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

2008 -2009 Annual Report

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ABSTRACT

The Columbia River PIT Tag Information System (PTAGIS) is a data collection, distribution and coordination project. Over 2.47 million juvenile salmonids were marked with passive integrated transponder (PIT) tags for the 2008 out-migration through the Columbia and Snake River systems, compared to 1.52 million fish tagged for the 2007 migration year (Tables 1 & 2). In 2008, over 964,000 unique tagged fish were detected (Table 3). These fish generated over 12 million interrogation records (Table 4). One fish can generate many interrogation records as it passes through multiple PIT tag antennas at one or more detection sites.

The PTAGIS project supported 17 separate Separation by Code projects for 10 separate agencies in 2008. PTAGIS managed a combined total of more than 2.1 million PIT tags in the look-up databases at all eight of the Separation by Code sites in the Columbia Basin. Development of Windows-based M4 interrogation and Separation-by-Code client software and web-based Tag Distribution System (TDS) continued in 2008.

Table 1

PIT Tag Releases, by Year, 2004-2008

Table 2

PIT Tag Releases, by Species, 2004-2008

	2004	2005	2006	2007	2008
Chinook	1,284,365	1,030,062	1,563,665	1,072,157	1,868,745
Steelhead	653,460	772,866	355,261	325,489	483,776
Coho	67,378	83,889	78,579	79,820	88,884
Sockeye	7,930	8,939	10,548	39,502	28,056
All Others	3,988	7,336	6,441	5,180	5,075

Table 3

PIT Tags Detected, by Year, 2004-2008

Table 4

PIT Tag Detections, by Year, 2004-2008

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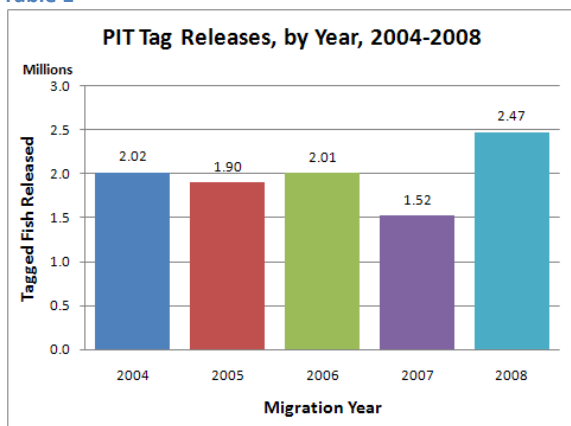
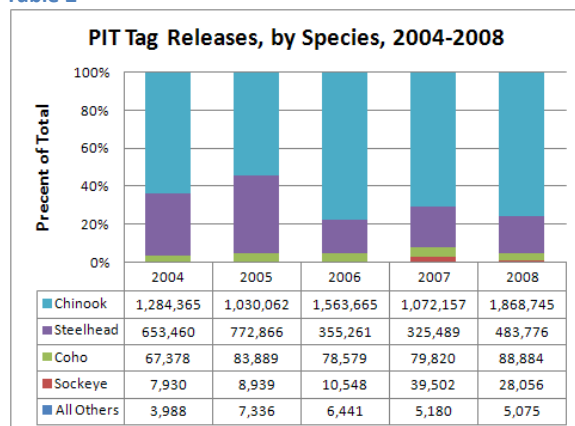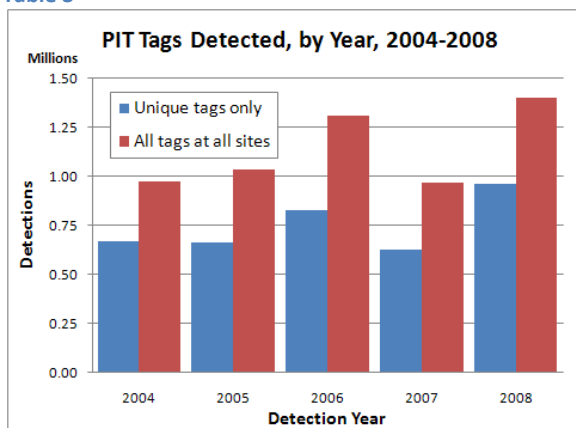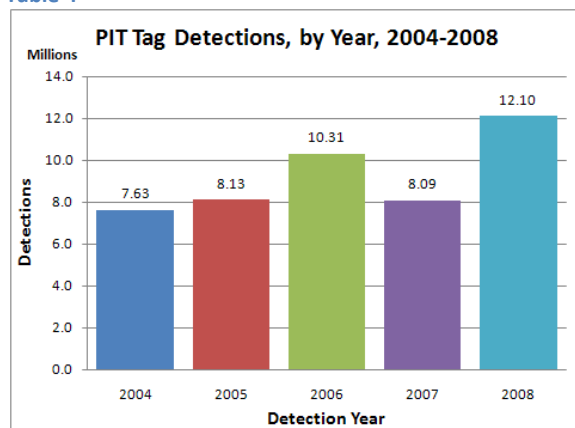## PREFACE

In 1984, Bonneville Power Administration (BPA) entered into an agreement with the National Marine Fisheries Service (NMFS) to research and 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 because it was 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.

