Conservation Council's Fish and Wildlife Program funded by Bonneville Power Administration since 1990. The NMFS 2000 BiOp for the Federal Columbia River Power System (FCRPS) includes approximately 15 RPA Actions calling for studies that explicitly include PIT-tags or would likely employ them. The Tagging Studies

Technical Committee (TSTC) would help ensure that the numbers of ESA-listed fish proposed for tagging (in the study designs) are necessary and adequate to address BiOp implementation and other needs. Additionally, the NMFS BiOp includes numerous RPA Actions calling for studies that may employ other tagging methods that may benefit from improved integration with PIT-tagging studies.

The PTAGIS project is guided by the Columbia Basin PIT Tag Steering Committee (PTSC) which was chartered through an agreement between Pacific States Marine Fisheries Commission and the Columbia Basin Fish and Wildlife Authority in 1993. PTSC representatives are National Marine Fisheries Service, U.S. Fish and Wildlife Service, Tribal Representation through CBFWA Anadromous Fish Advisory Committee, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game and Washington Department of Fish and Wildlife.

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.

INTRODUCTION

In 2011 and 2012, PTAGIS operated computer systems to collect and distribute PIT tag information related to various projects in the Columbia River basin as shown in Figure 1. In addition, we operated and maintained (O&M) equipment to assist various entities in efforts to monitor, manage and study the migration of juvenile salmonids at seven dams Federal Columbia River Power System (FCRPS) projects on the Columbia and Snake rivers. These O&M locations are Bonneville Dam (BON), John Day Dam (JDA), McNary Dam (MCN), Ice Harbor Dam (ICH), Lower Monumental Dam (LMN), Little Goose Dam (LGO), Lower Granite Dam (LGR). In addition, we monitor fish migration at the Bureau of Reclamation facilities at Prosser and Yakima Indian Nation acclimation ponds on Yakima River tributaries. We also operate the PIT tag volitional release system located at Rapid River Hatchery.
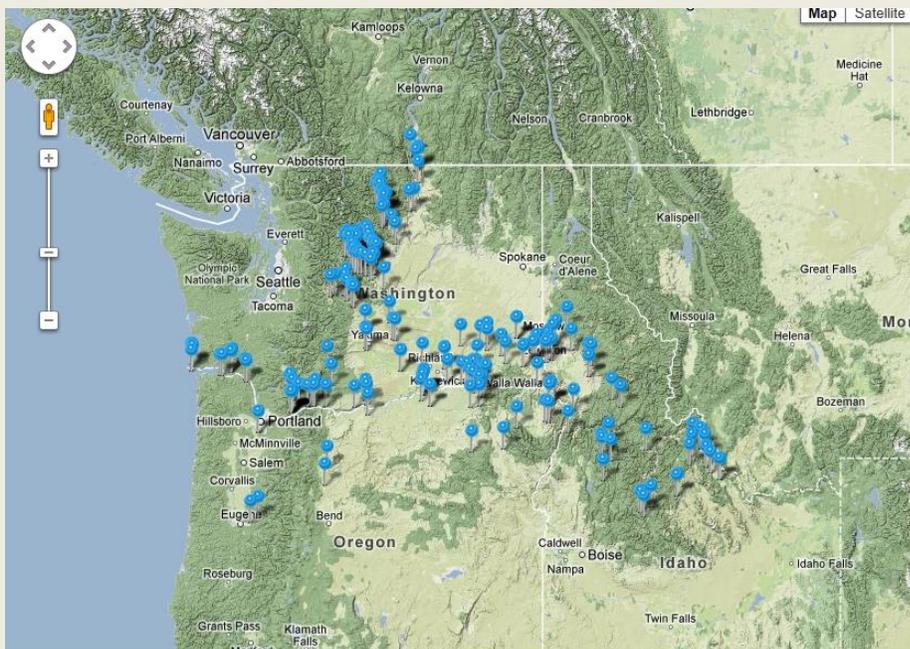

Figure 1 –Map of all Interrogation Sites from Beta Web Site

PROJECT GOAL and OBJECTIVES

The goal of this project is to operate and maintain the Columbia River Basin-wide database for PIT Tagged fish and to operate and maintain the established interrogation systems. The data collected by this system is accessible to all entities. The measurable goal for the system is to collect 100% valid data[1] and provide that data[2] in "near-real" time with downtime of any system component of not more than one percent as measured during the period of peak outmigration.

The PTAGIS project achieved this goal. PTAGIS provides client software applications that capture field data, validate and submit this data to PTAGIS several times a day. Field data that are incorporated into the PTAGIS database are validated for conformance to format and content based upon rules defined in the updated *2009 PIT Tag Specifications Document*. PTAGIS server and web systems performed reliably with down-time limited to less than four hours on few occasions for some system components. PTAGIS supported interrogation equipment was also highly reliable and fully redundant. Any data outages are logged in the PTAGIS event logs which are available at the project's website (www.ptagis.org).

OPERATE, MAINTAIN and ENHANCE the PTAGIS SYSTEM

This objective relates to our BPA Work Element titled, A: 160. Create/Manage/Maintain Database". This objective delivers near-real-time PIT tag mark, recapture and interrogation data and tools to allow for the collection and retrieval of that data to all entities. This objective also incorporates BPA Work Element, I: 119 Manage and Administer Projects, the purpose of which is to provide for the program and project management necessary for the PTAGIS efforts.

This objective, managed by PTAGIS staff and a principal consultant, are described in three parts:

- O&M Server Systems Development
- O&M Web Systems Development
- O&M Field Systems Development

O&M Server Systems Development

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 a relational database system that contains several million rows of tagging and observation data. Key tasks related to this portion of the objective include:

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[1] Valid Data is defined in the "2009 PIT Tag Specification Document" which is maintained by the Columbia Basin PIT Tag Steering Committee.

[2] This means PIT tag mark, recapture and release information provided by PTAGIS users in addition to interrogation data provided by PTAGIS or other system users.

- Maintenance and enhancement of system components that support the automated extraction, transformation and loading (ETL) of field data into the central database.
- Systems management, including backup, performance tuning, capacity planning, system monitoring, database, hardware and operating systems upgrades and other necessary activities.
- Development of new database schema and supporting infrastructure to address new and changing user requirements.

Tables 1- 4 in the Abstract of this report summarize acquisition, processing and update of mark, release and recovery data for this milestone.

Activities associated with this portion of the objective are divided between work performed to maintain the current (legacy) PTAGIS3 server system and the development of the next-generation server called PTAGIS4. The rational for upgrading system infrastructure is explained in the 2009 annual report. The PTAGIS3 server was maintained with limited enhancements while resource and efforts were focused on developing PTAGIS4. The upgrade process has had no impact to the integrity or availability of PTAGIS data.

Summary of PTAGIS3 Server System Activities for 2011 and 2012

The following list summarizes PTAGIS3 server system activities performed primarily by a principal consultant (Doug Clough of Synergetics) in 2011 and 2012. As noted in the 2009 Annual Report, the consultant has the specialized knowledge and skills required to maintain the Ingres database and related PTAGIS3 system components that have evolved over the lifetime of the program. He has transferred his knowledge to PTAGIS staff to perform most of the routine system maintenance and data validation with the overall goal of sustaining his contract hours for more complex tasks such as recovery from system failures and maintenance of the Tag Distribution System (TDS).

1. General Questions
   Includes answering questions about Ingres or other server-side components.

2. Maintain Ingres Database
   Includes database administration (DBA) activities and monitoring of day-to-day behavior of the development and production Ingres database installations.

3. Ingres Query Optimization
   Includes generating fresh Ingres query-optimizer statistics as needed (typically, twice per year) and addressing query performance issues by studying query execution plans (QEPs) and creating additional access methods (e.g. secondary indexes) as necessary.

4. Maintain O&M and TMT
   Includes initializing report-specific counters and incorporating additions or changes to interrogation equipment into configuration files to support the automated generation of reports used by PTAGIS O&M staff, and the Technical Management Team.

5. File Validation Mechanisms
   Includes requirements analysis, design, implementation, testing, and deployment of improved mechanisms for interrogation file validation, and associated diagnostic messaging capabilities.

6. TDS at Fiscal Year End
   Includes sending bulk email messages to projects authorized by BPA to request PIT tags through TDS, and adding or updating information about authorized projects and associated personnel in the PPO tables, at the end of the BPA fiscal year (i.e. late September).

7. Craig – File Submittal Knowledge Transfer
   Includes Knowledge Transfer from Doug Clough to Craig White, regarding mechanisms by which interrogation and tagging files are submitted to the PTAGIS server environment (i.e. PTTP – PIT-Tag Transfer Protocol) and their respective validation / rejection / messaging facilities (IDL File Validator for interrogation files, and FDVL for tagging files).

8. Craig – O&M Reporting Knowledge Transfer
   Includes Knowledge Transfer from Doug Clough to Craig White, on initializing report-specific counters and incorporating additions or changes to interrogation equipment into configuration files that support the automated generation of reports used by PTAGIS O&M staff, and the Technical Management Team.

9. Alan – TPA Messaging Knowledge Transfer
   Includes Knowledge Transfer from Doug Clough to Alan Brower, on use of the email-based TPA (Tag Procurement Activities) messaging system for registration of "make-up tags", by means of QA STOCK messages, and registration of replacements for defective PIT tags culled out by the Automated PIT-Tag Testing System (APTTS) by means of REPLACED and VERIFIED messages.

10. PTAGIS3 to PTAGIS4 Sync
    Includes design, construction, and deployment of mechanism to implement the Extract component of the ETL (Extract-Transform-Load) process for keeping the new PTAGIS4 data warehouse in sync with the PTAGIS3 database, as new data arrives).

Summary of PTAGIS4 Server System Development Activities for 2011 and 2012

The tasks described in this section are specific to the PTAGIS4 server upgrade and were performed by PTAGIS staff and subcontractors during the 2011 and 2012 period. These tasks are primarily focused on the development of a new database/datamart and web reporting tools (a.k.a. business intelligence tools). General website development tasks and components are described separately in the subsequent section of this report; however, the PTAGIS4 server term consists of components of both sections and include: database, datamart, web reporting, content management system and web site.

A beta version of the new web reporting system was debuted as planned at the *2011 PIT Tag Workshop* using a large snapshot of the PTAGIS dataset. Significant performance issues were discovered due to hardware licensing restrictions. Staff contacted the vendor, Microstrategy, about the discrepancy between the hardware license delivered and what was negotiated during the evaluation phase. After a series of discussions the vendor declined to upgrade the license and the BPA COTR and CO were notified about the incident. Given the initial investment of time and resource up to this point, it was decided to continue with the project with the delivered license restricted to a single core of a CPU. High-capacity hardware was procured to solely run the Microstrategy system to offset the poor performance. Staff's concern about performance of this system has less to do with how fast queries return results but more to do with how the system will handle a large number of users extracting data simultaneously, especially as the system grows more popular over time.

Staff implemented a real-time datamart that uses a structure called a dimensional data model which efficiently manages contention, locking, bandwidth, tight schema coupling, platform dependencies, and query inefficiencies. This dimensional data model allows for easy data sharing in and across platforms, making inter-program data analysis intuitive and efficient. The datamart contains the entire PTAGIS dataset updated in near real-time and is the comprehensive data source for the web reporting tools.

A major improvement in the new system architecture isolates the transaction processing operations (*e.g.* inserting, updating, and deleting rows) from the reporting operations -- creating dedicated environments for each. There are numerous benefits to having dedicated environments for these distinct processes including flexibility, reliability, usability, and performance. Our new transaction processing system allows for easy and efficient changes to the types of data we collect and the tools used to submit that data while eliminating tight system coupling and schema coupling from the reporting environment. Our new reporting environment has more flexible reporting and data extraction structures that allow for faster access to more data while not impeding system evolution or impacting transaction processing. This also allows for near real-time access to field data which is especially useful for field maintenance and troubleshooting.

The new PTAGIS4 system will provide the basis of all data access for the future with numerous options for data reporting, data understanding, data visualization, GIS/spatial reporting, self-service reports, data extraction, and graphing operations on very large sets of data (100 million rows +) with immediate response times. All of the features of the current (PTAGIS3) QueryBuilder web tool have been implemented and enhanced in the new system and can be accessed from the beta release of the new PTAGIS web site discussed in the next section of this report (figure 2).
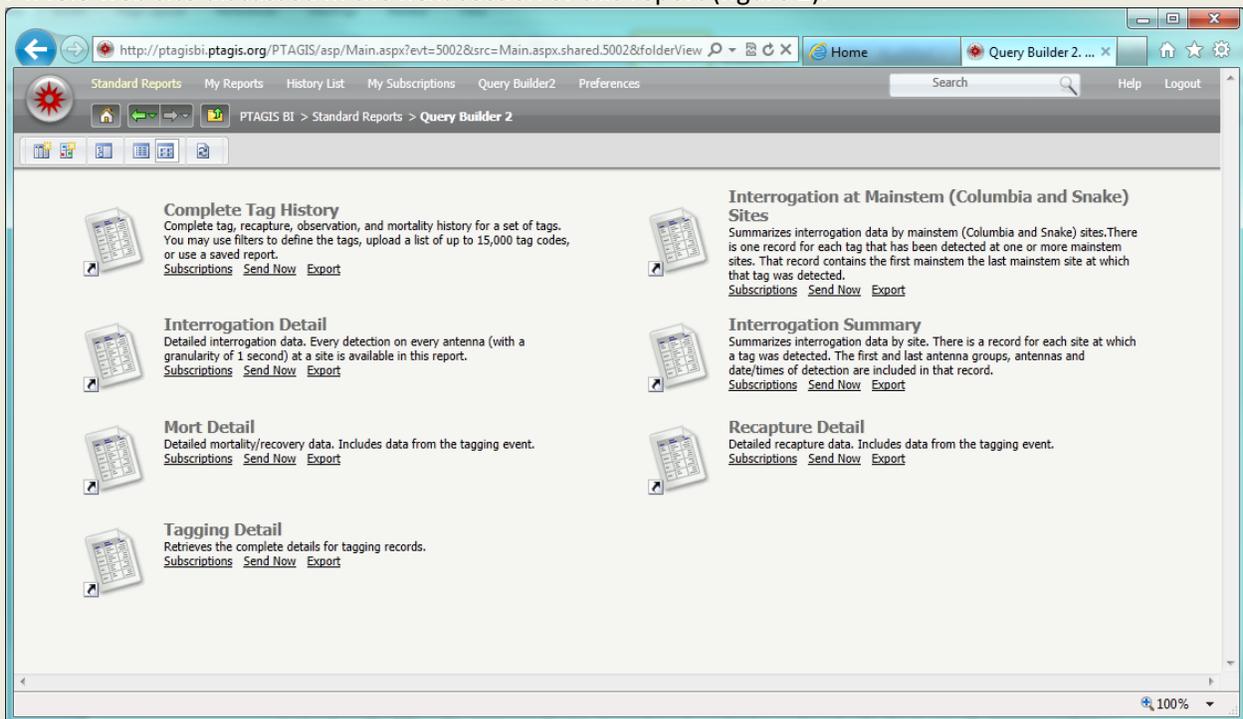

Figure 2 - Beta2 Website Standard Reports Page

A *Transition Architecture Model* diagram (Figure 3) provides a high-level view of how the legacy system (PTAGIS3) and related field systems will be transitioned to the new system (PTAGIS4). The entire dataset was migrated from PTAGIS3 to the PTAGIS4 system so the data model could be further refined

and optimized. A synchronization process between the PTAGIS3 and PTAGIS4 database servers (labeled Sync in Figure 5) was implemented to allow new field data to flow into PTAGIS4. The Sync system is a temporary bridge until field data can be processed directly by the new PTAGIS4 Extraction Transform and Load (labeled ETL) system.