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, however, 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 five data systems staff located at PSMFC headquarters in Portland, Oregon and five field operations staff in Kennewick, Washington.

INTRODUCTION

In 2008, 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

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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 Hydroelectric projects on the Snake and Columbia Rivers. This figure is reprinted courtesy of the U.S. Army Corps of Engineers, Portland District. Red circles are Corps of Engineers projects, yellow circles are privately owned or Bureau of Reclamation projects.
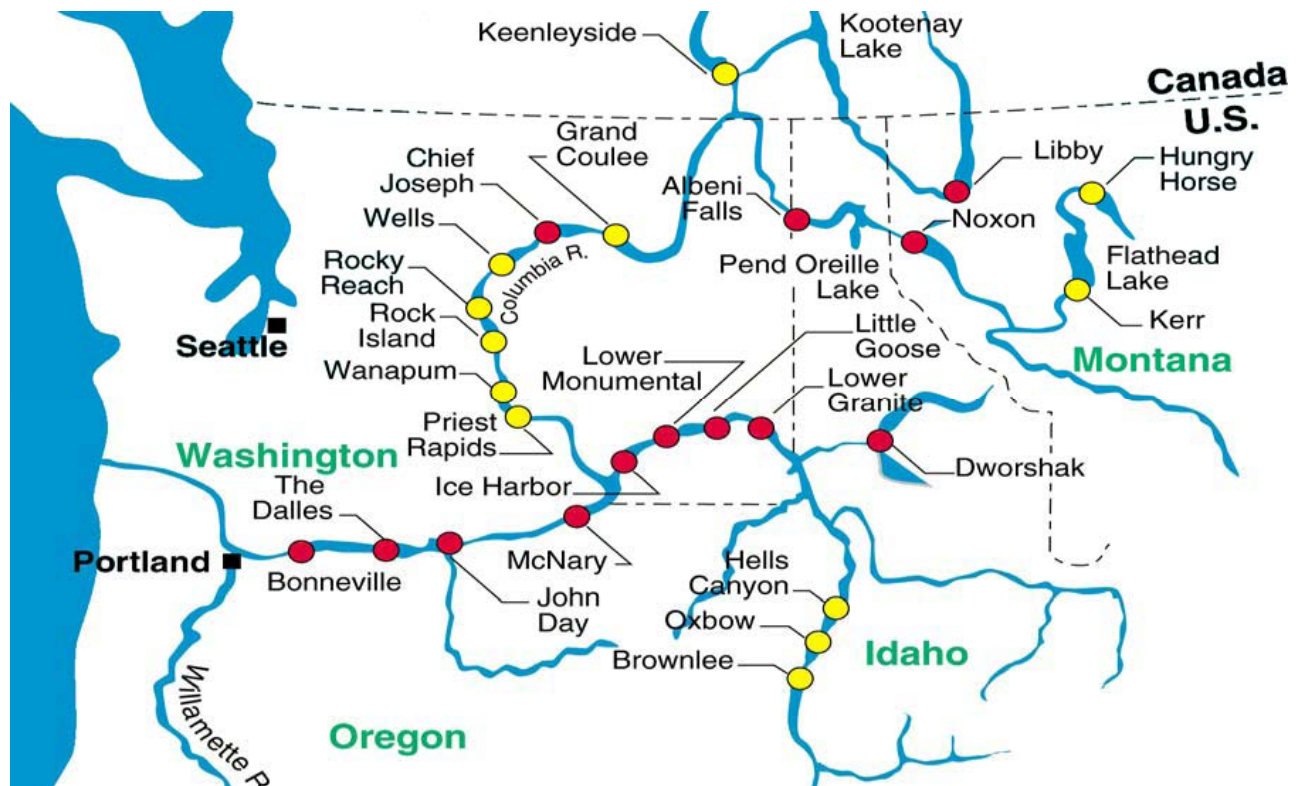
PROJECT GOAL and OBJECTIVES

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]

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[1] Valid Data is defined in the "2004 PIT Tag Specification Document" which is maintained by the Columbia Basin PIT Tag Steering Committee.

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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 robust 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 2004 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).

Program Audit

At the request of the PSMFC Executive Director, an audit of the PTAGIS Program was conducted in FY2008 to determine if the project was meeting the current and future needs of the community it serves. The focus of this audit was on the performance of staff and all client, server and web systems. Activities of the O&M Field crew were not included in the audit; however, the Executive Director also met with the O&M Field staff to determine if they were meeting the project objectives and goals. The audit was performed by two IT consultants chosen by the Executive Director that were familiar with the systems and programming languages used by PTAGIS staff. The audit consisted of a series of review meetings presented by each PTAGIS staff member in their areas of expertise.

The results of the audit were presented by the consultants and the Executive Director to the PIT Tag Steering Committee (PTSC) and are summarized as follows:

1. Overall the PTAGIS program was sound and meeting objectives and goals.
2. PTAGIS O&M field staff was performing well in site operations and maintenance.
3. Some PTAGIS staff members are resistant to technology changes.
4. Concern about the M4 development schedule.
5. Concern about the long-term viability of the PTAGIS server system.

The PIT Tag Steering Committee (PTSC) requested a subsequent audit focusing on the PTAGIS Server system and submitted a questionnaire identifying key concerns about upgrading the existing server technology. The PSMFC Executive Director and program staff will coordinate this subsequent audit using new consultants. This subsequent audit of the PTAGIS server systems will continue through FY2009.

OPERATE, MAINTAIN and ENHANCE the PTAGIS SYSTEM

This objective relates to our BPA Work Element titled, A: 160. Create/Manage/Maintain Database". This objective intends to deliver 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

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[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.

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Work Element, <u>I: 119 Manage and Administer Projects</u>, the purpose of which is to provide for the program and project management necessary for the PTAGIS efforts.

PTAGIS project headquarters staff and one contractor are organized into three parts to support this objective:

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

O&M Server Systems Development

This objective addresses the continuous updating and refinements to the 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 objective include:

- Maintenance and enhancement of system components that support the automated extraction, transformation and loading 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/ recapture and interrogation data for this milestone.

The database server that stores all of the data events and some metadata is called PTAGIS3 and is a 64-bit Ingres 2006 Release 2/9.1 relational database server running Sun Solaris operating system. The schemas used to store PTAGIS data are described in the *PIT Tag Specifications Document* and haven't changed much in the last 15 years (with the exception of Tag Distribution data). Currently there are 22 million rows of tagging data and about 97 million rows of associated detection data.

2008 O&M Server System Development Activities

The following table describes 2007 O&M server system development activities performed primarily by a principal consultant for the PTAGIS project. These tasks are grouped into the following two task orders:

- TO 0801: Miscellaneous Server-Side Support
- TO 0802: Meta Data Integration and Data Access Definitions

Table 5

Task Order	2008 O&M Server System Development Activities
TO-0801	<u>General support</u>: includes minor bug-fixes, answering question about Ingres or other server-side components, and day-to-day monitoring of system behavior.
TO-0801	<u>Field Data Validation Loader (FDVL) Modification:</u> includes development, test and

	deployment of behavioral changes to FDVL for incorporating tagging data into the PTAGIS server. Changes were requested by Dave Marvin.
TO-0801	2008 Annual "Game Reset": due to minimal hardware changes, a very abbreviated 'game reset' was performed for the following server components: • TASS – Transceiver Annunciator / Statistical Summarizer • DGE – Diversion Gate Efficiency Analyzer Ingres Query Optimizer Statistics A subsequent phone conference was coordinated to discuss strategy for 2009 and future game resets.
TO-0801	New Timer Tag Report: includes design, implementation, testing, and deployment of enhanced web-based 'timer-tag' report, based on requirements from Don Warf and Alan Brower.
TO-0801	DISOWN Processing: includes design, implementation, testing and deployment of an Ingres database table plus associated 'rule' and 'rule-fired' procedures (and modification of an existing 'called' sub-procedure) so that the PTAGIS database can discriminate between ORPHAN tags (observed tags net yet associated with a tagging file) and DISOWNed tags (tags that were previously but not currently associated with a tagging file), based upon requirements by Dave Marvin.
TO-0802	Tag Distribution System (TDS) Design: includes conceptual design, preparation of design and as-built documentation, and conducting design review meetings. Note that TDS supports the entire 'PIT-tag procurement process': request, approval, distribution, and receiving into inventory.
TO-0802	TDS Implementation: includes configuring Subversion version-control repository and Ant build-scripts; adjustment of Ingres-based meta-data describing tables of the PPO and TPA schemas; generation of updated SQL scripts to create the tables and their primary storage structures; coding of additional Java 'service' and 'data access' components for performing CRUD operations on pertinent tables; coding of Dynamic HTML user interface using JavaScript and 'prototype.js'; preparation of XML configuration files for Spring Framework and DWR (Direct Web Remoting – AJAX implementation); unit-testing of components in development environment on 'sockeye'; integration-testing of completed app, deployed to development environment on 'pitblade'; coding and testing of 'event-notification' sub-system using Ingres 'database events' and object-oriented Perl; coding and testing of email-based TPA_MessageArchiver for registering newly received shipments from Destron-Fearing into inventory, and for capturing in the database lists of PIT-tags distributed by other agencies (e.g. USACE, Chelan PUD).
TO-0802	TDS Deployment: includes populating PPO tables with names, addresses, and phone numbers of personnel identified by BPA as 'COTR' and 'Point of Contact' on projects authorized to receive PIT tags during the 2009 BPA fiscal year (Oct 2008 through Sep 2009); deploying 'tpw.war' (Web-Application Archive) file to production WebLogic environment; preparation and deployment of user-oriented documentation; monitoring system behavior after production roll-out, making minor bug fixes as problems crop up.
TO-0802	Schema Walker and Maintenance Interface (SWAMI) Design: During pre-