The PTAGIS4 ETL (Figure 3) system provides efficient means to keep the PTAGIS4 dataset updated with field data in near-real time. It performs comprehensive validation and immediately notifies site stewards and tag data coordinators about invalid data at the point of submission. These complex data validation rules already defined in PTAGIS3 have been duplicated and enhanced in the PTAGIS4 system. The ETL system was implemented as an industry-standard series of SQL Server Integration Services (SSIS) packages (Figure 4). Once the system is finalized and validated for production use, the Sync system will be decommissioned, PTAGIS4 will become the authorized dataset, and PTAGIS3 will transition to a reference dataset for evaluation purposes.
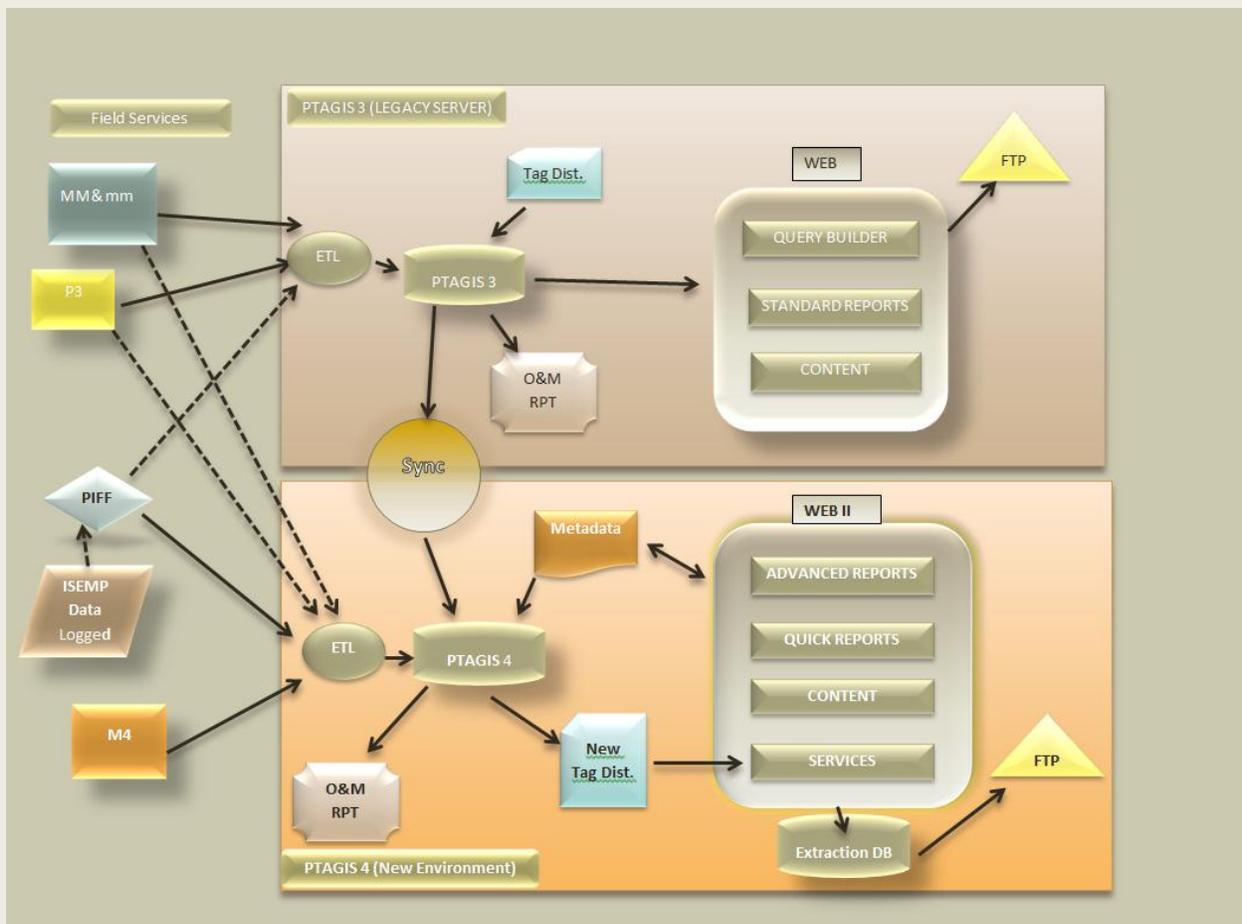
Figure 3 - Transition Architecture Model

The Extraction DB shown in the Figure 3 is a file-based replica of the entire PTAGIS dataset. These files are updated nightly and are partitioned by distinct periods of time (such as changes occurring yesterday, last week, last month, last year etc.). These files can be downloaded and merged into databases maintained by other research projects such as Fish Passage Center and Dart. These large data consumers provide multi-year analysis and interpretation of gigabytes of PIT tag information. The

resource requirements for large data consumers presently fall outside the scope of the new web reporting tool. This Extraction DB feature replaces the TMT and telnet application offered in PTAGIS3 and was completed at the end of 2012.
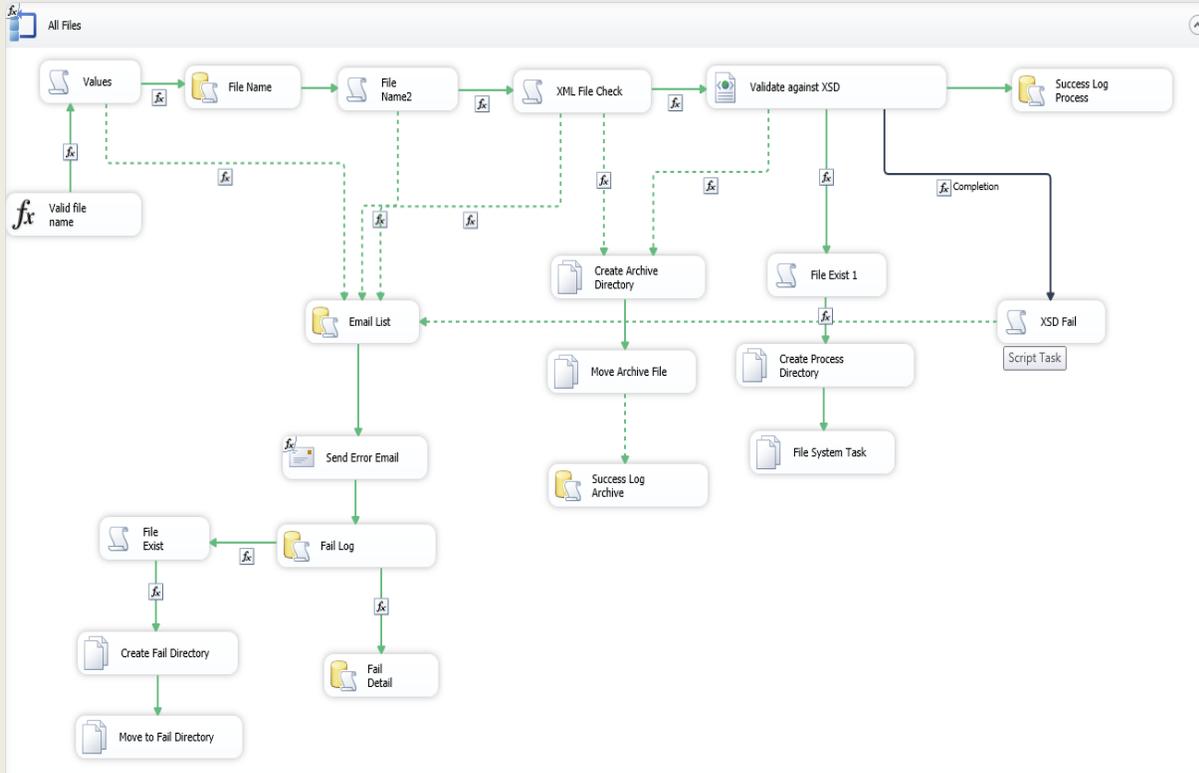
Figure 4 – Sample ETL Package for Validating M4 Interrogation Data

PTAGIS field staff use O&M web reports (Figure 5) and tools to maintain and operate established interrogation sites per standard operating procedures. Some of these reports have been recreated in the new PTAGIS4 system at the end of 2012. The remaining reports will be completed before the 2013 out-migration season so they can be compared against legacy PTAGIS3 reports for accuracy.
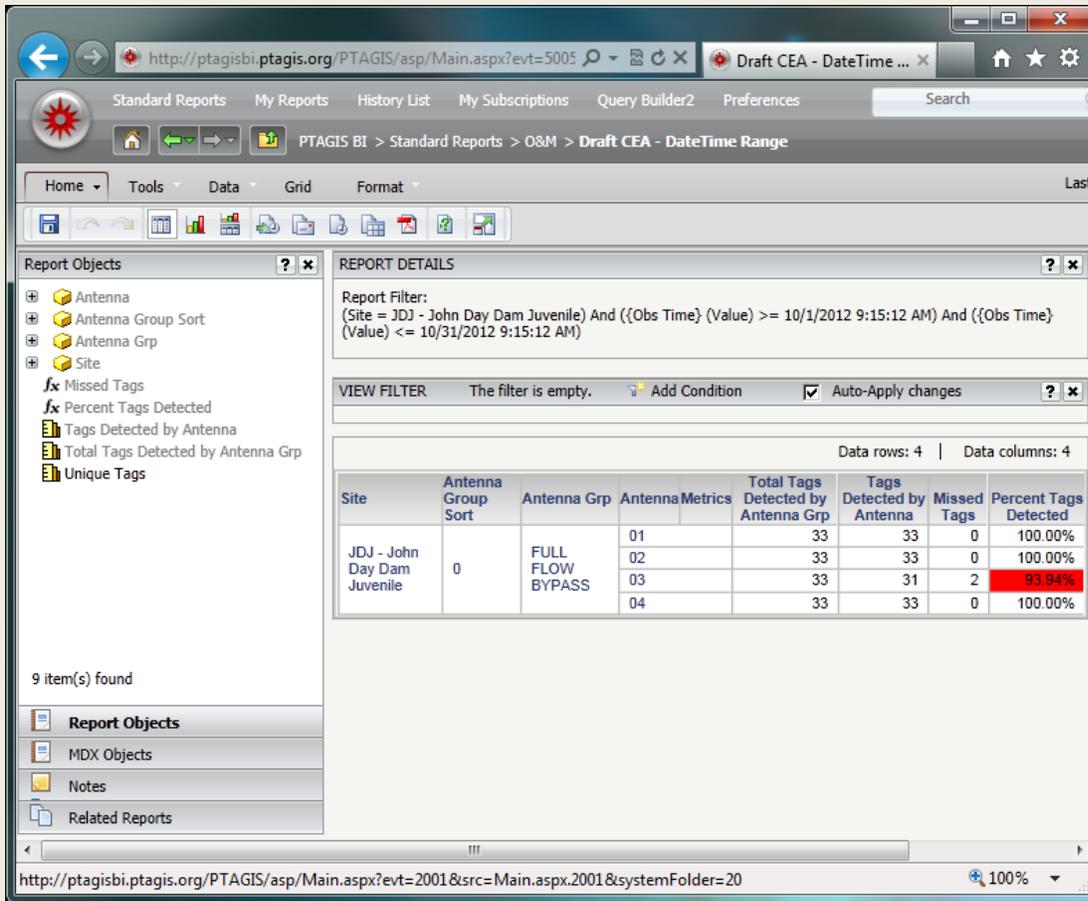
Figure 5 – Example of a PTAGIS O&M Field Report: Cumulative Efficiency Analysis or CEA

2013 Planned Activities for the PTAGIS3 Server

Due to a decrease in funding (explained later in this report) the PTAGIS3 server will be decommissioned in October, 2013 when the annual Ingres database license expires. PTAGIS3 will transition into a reference dataset to validate the new PTAGIS4 replacement during the 2013 out-migration period. The remaining hours of the FY12 Synergetics contract will be extended into 2013 to maintain the server including the Tag Distribution System (TDS) until it is decommissioned.

2013 Planned Activities for the PTAGIS4 Server

These activities have the highest priority for completion to enable a smooth transition from the PTAGIS3 server:

1. Continue manual and automated data audits to evaluate the PTAGIS4 transition

2. Complete remaining ETL features to allow for the efficient submission of standard field data, which includes:

    a. MiniMon transformation service to allow interrogation sites not running M4 to submit data

    b. P3 tagging data submission and validation

      c.   Complete M4 transceiver diagnostic data extraction for O&M reporting

3. Create patch management utility to submit redundant data to patch any gaps in interrogation data both in PTAGIS3 and PTAGIS4 systems.

4. Complete remaining O&M reports which include:

      a.   Diversion Gate Efficiency (DGE) report for SbyC operations

      b.   TASS enunciator report to manage transceiver alarms and other faults via the web

5. Evaluate and enable fault-tolerant features on the new database server

6. Refine Master Database Management system and related schema to manage metadata

7. Complete consolidation of raw-data file attributes into new database for reporting and web-enabled access.

O&M Web Systems Development

The PTAGIS web site provides online access to PIT tag data and metadata and other content. The current website (www.ptagis.org) will be decommissioned with the PTAGIS3 server as described above.

A new web system was developed by PTAGIS staff and contractors during the period of this report as a suitable replacement. This section provides a summary of that work and describes some of the new features of the website (currently http://beta.ptagis.org/).

2011 and 2012 Development Activities

In early 2011, PTAGIS subcontracted with a consulting firm (contract #11-69) that was well known in the fisheries community to lead the design and development of the next generation PTAGIS web site. One of the goals of using this firm was to leverage web components already built for other fish and wildlife programs. The project continued through the summer but was not progressing as planned mostly due to resource issues. PTAGIS hired a new software engineer during the summer of 2011 to work with the consultant to improve progress. The project was falling short of stated goals and a decision was made to cancel the contract in September of 2011.

Behind schedule, the project was beginning to hold up the related database and reporting development described in the previous section. To expedite the development of the new website, staff evaluated off-the-shelf ASP.NET compatible web content management systems (CMS) that provided much of what the project required out-of-the-box. There are inherent risks with this buy instead of build strategy. After staff evaluated several products, the SiteFinity CMS system was chosen to be the foundation of the new PTAGIS website.

A Content Management System allows the editor (staff) to interact with the site in several ways. The CMS provides a graphical user interface that allows the editor to create content, add images and multimedia files, create content schedules, and much more.

Other Common advantages of a CMS:

1. Decentralized maintenance

2. Based on a common web browser - Editing anywhere, anytime removes bottlenecks.

3. Designed with non-technical content authors in mind - People with average knowledge of word processing can create the content directly. No HTML knowledge needed.

4. Configurable access restrictions - Users are assigned roles and permissions that prevent them from editing content which they are not authorized to change.

5. Consistency of design is preserved - Because content is stored separate from design, the content from all authors is presented with the same, consistent design.

6. Navigation is automatically generated and adjusted - Menus are typically generated automatically based on the database content and links will not point to non-existing pages.

7. Content is stored in a database - Central storage means that content can be reused in many places on the website and formatted for any device (web browser, mobile phone/WAP, PDA, print).

8. Dynamic content - Extensions like forums, polls, shopping applications, searching, news management are typically modules.

9. Cooperation - Encourages faster updates, generates accountability for authored content (logs) and cooperation between authors.

10. Content scheduling - Content publication can often be time-controlled, hidden for later use or require user login with password.

Because of a steep learning curve, a local consulting firm was sought to jump-start the project and cross-train the new PTAGIS staff engineer on the complexity and design of a SiteFinity system. PTAGIS solicited two local consultants certified by SiteFinity and had Microstrategy experience. The first candidate was given a small project to demonstrate their competency with both technologies which proved otherwise. The second candidate demonstrated other projects for other customers that were deemed successful that used both technology platforms. They also provided staff with a comprehensive project proposal. The second consultant was subcontracted (#12-31) and delivered top-level and secondary web page templates reusing existing visual designs from the previous contract. They also provided cross-training to the staff engineer.

An additional SDK license to customize the Microstrategy system was purchased (PO-8192) along with a subcontract (#12-37) to a Microstrategy consultant to develop a web service wrapper allowing the synchronization of user accounts between the SiteFinity and Microstrategy platforms. This solution was much more economical and efficient to implement than purchasing and integrating a third-party Single Sign-on (SSO) solution.

In May of 2012, a preview of the site was launched to a focus group of PTAGIS users and was given positive feedback. A second subcontract was issued (#12-94) with the same local SiteFinity consultant to continue the next phase of the project but this time with the PTAGIS staff engineer taking the lead. This contract was discontinued in June of 2012 because of the consultant's flagging project management and the fact they were no longer useful to solve some of the more complex issues of the project. The remaining hours were used to purchase mentoring and support (PO 8672) from an out-of-state

consulting firm whose expertise helped staff get over some of the most complex technical roadblocks of this project. A communication and design consultant used from past projects was also subcontracted (#12-98) to improve the overall look-and-feel of the website using the SiteFinity templates and CSS programming. The completed templates allow staff to add additional web content/pages to the system and maintain a professional look-and-feel.

The project was now gaining velocity and an internal beta of the website was launched in October of 2012 receiving positive feedback from the focus group. A public beta was launched in December 2012 (Figure 6) containing the following additional features:

- Interactive maps of mark/release/recovery (MMR), and interrogation sites

- Organized and tagged content, as well as archived PTAGIS newsletters, Annual Reports, PTSC meeting notes, etc.

- Community forums

- An updated Interpretive Center (tour)

- A streamlined Separation by Code project request process

- Online tutorial videos on how to create use the Advanced Reporting features
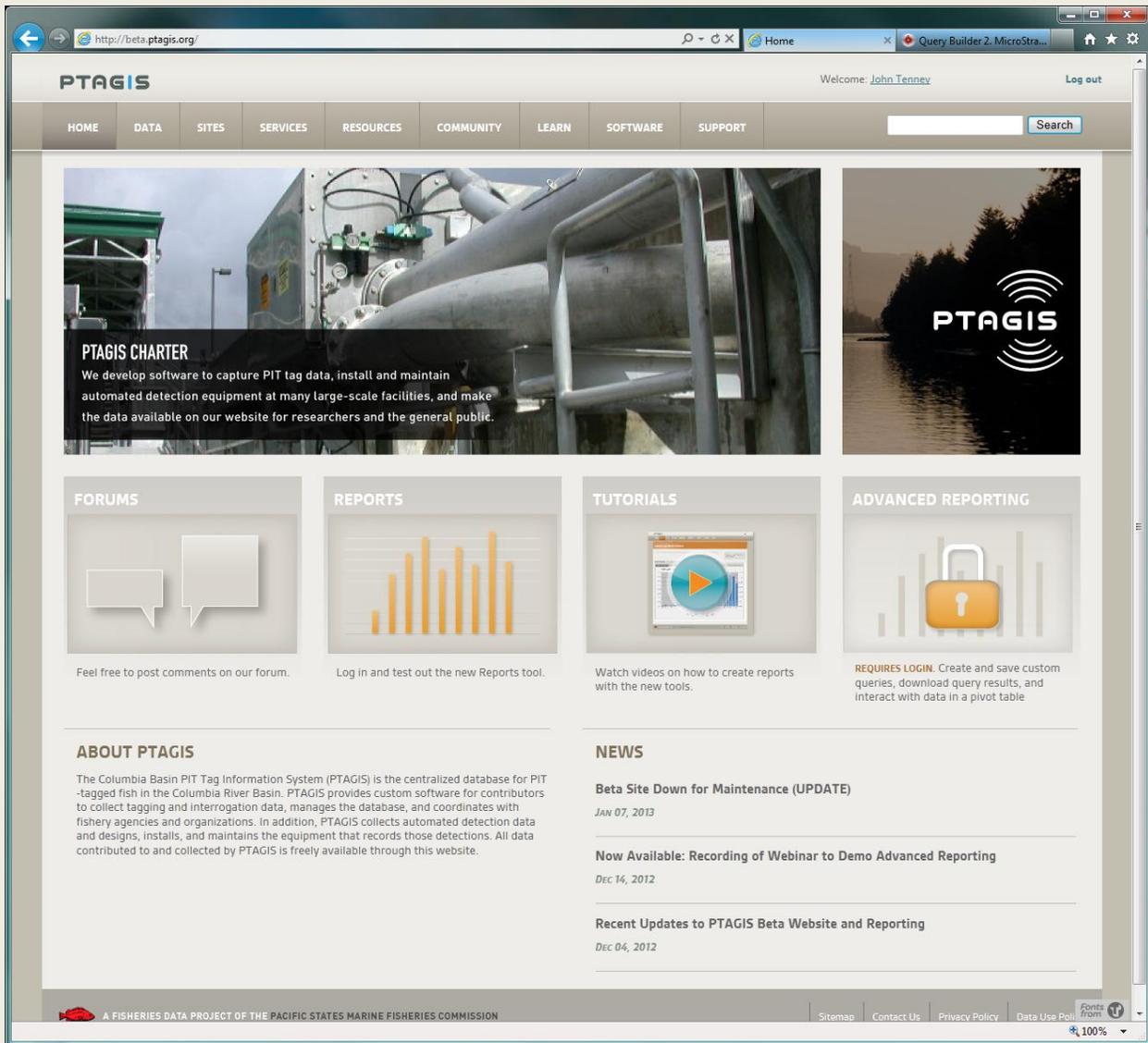
Figure 6 - PTAGIS Beta Website Home Page

Community Outreach

A portion of the website project is dedicated to online community features to enhance technical coordination with a disparate user base. In addition to a standard feedback feature, the Forum tools (Figure 7) allow threaded communication between researchers, staff and other members of the community for all things related to PTAGIS and PIT tags. A long term objective of the community features is to make technical support more self-service and efficient.
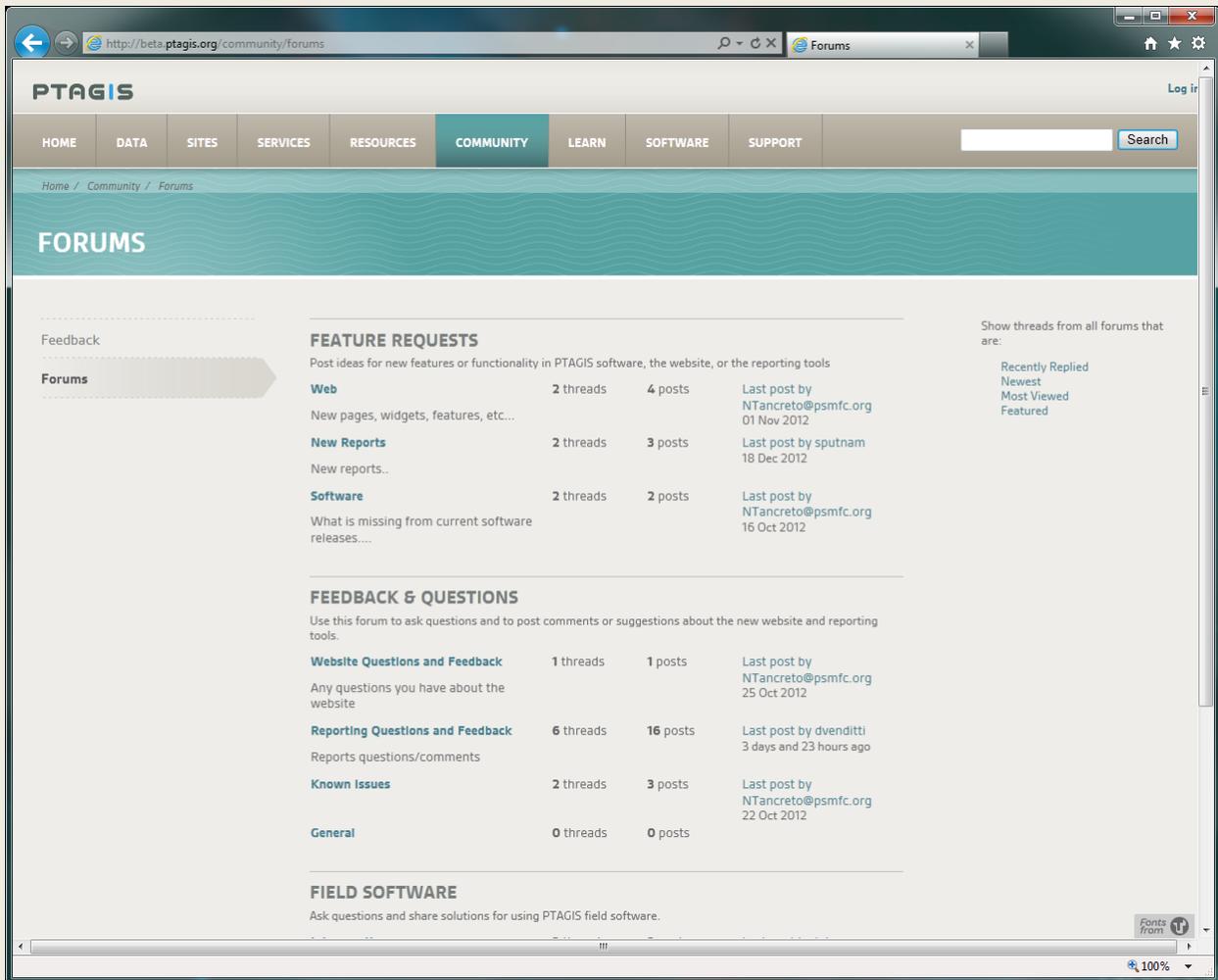
Figure 7 – Available Forums on the new PTAGIS website

The *News* digest located on the site's home page and the *News and Announcements* (Figure 8) section keeps agencies and the community informed of recent changes within the PTAGIS program, as well as new software releases and field developments.
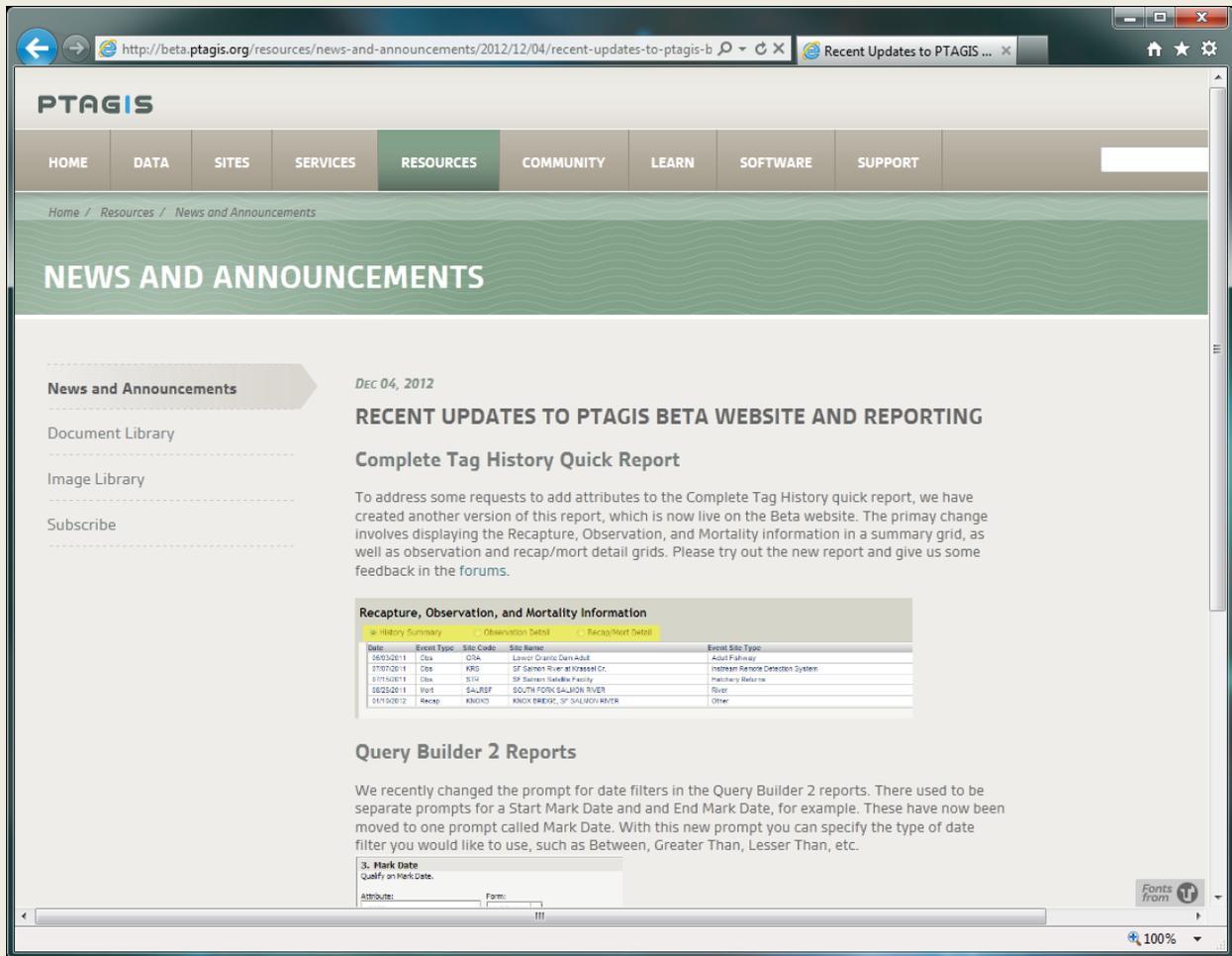
Figure 8 - News and Announcements example from the new PTAGIS website

Based upon the underlying features of the content management system (CMS), the website provides access to other useful resources such as technical documents, meeting notes, newsletters, images and training videos. This content can be discovered from the full-text search capabilities, from tag-based filtering or by navigating the *Resource* and *Learn* sections of the website. Newsletter creation, subscriptions and distribution have also been enhanced with features of the CMS system.