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	deployment stage of TDS development, it became apparent that a GUI tool was needed to deal with the large volume of PPO (Person-Project-Organization) data which would require initial setup and ongoing maintenance. SWAMI (Schema Walker and Maintenance Interface) was built as a 'low-level' tool to fill this need. This task includes conceptual design and early experiments with implementation techniques for a generalized tool driven by meta-data – to be configured initially for manipulating tables of the PPO and XDD (Extended Data Dictionary) schemas.
TO-0802	SWAMI Implementation: includes configuring Subversion version-control repository and Ant build-scripts; coding of generalized Java 'service' and 'data access' components for performing CRUD operations on arbitrary tables; coding of Dynamic HTML user interface and meta-data driven query generator, using JavaScript and 'prototype.js'; preparation of XML configuration files for SpringFramework and DWR (Direct Web Remoting – AJAX implementation); unit-testing of components in development environment on 'sockeye'; integration-testing of completed app, deployed to development environment on 'pitblade'. As this is exclusively a 'development tool', it is deployed only to 'pitblade' – but has access to PTAGIS3 database on either 'sockeye' or 'blueback' (under control of 'radio buttons').

2009 Planned O&M Server System Development Activities

This section describes next year's activity planning of development, operational and maintenance activities for all PTAGIS server system components.

Table 6

Task Order	2009 Planned O&M Server System Development Activities
TO-0801	Perform general support and maintenance duties as well as the 2008 Annual "Game Reset".
TO-0802	Continue refinement of TDS system.
TO-0802	Perform knowledge transfer to PTAGIS staff for all server maintenance
	Implement any recommended upgrades and new development based upon the results of a PTAGIS server technology audit in FY2009.

2008 O&M Client Systems Development

Client Systems Development Overview

The PTAGIS project develops and maintains custom client software systems to capture mark/release and interrogation data from hundreds of field sites operated by PTAGIS staff, disparate fisheries management agencies and research organizations within the Columbia Basin. These complex 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.

Client Systems Development and O&M Tasks

The essential duties and skills required by staff to develop, operate, and maintain PTAGIS client systems are described in the following subsections.

NOTE: In September 2008, a decision was made by the current PTAGIS Program Manager to transfer one of the two software engineers developing client systems to fill a new position to perform Server O&M Server Systems Development. The open position for O&M Client Systems Development was never filled for the remainder of this fiscal year.

Client Development Tasks

All client development tasks are performed by two PTAGIS software engineers with occasional support of outside contractors for specialized tasks.

1. Requires technical proficiency in all aspects of software engineering including expertise in object-oriented analysis and design of mission-critical/high-performance systems; expertise with relational databases, hardware abstraction, network and device communication; and the ability to create intuitive graphical user interfaces for broad use-case scenarios.
2. In developing new client software systems, staff must evaluate and adapt emerging technologies and platforms to maintain efficiency, performance and cost.
3. Advanced project management and communication skills are necessary to capture complex system and performance requirements; target objectives, risks, quality assurance, deliverables and schedule for new software development projects; procure hardware and software systems; and hire and manage outside contractors for specialized development efforts.

Client Operational Tasks

Operational tasks are divided between field staff, client software engineers and the PTAGIS data analyst.