Data Dictionary

In 2012 PTAGIS transformed the *PIT Tag Specification Document* into an indexed *Data Dictionary* (Figure 9) and is available from the Data menu. The online *Data Dictionary* defines terms and related metadata providing important context to the PTAGIS dataset. It has been requested by the ISRP in the last two program review cycles. The PTSC reviewed and approved this feature as the eventual replacement for the *PIT Tag Specification Document* once it matures. All dictionary terms are segregated into "types", for which we have created three categories: *Interrogation File, Report Attribute, and Tag file* that users can filter by.
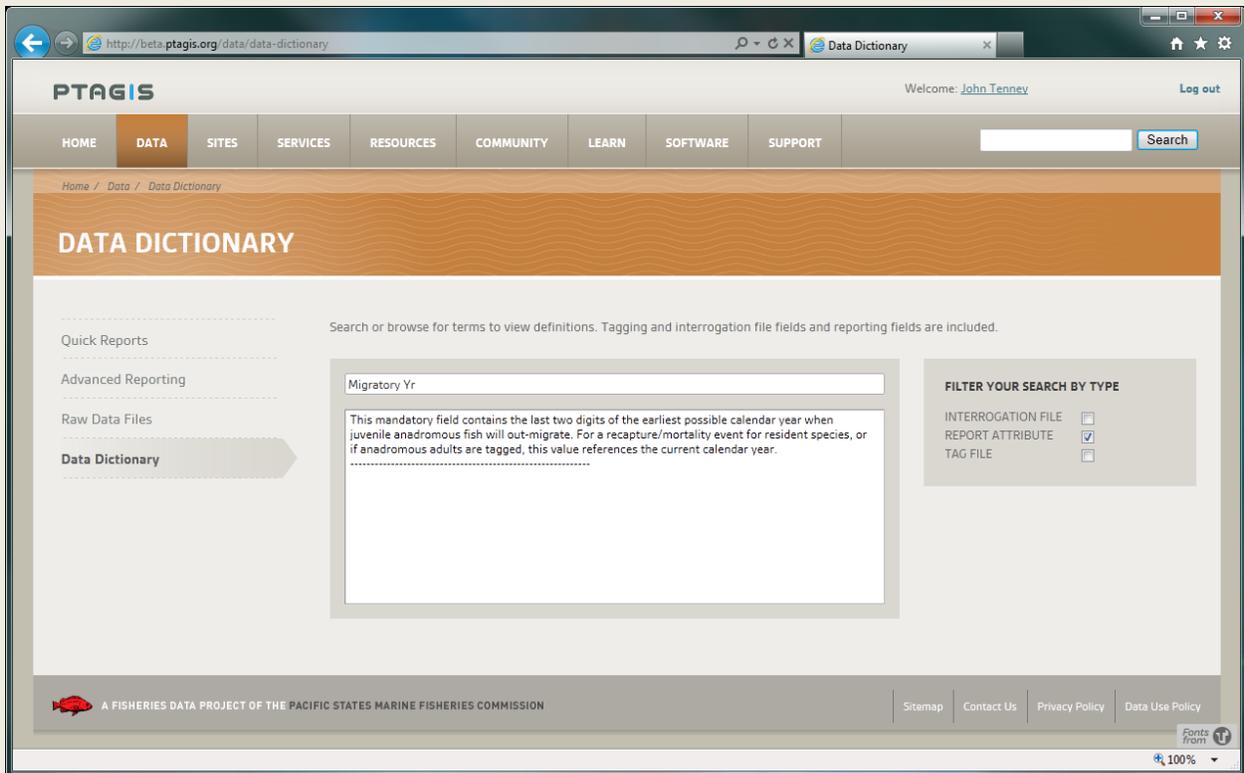
Figure 9 - PTAGIS Data Dictionary

2013 Planned Activities for Web System Development

Many of the core features of the new PTAGIS web site were completed in 2012 but there some important ones that will be added over the next few years. A central goal of this project is to not only leverage the new PTAGIS4 reporting features but to also enhance community collaboration. For example, with several in-stream (tributary) interrogation sites coming online, the new PTAGIS web site will eventually provide self-service features allowing stewards to maintain site metadata and manually import raw field data (PIFF replacement). An RSS feed will provide an online display as well as automate the delivery of news items in "near real-time" related to the PTAGIS program and the community at large.

The following features will be added to the PTAGIS website in 2013 as time and resource allow:

1. Additional web-enabled workflow services to allow researchers to request and PTSC approve metadata additions such as new interrogation sites.

2. Design and build Interrogation Site Metadata page

3. Evaluate the inventory and e-commerce features of SiteFinity as a potential replacement for the Tag Distribution System in PTAGIS3.

4. Complete the Image Library features

5. Refine Data Dictionary per PTSC recommendations as a replacement or extension of the *PIT Tag Specification Document*

6. Include Video content in the Library section to host PTSC Marking Procedures and others

7. Upgrade Raw Data file feature to point to files as links from the database

8. Design and build the Interrogation Site Steward portal to allow researchers to manage their interrogation metadata and launch O&M reports.

9. Web-enabled the PIFF utility software to allow non-standard data to be submitted to PTAGIS via the steward portal or a published web service.

O&M Field Systems Development

Field Systems Development Overview

The PTAGIS project develops and maintains custom field (client) software systems to capture mark, release, and recovery data from hundreds of field sites operated by PTAGIS staff and other agency/research organizations within the Columbia Basin. These software systems perform simultaneous communication with atypical hardware devices such as RFID tag readers, PLC devices, GPS units, digitizer boards and digital balances. Field data captured by client systems are verified to be 100% valid and uploaded to the PTAGIS server to be incorporated into the regional database in "near real-time" to meet the goals of the program as defined in *Project Goal and Objectives* section of this report.

2011 and 2012 O&M Field System Development Activities

This section describes development and maintenance activities performed for each client software system in the calendar years of 2011 and 2012. As noted in previous annual reports, PTAGIS is balancing the development of the next-generation client software with the concurrent support of existing client software systems already in the field. The work described in this section was performed by a single software engineer while concurrently performing program management duties.

P3 Tagging Software

P3 software is 10 years old and is a workhorse in the basin for collecting PIT tag mark, release, recapture, and mortality data. The software has been designated as end-of-life for the last 5 years. The development of a much needed replacement (P4) has been rescheduled each year due to lack of resources and higher priority projects such as PTAGIS4 and M4. The P4 development is presently scheduled for 2014 requiring another year for staff and users to rely upon this aging but stable software. To promote stability, any enhancements to P3 are carefully considered.

There were three releases of P3 during this period of time with two important enhancements: P3 no longer rejects a PIT tag code if the first 3-digits do not match an entry in an internal list of known manufacturer codes (a.k.a. country codes). This modification was at the request of the PIT Tag Steering Committee because the validation constraint implemented over 10 years ago has become difficult to maintain with the recent changes in tag vendors and types. Instead, this constraint will be implemented in the new PTAGIS4 server to flag any mark/recapture data containing tag codes of dubious origins (and specifications) upon submission. The second important enhancement of P3 added support for the new Biomark HPR+ portable transceiver.

MiniMon Interrogation Software

MiniMon was developed by PTAGIS in 1999 as a PC-based replacement for the MultiMon application at interrogation sites that do not have Separation by Code requirements. It provides 24x7 unattended monitoring for fish marked with a PIT Tag by collecting data from 50 or more transceivers simultaneously. The collected data is transformed into interrogation files that are automatically uploaded into the PTAGIS database in "near real-time". MiniMon will be discontinued after 2013 season and any remaining interrogation sites running this software will be upgraded to M4.

MiniMon is also designated as end-of-life but had important releases in this period of time. As with P3, in order to read new types of tag codes, the validation constraint on known manufacturer codes was disabled. MiniMon was also updated to support the new Biomark FS-2020 adult transceiver and HDX tag types per PTSC specifications.

PIFF Utility Software

The PTAGIS Interrogation File Formatter (PIFF) utility offers interrogation site stewards a way to format raw transceiver or data logger output into a standard interrogation file format that can be uploaded to the PTAGIS database. A new release of this software, version 1.1.0.5 was issued in July of 2011 to modify the default date handling rules to always use a transceiver timestamp when available.

M4 Interrogation Software

M4 is the next-generation interrogation software designed to capture real-time observation data from fish marked with a PIT tag. M4 also support Separation by Code (SbyC) diversion activities at various interrogation sites. This software is a replacement for MiniMon and MultiMon systems.

A beta version of the M4 software was presented at the *2011 PIT Tag Workshop* where staff discovered many researchers operating in-stream interrogation sites were already using a data logger solution and did not require new software. Features that were designed for in-stream use to capture extensive metadata in the field were dropped including the need for a local database. The redesign focused extensively on mainstem use where PTAGIS Kennewick staff are the principal users and simplified the data collection requirements. M4 could still be used for in-stream interrogation sites but metadata management would be transitioned to the new PTAGIS4 server.

Progress continued on this project through the fall of 2012 when the sophisticated Separation-by-Code (SbyC) features were completed. M4 was extended to support two families of Allen-Bradley programmable logic controllers (PLC). A PTAGIS field engineer with expertise in PLC programming redeveloped the necessary ladder logic to process diversion gate requests from the M4 software application running on a cluster of computers. The process for diverting target fish in real-time with redundant detection points is very complex and requires sub second response times between the transceivers, M4 and the PLC. The configuration requirements are also intricate to allow the scheduling of SbyC operations and the management of target fish quotas (Figure 10).
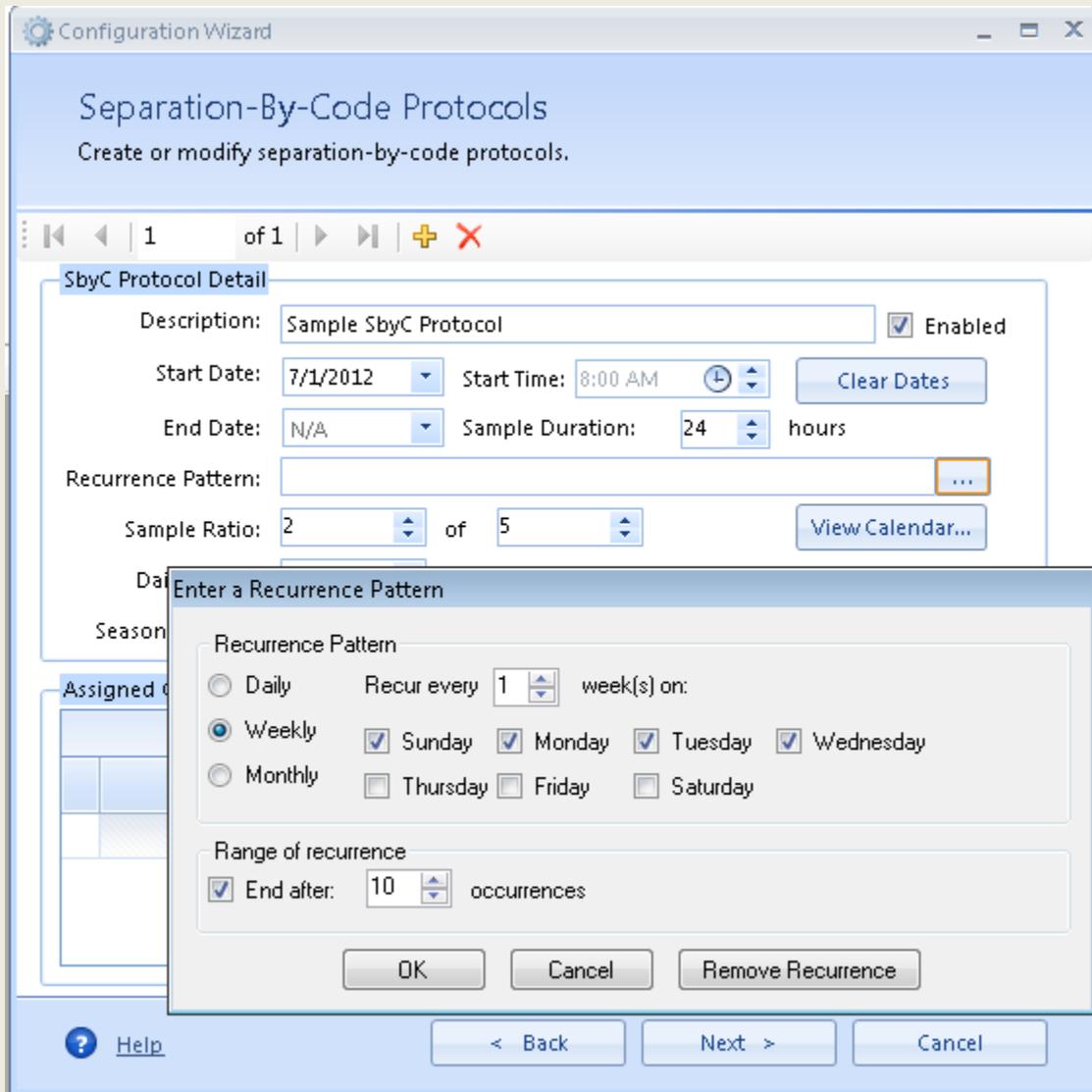
Figure 10 – Example of a Protocol Configuration for Separation-by-Code

Staff from both of the Portland and Kennewick offices performed rigorous laboratory testing with custom, complex systems simulating large interrogation sites to ensure that necessary high performance and stability standards were met. A live fish test was conducted at Little Goose Dam by NOAA and PTAGIS staff. M4 successfully diverted 2,200 fish marked and released by a crew led by Sandy Downing of NOAA and confirmed the validity of PTAGIS laboratory test results.
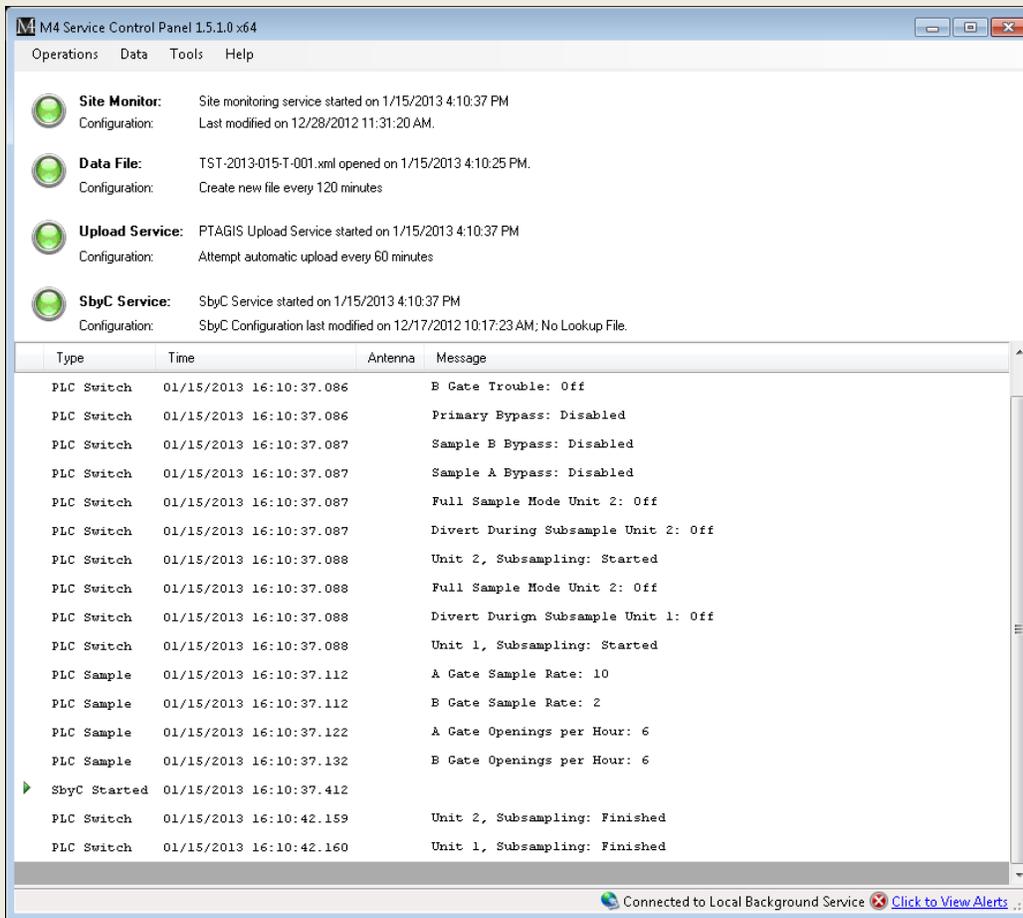
Figure 11 - M4 Service Control Panel

Since early June of 2012, M4 (Figure 11) has been controlling the separation-by-code diversion gates at the Bonneville Dam PH2 Juvenile Bypass and Sampling Facility (B2J) facility and has met our high standards of performance. The existing MultiMon platform is still in place running as the primary data collection platform and we can use our standard O&M reports to verify diversion gate efficiency. Staff engineered a failover scheme with an automatic\manual override switch (Figure 12) allowing MultiMon to resume control of the diversion gates in case of system failure or low diversion gate efficiency. M4 has been operating as expected and we have needed the switch only to support an unrelated network upgrade at the site.

M4 was also deployed at the Bonneville Dam 2nd Powerhouse Corner Collector Outfall Channel (BCC) site running as the primary controller of the Automated Read Range Tester (ARRT is described in the March 2010 PTAGIS newsletter). The existing MiniMon platform is running in parallel as the primary data collection platform.

In the last quarter of 2012, Kennewick staff modified equipment rooms and M4 was deployed at all PTAGIS-maintained interrogation sites. M4 is uploading data to the new PTAGIS4 server system allowing us fine-tune the server-side ETL data submission process as well as build the next-generation operations and maintenance (O&M) reports. This in-situ testing has not impacted data continuity in any way as the

primary data set published in the PTAGIS database is still sourced from the legacy data collection platforms and not M4.

Each PTAGIS interrogation site will operate redundant platforms (Figure 12) for the 2013 out-migration season. This redundancy provides two central benefits: the first is the ability to compare data and O&M reports from both server systems for efficiency and validity; secondly, the legacy platform can be used as a failover in the very remote case we encounter serious failure on the M4 platform. To support this failover scheme as well as to relax the M4 migration schedule for non-PTAGIS sites, the new PTAGIS-4 database server will be provisioned to accept legacy datasets as primary data with the same robust validation as the current PTAGIS-3 database. The tradeoff for deploying a redundant platform is additional equipment will be squeezed into an already confined space and staff must now maintain two platforms. PTAGIS staff agreed the benefits of this evaluation platform outweigh the costs.
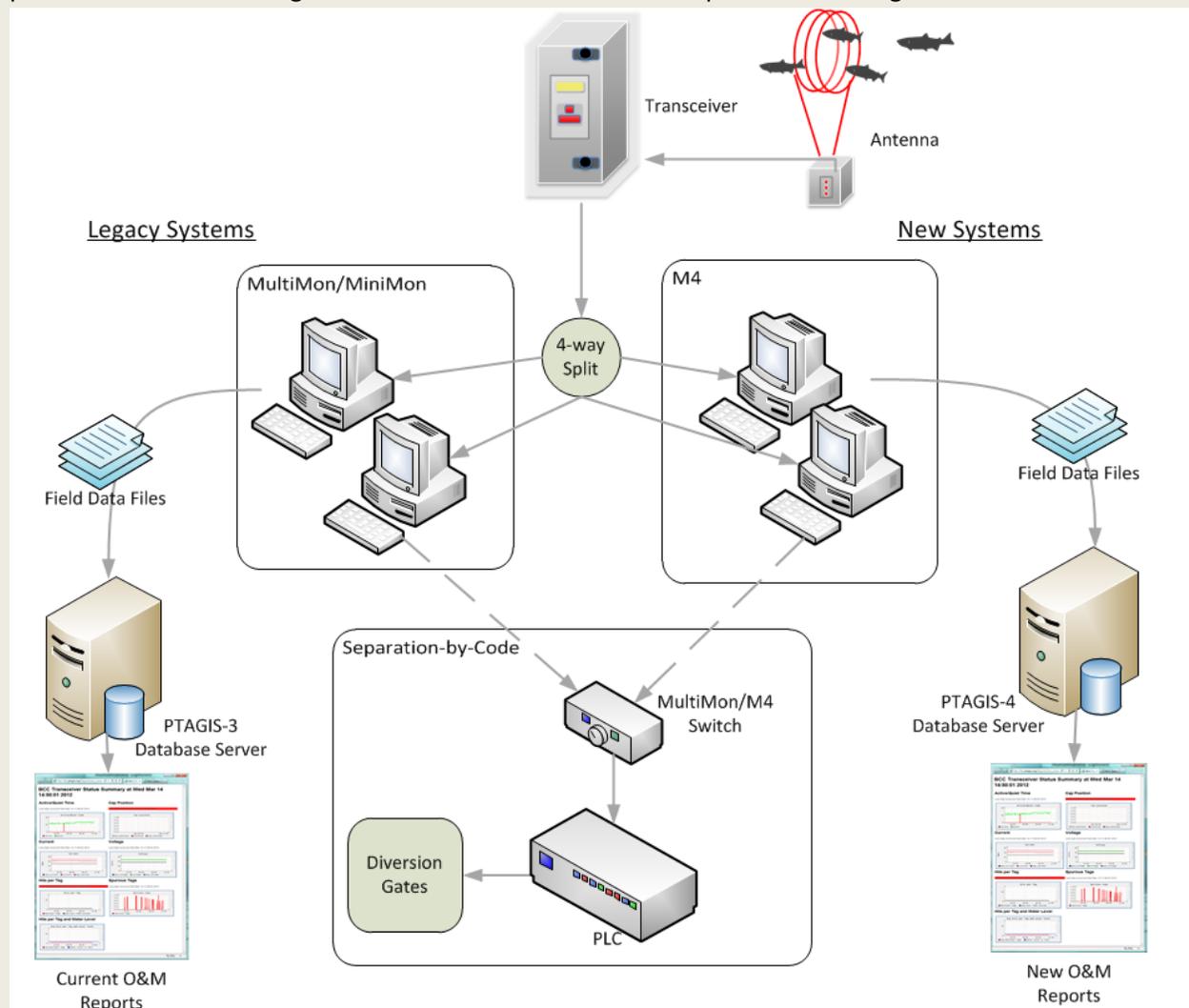
Figure 12 - Redundant Interrogation Platform for 2013

Each platform, M4 and MultiMon, are fully redundant in themselves to maintain our high uptime requirements. Each platform consists of the two computers collecting the same data. One computer is

designated as the primary machine and the second as a backup. The primary machine submits data to PTAGIS and controls the diversion gates. If a failure occurs on the primary computer, the backup machine takes control of the diversion gates and data is patched from the backup for continuity. With redundant platforms shown in Figure 13, 3 computers are designated as backup and one as the primary. Standard operating procedures and system validation are in place to protect against duplicate data submissions and will be completely transparent to researchers querying data from the PTAGIS database.

2013 Planned O&M Field System Development Activities

Modifications to legacy software will be limited to allow staff to focus on the M4 evaluation through the 2013 out-migration season as well as the PTAGIS4 server transition.

An online service (Figure 13) provides an efficient means for staff to discuss, track and prioritize dozens of bug and enhancement requests for the M4 software.
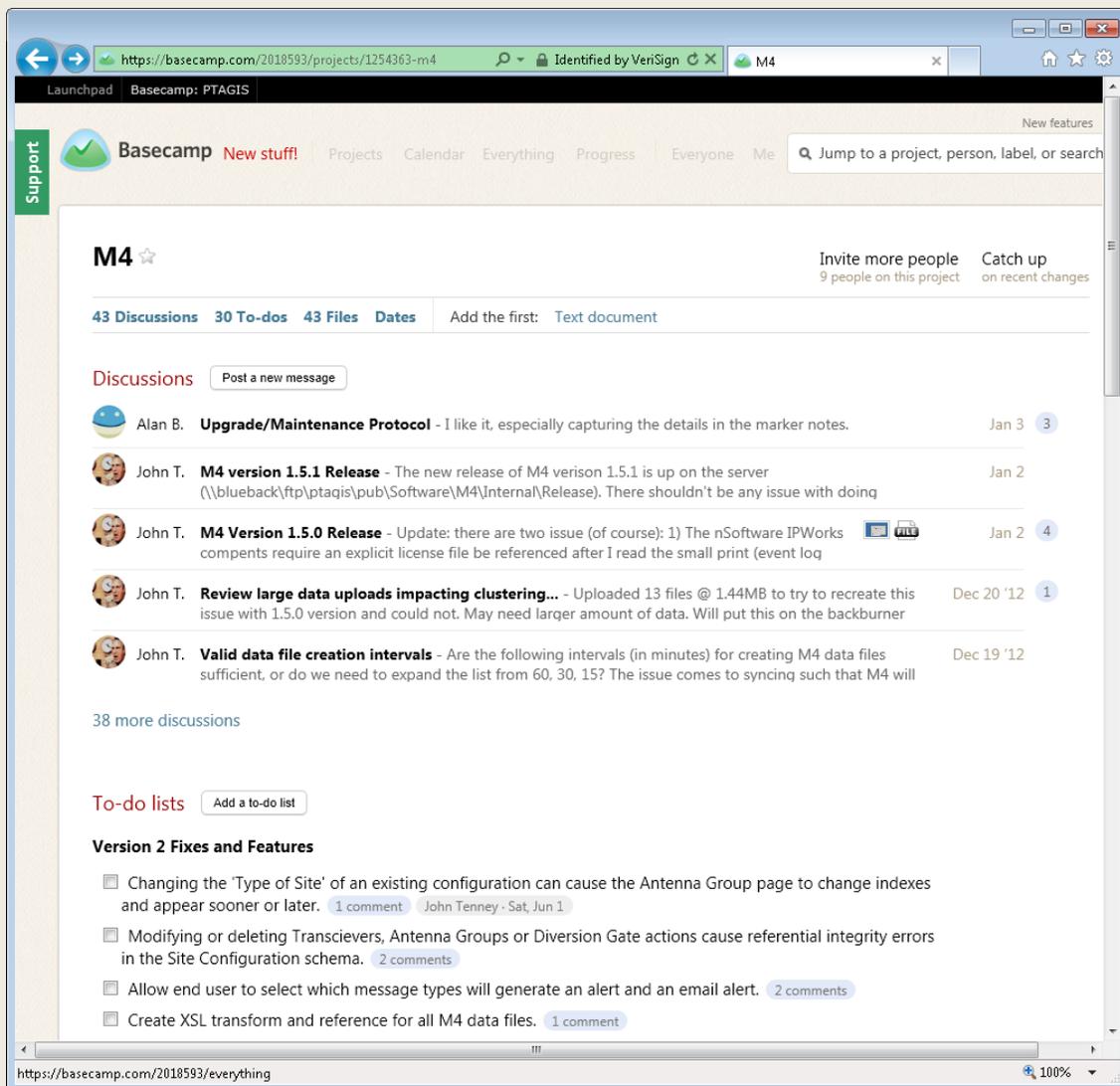
Figure 13 - Staff Discussions on Basecamp

If time and resource allow, staff will begin scoping requirements for the next-generation tagging software called P4.

SEPARATION by CODE SUPPORT

This objective relates to our BPA Work Element titled, B: 160. Create/Manage/Maintain Database. This objective intends to deliver a well-coordinated and successfully implemented Separation by Code (SbyC) system for use by the research community. Key milestones include updating seasonal database support tables, capturing user requests, implementing user requests and monitoring separation by code passage on a daily or more frequent basis during the migration season.

We identified a third work element in our statement of work, D: 70 Install Fish Monitoring Equipment with the deliverable of providing instrumentation to activate fish routing gates based upon SbyC activity. This work is performed by PTAGIS Kennewick field staff.

2011 SbyC Project Support Activities

PTAGIS project provides researchers in the Columbia Basin the opportunity to target and collect specific PIT-tagged fish as those fish pass through the detection facilities at six main-stem dams on the Snake and Columbia rivers. This process of selecting and diverting individual PIT-tagged fish is called Separation by Code (SbyC). In 2011, the PTAGIS project implemented 18 Separation by Code projects for twelve agencies at seven of the eight SbyC sites, and managed around 1.7 million PIT tag codes. (see table below)

Table 2- 2011 Separation by Code Organizations and Tags

Organization	Project Title	Project Description	Number of Tag Codes
CRITFC	Evaluate video counting box	Divert PIT tagged fish through a video counting box equipped with a PIT tag detector off the A-separator gate at McNary Dam.	10,367
FPC	CSS - Comparative Survival Study	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	371,654
IDFG	ISEMP - Lemhi River watershed monitoring and evaluation and Idaho Fish Screening and Passage Improvements.	Collect returning Chinook originating from the Lemhi River watershed at the Lower Granite adult trap.	10,352
IDFG	Clearwater, Sawtooth, Pahsimeroi hatcheries spring/summer Chinook	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	95,619
IDFG	Dworshak Hatchery returning steelhead	Collect returning Dworshak Hatchery steelhead at the Lower Granite adult trap to measure length.	819
NMFS	Monitor wild Salmon River Chinook salmon migrations	Collect fish at Little Goose Dam that were marked in various Salmon River drainages in 2009 and 2010.	29,556
NMFS	Chinook salmon transportation and life history studies.	Transport wild and hatchery yearling and subyearling Chinook; sample smolts at Bonneville JMF; collect adults at Lower Granite adult trap.	930,544
NMFS	A Study to Evaluate Survival of Adult Spring/Summer Chinook Salmon Migrating from the Mouth of the Columbia River to Bonneville Dam	Avoid collecting tagged fish in the Bonneville AFF fish trap; collect up to 9 tagged fish the Lower Granite adult trap.	629
NPT	Imnaha River wild Chinook and wild steelhead, Nez Perce Tribe hatchery Chinook, and Clearwater hatchery coho.	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	25,096
ODFW	Smolt outmigration timing and survival for LSRCP Wallowa and Imnaha stock steelhead.	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	30,277
PNNL	Acoustic Telemetry, Evaluation of Dam Passage Survival and Associated Metrics at John Day, The Dalles, and Bonneville Dams, 2011	Collect up to 20 fish at the Bonneville JMF from each of at least 5 cohorts tagged at John Day Dam.	4,953
QCI	ISEMP Previously spawned steelhead	Collect up to 100 steelhead at the Lower Granite adult trap to collect additional scale samples.	8,460
UFWS	Evaluation of Kooskia Spring Chinook Releases	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	12,969
USACE	A Pilot Study to Develop a Snake River Sockeye Transportation Plan.	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	43,345
USFWS	Research, monitoring, and evaluation related to recovery of the Snake River fall Chinook salmon ESU	Collect tagged fish at Lower Granite JFF.	10,900
WDFW	Estimate SARs for endemic stock hatchery steelhead released in SE Washington and NE Oregon rivers.	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	65,994
WDFW	Asotin Creek RM&E Project	Treat PIT-tagged fish similar to the untagged population when detected at transport sites.	14,607
YINN	Energetics and morphology of Wenatchee River coho salmon	Collect PIT-tagged fish at the Bonneville AFF.	34,453

2012 SbyC [Project](#) Support Activities

PTAGIS project provides researchers in the Columbia Basin the opportunity to target and collect specific PIT-tagged fish as those fish pass through the detection facilities at six main-stem dams on the Snake and Columbia rivers. This process of selecting and diverting individual PIT-tagged fish is called Separation by Code (SbyC). In 2012, the PTAGIS project implemented 17 Separation by Code projects for twelve agencies at seven of the eight SbyC sites, and managed around 1.6 million PIT tag codes. (See Table 12 below)

Table 3 - Separation by Code Organizations & Tags 2012

Org.	Project Title	Project Description	Number of Tags
FPC	CSS - Comparative Survival Study	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	353,659
IDFG	Lemhi River watershed monitoring and evaluation.	Divert returning Chinook originating from the Lemhi River watershed to the trap at the Lower Granite adult fishway.	24,452
IDFG	Clearwater/Sawtooth/Pahsimeroi hatchery spring/summer Chinook	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	96,360
IDFG	PIT tag retention in returning spring/summer Chinook from McCall and Rapid River hatcheries	Divert targeted fish to Lower Granite adult trap for sampling and jaw-tag application.	483
NMFS	Chinook salmon transportation and life history studies.	Transport wild and hatchery yearling and subyearling Chinook; subsample smolts at B2J; collect all target tags at GRA.	901,345
NMFS	Evaluation of methods to reduce staying rates of barged juvenile steelhead	Collect wild and hatchery steelhead at MCN and BON that were tagged and release at LGR	11,664
NMFS	Monitor wild Salmon River Chinook salmon migrations	Sample fish at Lower Granite Dam that were marked in various Salmon River drainages in 2011 and 2012.	32,803
NPT	Imnaha River Chinook and stealhead, Clearwater coho	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	27,500
ODFW	Smolt outmigration timing and survival for LSRCP steelhead from the Grande Ronde and Wallowa basins.	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	30,462
PNNL	Evaluation of Externally JSATS-tagged Subyearling Chinook Salmon	Collect fish at MCJ that were marked with neutrally boyant external JSATS tags and released at LMJ.	499
PNNL	Effects of Tagging	Collect fish at BON PH2 LMF that were tagged at JDA and released at Arlington.	5,340
USACE	A Pilot Study to Develop a Snake River Sockeye Transportation Plan	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	43,359
USFWS	Evaluate releases of spring Chinook from Kooskia NFH and releases of steelhead from Dworshak NFH	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	13,970
USFWS	Research, monitoring, and evaluation related to recovery of the Snake River fall Chinook salmon ESU	Collect tagged fish at LGR JFF.	8,880
WDFW	Asotin Creek RM&E Project	Assess the status of anadromous salmonid populations in the Asotin Creek Subbasin.	18,107
WDFW	Estimate SARs for endemic stock hatchery steelhead released in SE Washington and NE Oregon rivers	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, or MCN.	67,998
WDFW	Subyearling Chinook released at Lyons Ferry Hatchery	Treat PIT-tagged fish similar to the untagged population when detected at LGR, LGS, LMN, MCN.	19,977
		Total Tags	1,656,858

The Fish Passage Advisory Committee (FPAC) requested the streamlining of the SbyC Project review and coordination process to make the process more transparent. PTAGIS responded by developing an online workflow system hosted in the new website to manage these requests (Figure 14).

Figure 14 - Separation by Code Project Request Service on new PTAGIS website

In addition to transparency, the new process makes it easier for researchers to submit and FPAC to approve new requests. Instead of sending separate memos to both FPAC and PTAGIS, a researcher now just needs to log into the new website and complete a web form with the necessary information and click a button to submit the request. Once it is submitted, an email notification is sent to the co-chairs of FPAC and to the PTAGIS SbyC coordinator for review; the researcher also receives an email confirming that his/her request was successfully submitted. After FPAC reviews the request, they use the same web application to approve the project; they can also request more information from the researcher. Once the project has been approved by FPAC, the PTAGIS SbyC coordinator will review the project request to ensure that all information necessary for implementation is included. After the project has been implemented at the appropriate sites, the PTAGIS SbyC Coordinator marks it as implemented. Email notifications are sent to the researcher throughout the process, and they can also check the status of their project on the website.

In addition to streamlining the review and coordination of this process, it will also provide a repository of information about SbyC projects in the Columbia Basin. Any registered user can view the details of projects that have been approved by FPAC, right down to the tag codes that were submitted by the original researcher.

It is important to note that this new process does not provide coordination with the US Army Corps of Engineers or Smolt Monitoring Program; the researcher is responsible for contacting and coordinating with the appropriate personnel from each of these programs, as well as any other researchers or trap operators.

As of the last beta release discussed in *O&M Web Systems Development* this system was completed and based upon a pending review with FPAC it will be deployed for production use for the 2013 season.

2011 and 2012 SbyC Field System Support Activities

During the migration season, PTAGIS field systems personnel inspect and test separation by code pneumatic, electrical, and mechanical components at each facility on a weekly basis. During these site visits, PTAGIS staff communicates with Corps of Engineers facility biologists and other researchers at the site. Often time's SbyC issues are identified during these discussions. In 2006, there were 27 gate related issues between the Lower Granite, Little Goose, and Lower Monumental sites. The issues ranged from gates sticking open or closed to gates breaking due to slamming. In October 2006, PTAGIS field O&M staff kicked off a project to upgrade slide gates in time for the 2007 migration season. The project included the collaboration of the NOAA Fisheries Pasco shop to provide fortification and mounting modifications to the slide gates. Three optical sensors were added to each gate and the programmable logic controllers (PLC) at the facilities were upgraded to incorporate these sensors as inputs. The PLC logic was updated to incorporate the optical sensor input to prevent gate slamming. In addition, human machine interfaces (HMI) and signal lights were installed to notify on-site personnel when a gate problem alarm was issued by the PLC. As a result of these efforts, gate related issues were reduced from 27 issues in 2006 to 2 issues in 2007. During 2010, gate reliability has continued with little downtime and few trouble alarms. Emailing of gate alarms at a few test sites was initiated in 2010, adding another investigative tool. Gate mechanical longevity has continued to increased, resulting in cost savings for the operating agencies.

2013 Planned Activities for Separation By Code Support

This on-going task will require more resource this year due to the evaluation of new M4 software and the dual platform deployment (discussed earlier). This year also presents the trial use of the online SbyC Request System which may require additional technical coordination with FPAC and other entities to fine tune the new workflow. A new type of PLC hardware was deployed for evaluation to eventually replace aging infrastructure.

FIELD OPERATIONS and MAINTENANCE

This objective relates to the following BPA Work Elements in the PTAGIS Statement of Work:

- E: 70 Install Fish Monitoring Equipment. This work element provides for milestones (tasks) required to deliver installed PIT tag detection system as required by Action Agencies and approved by Bonneville Power Administration.

- F: 159 Transfer/Consolidate Regionally Standardized Data. This work element provides milestones (tasks) necessary to deliver high quality, near-real-time PIT tag interrogation data for incorporation into the PTAGIS database.

- G: 122 Provide Technical Review. This work element provides for development technical documentation, written standard operating procedures, provision of technical assistance and support to the research community related to the design, installation, operation and

maintenance of PIT tag interrogation system by other entities engaged in PIT tag detection research activities in the Columbia Basin.

- <u>H: 119 Manage and Administer Projects.</u> This work element provides for the efforts necessary for planning, organizing work, and directing and controlling efforts to achieve optimal results for PTAGIS field system operations.

The following describes the activities performed within the above work elements:

Field Operations & Maintenance Midyear Summary for 2011/2012

Since 1993, the PTAGIS Kennewick Field Office staff has worked behind the scenes to keep PIT tag detection efficiency as the "gold standard" of fish detection. These detection sites include Corps of Engineers dams on the Snake and Columbia, Bureau of Reclamation (BOR) sites on the Yakima and various other sites throughout the region. Details of all 2011 and 2012 field system operations can be found in event logs published on the PTAGIS 'PTOC Central' web site: http://www.ptoccentral.org/Ptoc_OM/event_log/index.html.

The PTAGIS Field O&M Staff utilizes daily operational reports, which are monitored multiple times each day, 365 days a year. During the portions of the season with high fish migration, PTAGIS 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. These visits include tuning all readers, inspecting and timing diversion gates, data collection computer maintenance and meeting with site operators and biologists.

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 preseason tuning and maintenance to ensure peak performance of the juvenile fish detection and diversion equipment. Detection efficiency rates for 2012 are being kept at very high levels as listed in this report: ttp://php.ptagis.org/wiki/index.php/CEA_YTD_Efficiency_Tallies

The efficiency of the diversion gates at the Separation by Code (SbyC) interrogation sites continue to be improved by PTAGIS upgrades to the Programmable Logic Controller (PLC) programs that control the gates at each site. The addition of remote monitoring capabilities included the addition of automated email and text messaging notifications of potential gate problems. Another benefit of the PTAGIS PLC improvements is the very low number of mechanical gate failures causing unscheduled site visits. Mechanical longevity of the gates has greatly increased due to these efforts. Diversion efficiency rates for 2011 and 2012 were outstanding as listed in this report: http://php.ptagis.org/wiki/index.php/DGE_Gate_Efficiency_YTD_Summary

Other PTAGIS Field Office projects in 2011 that continued into 2012 include the following:

1. Testing and deployment of the Biomark FS2020 transceivers in test locations throughout the basin. Initial results are positive. PTAGIS will deploy FS2020s in production mode when more become available.

2. In house testing of M4 interrogation software continues. Infrastructure for the new M4 interrogation software was installed throughout the basin. Testing progressed to the point that

M4 was deployed in Parallel with the production Multimon and Minimon interrogation software.

3. PTAGIS filed O&M staff consulted for the new PIT tags installations in the fish ladders at The Dalles and John Day dams, providing technical details, drawings etc. The use of 3D modeling software increased efficiency and response times to the design team.

4. New Yakama Nation interrogation sites at Lyle falls and Castile Falls were completed. On July 18, 2012 the first tag, 3D9.1C2C9B2AB was detected at the new Castile Falls Fishway.

5. PTAGIS continues to provide QA for new and production PIT tags for all BPA projects.

6. PTAGIS continues to repair all failed transceivers and computers at the Kennewick laboratory.

7. PTAGIS continues to refine facility controls for all COE mainstem juvenile fish facilities.

8. PTAGIS continues to provide researchers with Separation by Code capabilities.

9. PTAGIS continues to inventory and ship PIT tags to all BPA funded PIT tag projects.

10. PTAGIS continues on the design team with NOAA and the COE for the Lower Granite OGEE PIT tag project.

11. PTAGIS develops thin body PIT tag antenna prototype.

PTAGIS Kennewick Staff Develops Thin Body PIT Tag Antenna Prototype

Due to higher and higher construction costs and the dire need for PIT tag detection at critical points, such as the adult ladders and The Dalles and John Day Dams, the PTAGIS Kennewick group embarked on an effort to build a pass-through thin body antenna. *The goal of the thin body antenna is to be only two inches thick and still detect the same high level of efficiency that is expected at all other PTAGIS mainstem detection sites.*
In the past, at all other adult ladder detection points, it has been necessary to excavate large areas of concrete to house the standard thick body antennas and keep them from field-coupling to ferrous rebar. The new thin bodied antennas are possible due to the use of ferrite tiles embedded into the antenna housing.

As of September 25, 2012, these goals have been met. A prototype antenna was built at PTAGIS Kennewick and tested at the NMFS Pasco facility. The prototype was built with the goal of later building four of these antennas for the counting window slots at The Dalles North and East ladders. The PTAGIS staff is currently working with the USACE to install these antennas at The Dalles during the 2013 winter work period. Due to the tight schedule it is unknown if this goal is achievable. It scheduling permits, this temporary system will be installed at a relatively low cost since no concrete cutting will be required. The system is projected to read at near 100% detection efficiency and be maintained at near 100% uptime. The antennas should last 10 years or more. Below are the conceptual drawings for installing these antennas at The Dalles North Adult Ladder. The Dalles East Adult Ladder will be similar.

A prototype 5" deep thin wall antenna is being developed in Kennewick. A successful 5" deep antenna will allow a 15" footprint in the counting window slot. Near the debris guide, only a 12" footprint would be needed at the upstream end of the counting window slot.

5" thin wall PIT Tag antennas and two 5" ramp/guides give a total footprint of 15". This view shows the two-inch "speedbumps" on the side walls of the counting window channel (3plcs)

5" thin wall PIT Tag antenna, a 5" ramp/guide and a 2" debris guide/antenna mount give a total footprint of 12" for the light box side of the upstream antenna
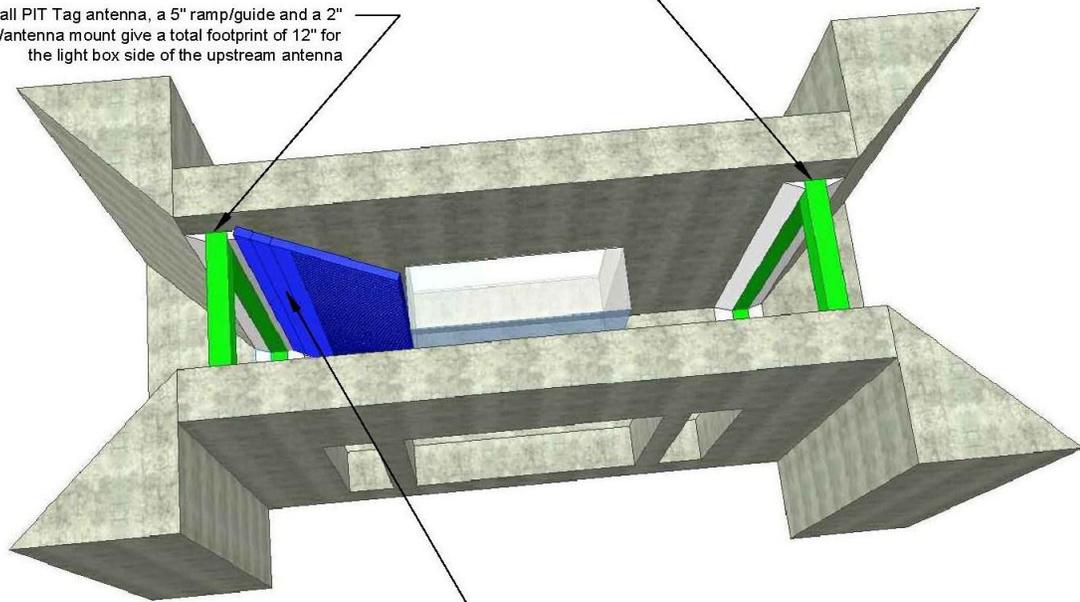
Current steel debris guide to be replaced with new fiberglass debris guide for light box (we can't have ferrous material in the RF field).

Color Legend:
Green - Thin Wall PIT Tag Antennas
White - PIT Tag Antenna Mounts
Dark Blue - Debris Guide for Light Box
Light Blue - Light Box

Figure 15 - Prototype Thin Wall Antenna

Existing metal spacer for debris guide replaced with thin wall antenna and antenna guide

Current steel debris guide to be replaced with new fiberglass debris guide for light box

Cutaway showing 2" "Speedbumps"

Color Legend:
Green - Thin Wall PIT Tag Antennas
White - PIT Tag Antenna Mounts
Dark Blue - Debris Guide for Light Box
Light Blue - Light Box
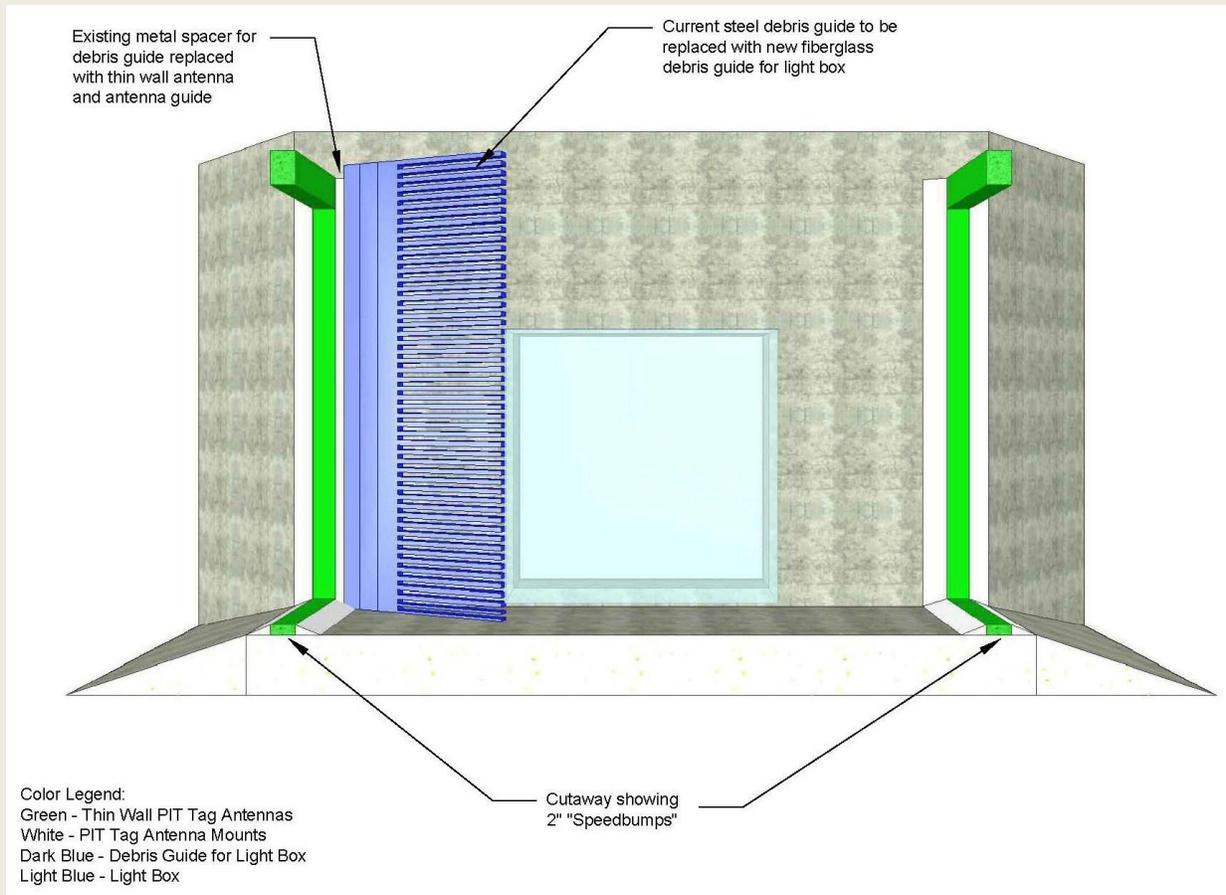
Figure 16 - Cutaway View Thin Wall Antenna

The PTAGIS crew is currently working on a smaller footprint antenna that will reduce the "speed bump" length by four inches and should reduce the cost and the weight of the antennas.
It should also be noted that these antennas can also be embedded in the concrete by excavating a slot the same size as the antenna. The can also be mounted on a metal surface. The full technical report is available at: ftp://ftp.ptagis.org/Documents/Newsletters/Volume_10/Thin_Bodied_Eval_0_1r2.pdf.

2013 Planned Field O&M Activities

PTAGIS will continue all of the on-going operational and maintenance tasks, described in this section, for 23 interrogation sites located throughout the Columbia Basin Region. PTAGIS will take on the O&M of three new detection sites at The Dalles East Adult Ladder, The Dalles North Adult Ladder and at the Little Goose Adult Ladder.

ADMINSTRATION, MANAGEMENT, and COORDINATION

This objective relates to the following BPA Work Elements in the PTAGIS Statement of Work:

- I: 119 Manage and Administer Projects. This work element provides for the efforts necessary for planning, organizing work, and directing and controlling efforts to achieve optimal results for overall PTAGIS program and project management.
- J: 122 Provide Technical Review. This work element provides for development technical documentation, written standard operating procedures, provision of technical assistance and support to the research community related to the design, installation, operation and maintenance of PIT tag interrogation system by other entities engaged in PIT tag detection research activities in the Columbia Basin.
- K: 122 Provide Technical Review. This work element provides for development technical documentation, written standard operating procedures, provision of technical assistance and support to the research community related to the design, installation, operation and maintenance of PIT tag interrogation system by other entities engaged in PIT tag detection research activities in the Columbia Basin.
- L: 132 Produce (Annual) Progress Report. This work product is this report.
- M: 185 Produce Pisces Status Report. This work involves updating the BPA contracting data through its "PISCES" Microsoft Windows client application.

Administration and Management

This on-going work consists of delivering annual funding packages, statements of work and providing technical review as well as the day-to-day supervision of staff, consultants, budgets and contracts.

Funding Issues

This section provides an overview of some of the significant funding issues encountered in FY11 and FY12 that required adaptive management to ensure the core products of the PTAGIS program are delivered.

FY11 BOG Reschedule Request and Recommendations

A request *by PTAGIS* to reschedule funds from FY11 to *the FY12* contract for continued software consulting services related to the upgrade and on-going maintenance of the database and related infrastructure was denied in the BOG process because of limited funding for FWP. Instead, *the BOG Committee recommended shutting down the current server systems by the end of FY12; applying the savings for on-going maintenance to the development of the new infrastructure to be completed in FY12.*

The line-item and WE budgets *in the FY12 contract* reflect this recommendation in that $200,000 will be spent in FY12 that would have maintained the legacy server through FY13. Given the workload and significance of this upgrade, PTAGIS staff cannot guarantee the new infrastructure will be ready for production by the end of FY12. The BOG Committee understands the risks to the continuity of the

PTAGIS dataset due to a premature shutdown of the current system as well as the impact this will have on several entities dependent upon this system for on-going PIT tag research and distribution.

Unplanned FY12 Funding Cuts and Adaptive Management

Due to lower than expected revenues and unexpected high invoice totals for current Fish and Wildlife Programs (FWP), Bonneville Power Administration (BPA) has directed spending cuts to the PTAGIS program in the 3rd quarter of FY12. The following sections summarize the actions taken to limit the impact of the PTAGIS work elements going forward into 2013.

PTAGIS Database and Website

Because of the decrease in funding and cost of support and licensing, the current PTAGIS web site, including the principal tools used by hundreds of researchers to extract PIT tag data, will be decommissioned as early as the end of March 2013. This is much sooner than requested by the PTSC to allow researchers a smooth transition to the new systems.

The schedule for deploying the replacement systems was escalated. Staff and the PTSC coordinated with researchers to create new accounts in a beta version deployed in the last quarter of 2012. Staff created online video tutorials and conducted online webinars to quickly bring new users up to speed on how to get their data out of the new system. Online feedback forums were included in the new website to get constructive feedback to optimize these tasks going forward.

The purchasing of new hardware to run the new PTAGIS4 website was deferred. Instead, the new site will operate on the same servers as the reporting systems which will make administration more complex, the systems less reliable and reduce the overall performance of both systems. We anticipate more downtime in 2013 than in the past.

Staff coordinated with projects that require large portions of the PTAGIS dataset to recreate a suitable replacement for the PTAGIS3 telnet reporting tool and TMT files. A plan to deploy a mirrored PTAGIS database in the cloud to serve these requests more efficiently has been postponed.

PIT Tag Distribution

The Tag Distribution System (TDS) used to inventory and distribute PIT tags to BPA's Fish and Wildlife Programs (FWP) will be decommissioned in October of 2013 due to support and licensing costs. Staff will spend a limited number of hours to scope a replacement system in 2013; if a replacement system is not available by this time it will require a transition to an interim system of spreadsheets and email to inventory and distribute tags.

PTAGIS Field Software

Development of the next-generation tagging software, P4, is postponed. Staff will continue to support the aging P3 software for at least another year.

Field Operations and Maintenance

Spare inventory for to maintain equipment has been reduced. Some of the more remote interrogation sites maintained by contractors for logistical purposes will now be maintained by PTAGIS staff to the best of their abilities and available resources.

Technical Coordination

Staff will limit travel to and participation in regional meetings and technical forums. Ad hoc requests such as the evaluation and integration of emerging RFID technologies will be deferred. BPA has recently indicated to us the support of PIT tag-related projects on the Willamette River is outside the scope of this program. Staff will rely on the PIT Tag Steering Committee (PTSC) to offset some the technical coordination tasks.

Staffing

In 2011 and 2012, the PSMFC Executive Director (Randy Fisher), PTAGIS Senior Software Engineer (John Tenney) and PTAGIS Field Engineering Supervisor (Don Warf) continue to fulfill the duties of the vacant Program Manager position. The decision to fill this position is deferred until FYI4 contract due to lack of funds. At this time staffing can also be reevaluated as the program will be transitioned to the new PTAGIS4 system.

Dave Marvin, the PTAGIS Information Coordinator, retired from PSMFC April of 2011. Dave was a principal part of the PTAGIS program since 1998 requiring us to replace his vast knowledge of the program, community and fisheries. Nicole Tancreto, PTAGIS Data Management Specialist, has proven to be very capable in taking over Dave's tasks relating to separation-by-code, data management, quality control, and technical coordination.

In September 2011, Sebastian Dudek joined the PTAGIS team in Portland filling a vacant software engineering position. He was a former PSMFC employee developing software in association with the USFWS LSRCP project a few years back. His primary responsibilities are developing and maintaining the next-generation PTAGIS web site. The program was fortunate fill this position because of a very competitive market. Sebastian was also has talents in GIS programming that will be eventually leveraged in the new PTAGIS4 system.

Doug Clough, the principal consultant to the program, was injured in an accident in 2011 requiring surgery and extensive rehabilitation. Nicole Tancreto, the PTAGIS Data Coordinator, assumed all tasks performed by this subcontractor for several months while maintaining her other full-time work.

In February 2012, Tricia Ledgewood joined the PTAGIS team in the Portland office as a part-time Administrative Support Specialist. Tricia has worked for PSMFC since 2008. She was originally hired to be part of the "Salmon Disaster Team" reviewing applications and distributing funds in the Klamath, Sacramento, Fraser River and Yukon federal salmon disasters. After which she designed and developed a digital repository for all the salmon disaster records as well as an archive for Commission documents. She has joined the PTAGIS staff to help manage accounts and publish content in addition to supporting the program and development staff.

The following tables provide a summary of all staff personnel within the PTAGIS program.

Table 4 - HQ Staff

Position	General Duties	Status	Location
Program Manager	Supervise project staff; agency coordination; program and project management; program budget and SOW.	Vacant	HQ
Senior Software Engineer	Design, develop and maintain M4, lead field system development, maintenance and support; project management; staff supervision.	John Tenney	HQ
Data Coordinator	Primary SbyC support; data and systems QA/QC; field and web systems tech support; agency and field coordination; Field system development, maintenance and tier-1 field tech support..	Nicole Tancreto	HQ
Software Engineer/Business Intelligence	Design, develop and maintain the data base server systems; data modeling; field tech support.	Craig White	HQ
Software Engineer Web	Web server system design, develop, maintain, administrate and teir-1 web support.	Sebastian Dudek	HQ
Administrative Support Specialist	Office coordination, project and development support, maintain PTAGIS archive, manage accounts.	Tricia Ledgewood	HQ

Table 5 - Kennewick Staff

Position	General Duties	Status	Location
Field Operations Program Manager	Supervise field staff; implement and maintain SOP for Field O&M	Don Warf	Kennewick, WA
Senior Field Engineer	Provides backup to Program Manager. O&M for detection equipment and systems at PTAGIS interrogation sites within the Columbia Basin. PLC system development, PIT tag QA, antenna design.	Scott Livingston	Kennewick, WA
Field Engineer Technicians (4)	O&M for detection equipment and systems at PTAGIS interrogation sites within the Columbia Basin. PLC system development, PIT tag QA, antenna design.	Alan Brower Darren Chase Roger Clark Troy Humphrey	Kennewick, WA
PIT Tag Coordinator / Administrative Assistant	PIT tag distribution; PTAGIS newsletter coordination, safety officer, office administration.	Jennifer Nighbor	Kennewick, WA

Coordination

PTAGIS continued on-going coordination activities throughout 2011 and 2012. These activities include the Annual PIT Tag Steering Committee (meeting notes can be viewed Resources section of the new PTAGIS website), newsletter articles, presentations at various review meetings, provided technical support for all PTAGIS systems, and other specific coordination activities described in the following subsections.

2011 PIT Tag Workshop

The 2011 PIT Tag Workshop was held January 25-27, 2011, at Skamania Lodge. The workshop had 27 presentations based upon these topics:

- PIT Tag RM&E Applications

- PIT Tag Data Management

- PIT Tag Detection Methods

- Tag Effects

- PIT Tag Data Modeling and Analysis

- Resource Management Implications

- New Technologies

An open forum near the end of the conference was moderated by the PTSC and allowed participants to ask open questions about PTAGIS metadata, concerns about tag placement and a variety of other issues.

Staff members from PTAGIS and the Commission facilitated the workshop which included an online registration system. The event was filled to capacity and considered a great success by staff and PTSC as well as the participants based upon responses from an attendee satisfaction survey.

Status and Needs BiOp PIT Tag Plan
PTAGIS contributed comments and attended meetings to help draft the *Status and Needs BiOp PIT Tag Plan*. This document, formerly called the *PIT Tag Action Plan,* reviews the status of the PIT tag detection network, the associated information system and tagging efforts directed at monitoring performance indices, targets, and standards specified in the 2008 FCRPS Biological Opinion and the 2010 Adaptive Management Implementation Plan (AMIP).

NPCC Fish Tagging Forum
Staff presented details of the new PTAGIS4 system to this forum in March of 2012. Staff attended additional meetings during the year. Staff provided additional review and comments on the resulting *Management Questions and Indicators* spreadsheet.

Technical Support
Staff provides ongoing technical support for all field software and web-related systems. The new Forum features of the website offer enhanced way for field users to request support and eventually will provide an online knowledgebase to answer common questions.

In addition to online documentation, staff created a series of online video tutorials to train new users of the web reporting tools (Figure 17).
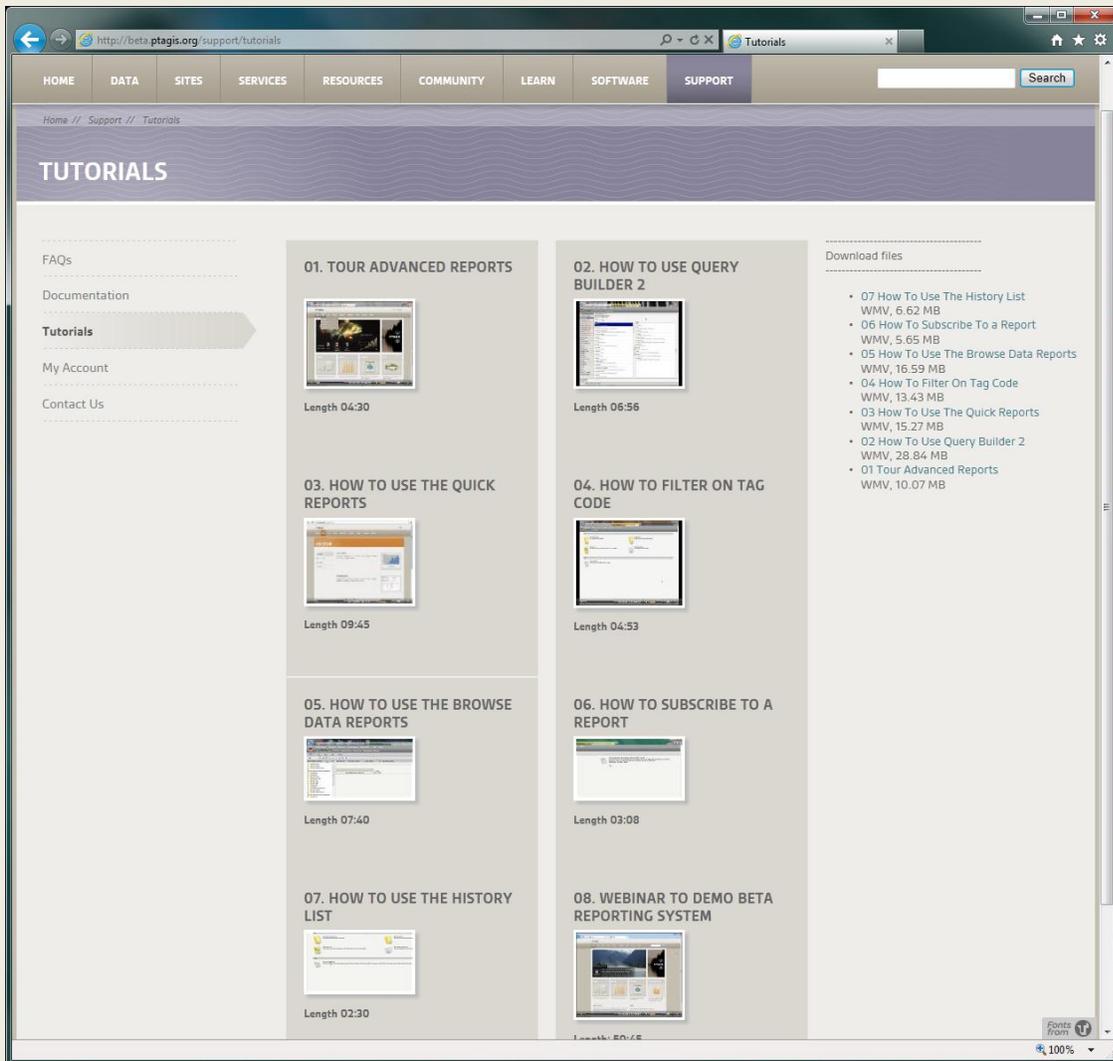
Figure 17 - Beta2 Website Support, Tutorial Page

In addition, staff also presented a series of webinars to the community to provide additional training on the advanced reporting features and to facilitate the transitioning of the new PTAGIS4 server.

Instream Interrogation Site Equipment Survey

PTAGIS operates and maintains most of the established, large scale interrogation sites that contribute the bulk of the observation data submitted to the PTAGIS database. The number of smaller interrogations sites operated and maintained (O&M) by other agencies that also contribute data to PTAGIS is steadily increasing. We are extending features of our field software and O&M web tools to collect, submit and maintain data and metadata with the highest of standards at all interrogation sites. To project the scope and resources required for this task, PTAGIS emailed a short, web-enabled *Site Equipment Survey* to 42 interrogation site stewards in October 2012. This section provides a summary of the 18 responses we received from this survey.

Deployment of the Allflex transceiver boards is increasing; one person commented they do not have a good way to transform data collected from an Allflex transceiver for uploading to PTAGIS. Another innovative user commented that they are currently developing a macro that will more easily convert Allflex data into the PTAGIS format.

Biomark equipment is still the most used by far with over 83% using the Biomark FS1001M multiplexor reader, known as the 'Mux'.

We asked what types of field data collection platforms were being used. More than half responded they used the transceiver's internal buffer to collect data, visiting the site to download, transform and upload the data to the PTAGIS server. The rest of the responses use automated/unattended platforms running either PTAGIS Minimon or a data logger system. We only received three responses to the question of the brand and model of data logger in use and all were using the Campbell Scientific CR1000.

When asked how interrogation data was submitted to PTAGIS:

- 44.4% email Minimon files
- 38.9% use PTAGIS Minimon auto or manual uploads
- 27.8% email PTAGIS PIFF files
- 5.6% use LNDRefactor

What are the future plans for interrogation sites? Will there be any new equipment or installation of additional sites? What will interrogation data collection and submission needs be in the next few years? Walla Walla basin plans to maintain their network of antennas and though they think auto upload to PTAGIS is "great", feel budget cuts may cause them to download manually and send from their office.

This data will help us scope the current and future needs of the community as we continue to advance interrogation data collection and reporting processes in a cost-effective manner.

PIT Tag Distribution

The PTAGIS PIT tag coordinator continued to house, receive, inventory and distribute PIT tags to BPA funded projects throughout the Pacific Northwest and Canada. PTAGIS experienced a unique situation with the 2011 tag distribution, as there was a full scale BPA recall on all PIT tags due to Q/A concerns with the vendor. This required PTAGIS to ship back 1,755,500 12mm PIT tags to the vendor. Since 82,900 tags were already shipped to researchers and put into fish, prior to the recall, replacement tags were sent to those projects to ensure the integrity of their studies.

BPA FY11 runs from Oct. 1, 2010-Sept. 30, 2011 and the following PIT tag numbers will cover the 2011 Annual Report.

2011 Total PIT Tags shipped – 1,629,500
TX1411SST-1 (12mm) – 1,084,300
TX1411SSTPL (12PL) – 469,800
TX148011B (9.0mm) – 67,000
TX148511B (8.5mm) – 8,400
TX1490PL (9PL) – 0

Overall, 1,629,500 PIT tags were distributed via 136 shipments to 77 unique BPA funded projects throughout the Pacific Northwest and Canada.

BPA FY12 runs from Oct. 1, 2011-Sept. 30, 2012 and the following PIT tag numbers will cover the 2012 Annual Report.

2012 Total PIT Tags shipped – 1,541,400
TX1411SST-1 (12mm) – 945,700
TX1411SSTPL (12PL) – 472,100
TX148011B (9.0mm) – 75,000
PT300 (9.0mm) – 33,600
TX1490PL (9PL) – 15,000

Overall, 1,541,400 PIT tags were distributed via 127 shipments to 83 unique BPA funded projects throughout the Pacific Northwest and Canada.

Annual inventories are conducted onsite with BPA staff and continued with perfect counts moving into BPA FY13.

Ongoing PIT Tag Testing and QA

PTAGIS finalized standard operating procedures (SOP) and protocols for on-going tag quality assurance (QA) and new tag acceptance (BPA RFO). Official performance metrics have been included in the BPA tag procurement contract for future QA.

QA sample testing of tags distributed by PTAGIS program began in October 2010. This testing immediately discovered quality issues with a large percentage of tags currently in PTAGIS inventory and the manufacturer quickly replaced them. The staff worked day and night shifts to keep up with the demands for QA and the BPA RFO tag acceptance processes using the Automatic PIT Tag Test System (APTTS shown in Figure 3). PTAGIS hopes to increase the sample size of on-going tag testing in 2013 by developing an automatic tag sorter (ATS) mechanism to put APTTS sampled tags back into their original vials.
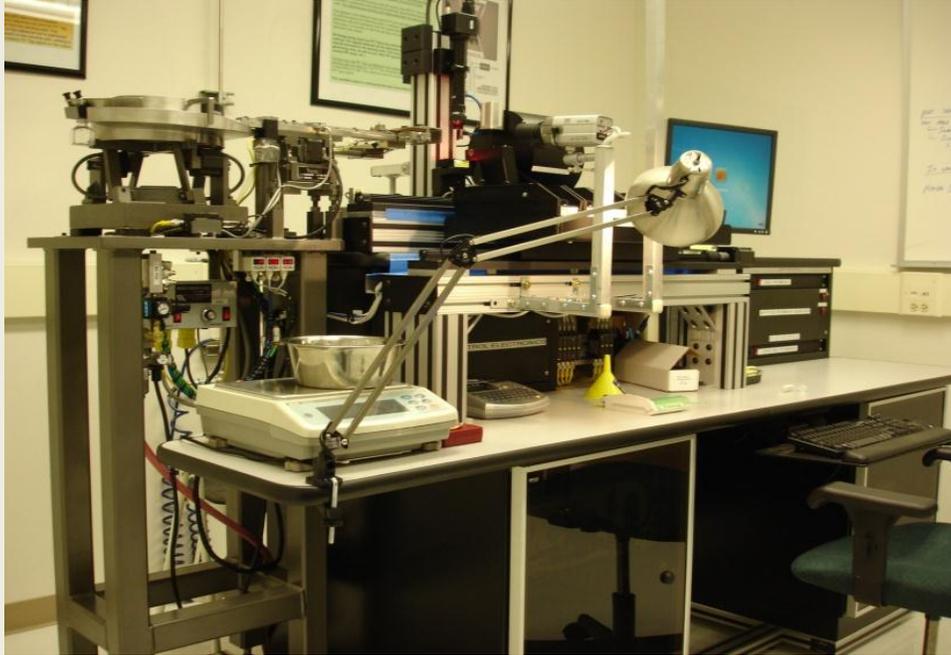
Figure 18 - Automated PIT Tag Testing System (APPTS) located in the PTAGIS Kennewick laboratory

Field O&M Technical Coordination

The following highlight the 2011 and 2012 field O&M technical coordination activities performed by the Kennewick field engineers.

Klickitat River Project

PTAGIS provided, design input, technical coordination and installation of the PIT tag system at the new sites on the Klickitat River. Construction was complete in 2012 at both Lyle and Castile Falls. Lyle Falls now has 12 smaller antennas for the lab and 3 large slot antennas. Castile Falls has 3 large slot antennas and runs unstaffed throughout the winter due to snow limiting access. PTAGIS Kennewick Staff set up a separate PTAGIS contract and budget through BPA for equipment procurement in 2010 and 2011.

Figure 19 - Construction on the Klickitat River Project

Roza Dam Flat Plate Prototype

The design of new flat-plate antennas using ferrite tiles started in July of 2010 and was installed at the Roza dam. The construction for these prototype antennas started in November 2010 with the systems operational in April 2011. The system was successfully tested with a live fish evaluation conducted by the Yakama Nation. Based upon the performance of this prototype, the Yakima Nation and Bureau of Reclamation are discussing spanning the full 110' length of roller-gates with antennas in 2013/2014.

Other

The Kennewick staff was part of the design team for the Ice Harbor (later becoming the Lower Granite) Ogee PIT Tag system. They were also part of the COE design team for MCJ and LMJ Full Flow remodel projects.

PIT Tag Recovery Rewards Program

During 2011 and 2012, the PTAGIS project continued its incentive program, established in 2006, to encourage people to report PIT tags recovered by fishers in the ocean or rivers and tributaries. 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 statistics 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 marked with the recovered PIT tag. Details on the PIT Tag Recovery Program can

be found on the PTAGIS Wiki at php.ptagis.org/wiki/index.php/PIT_Tag_Recovery_Program. The majority of PIT tag recoveries are submitted via mail. Many of the recovered PIT tags are mailed to the PTAIGS program, or information submitted via email, by an agency on behalf of a fisher.

There were 64 PIT tags recovered and reported to PTAGIS in 2011 and 21 in 2012. The tags recovered and reported provide researchers with valuable mortality information.

Annual Report

This report is the 2011/2012 Annual Report that will be submitted to the PISCES system.