1. To maintain project goals of 100% valid data and 99% system uptime during peak out-migration, standard operating procedures (SOPs) are used to deploy, upgrade and verify the operations of client systems at all data collection sites managed exclusively by PTAGIS staff.
2. To ensure the quality and availability of PTAGIS data from client systems operating at data collection sites not managed by PTAGIS, responsive technical support, comprehensive documentation, data specifications, end-user training, and industry-standard web deployment are vital to the success of the program.
3. Client systems that run unattended must provide robust event logging and notification services to identify any system-related issues that can impact performance or the availability of data. These event logs trigger automatic notifications to field staff to minimize downtime of automated client systems that are often located in remote areas of the Columbia Basin.

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Client System Maintenance

PTAGIS client software engineers are responsible for the following client system maintenance tasks:

1. Quality control for client system upgrades requires comprehensive testing by PTAGIS staff before any software is released. Performance regression testing for separation-by-code client systems may involve additional field staff and resources.
2. PTAGIS client system upgrades are announced and released to the community typically twice a year and include bug fixes, feature enhancements and expanded hardware compatibility.
3. Industry-standard deployment tools provided by PTAGIS allow users to easily upgrade existing client systems by downloading and installing the latest versions of the software. Installation CD-ROMS can be mailed upon request.
4. All defects and feature requests from end-users are captured in an internal defect-tracking system and cross-referenced within the source code and release manifests.

Client Systems Overview

Tagging and interrogation client software systems capture and submit most of the PTAGIS data served to the public. In addition to tagging and interrogation types of software, utility and legacy systems are also described below.

To maximize limited resources for PTAGIS client development and to utilize new PTAGIS data models, the overriding goal for fiscal 2008 and beyond is to streamline existing applications into just two systems: P4 tagging software and M4 interrogation software. The new PTAGIS data models will eventually be incorporated in to the PTAGIS server systems TBD.

Tagging Software Overview

PTAGIS provides tagging software used in the field by various agencies and organizations to capture mark/release data. This software provides end users with form-based, rapid data entry integrated with a variety of peripheral hardware devices to accurately correlate each PIT tag code with a biological assessment of the host animal.

Interrogation Software Overview

PTAGIS provides interrogation software to observe and sometimes control the passage of fish marked with a PIT-tag (separation-by-code) at various data collection sites within the Columbia Basin Region. Data specified by the PTAGIS Specification Document are captured by interrogation software and then uploaded to the PTAGIS server. For interrogation sites that require separation-by-code features, MULTIMON software developed by NOAA Fisheries is currently used; all other interrogation sites use the PTAGIS MINIMON software.

PTAGIS identified key requirements for supporting In-Stream interrogation sites with the next generation interrogation software M4. These requirements include automated site-configuration change tracking, support for multiplexed transceivers, and the incorporation of specialized "trigger" devices to capture adjunct data such as GPS coordinates and water temperature.

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Current PTAGIS Client Systems

The table below describes current software systems developed, operated and/or maintained by the PTAGIS project in 2008 unless otherwise noted.

System	Type	Status	Description
P3	Tagging	Community Release	P3 is a PC-based software system designed to efficiently capture mark/release and recapture tagging data. Developed in 2002, several enhancements have been made to the software over the years since the initial release. P3's stability, ease-of-use, and support for a variety of peripheral hardware have made this software popular among users inside and outside of the PTAGIS community.
P4	Tagging	Planning Phase	P4 will replace the existing P3 tagging software with new features requested by the PTAGIS community and target emerging platforms, hardware devices and PTAGIS data models. The single most challenging aspect of this project is to produce a simple yet robust solution that can be used by researchers for a wide variety of usage scenarios.
MultiMon	Interr.	Internal Release	Multimon is a Microsoft DOS operating system client used at the major FCRPS fish transportation and bypass facilities and adult fishways to separate (or sort) fish by code, also referred as separation-by-code or SxC for short. This software was developed by NOAA Fisheries and is operated exclusively by PTAGIS field staff. MultiMon interrogation data is collected into files and uploaded to PTAGIS using the Uploader utility software.
MiniMon	Interr.	Community Release	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. MiniMon can collect data simultaneously from 50 or more transceivers. The collected data is transformed into interrogation files that are automatically uploaded to the PTAGIS database in "near real-time".
M4	Interr.	Develop-ment	M4 interrogation software is a direct replacement for MULTIMON, MINIMON and MOBILEMONITER client systems. It incorporates many features of the legacy systems including time-critical Separation-by-Code (SxC) and failover cluster features. M4 will use a richer data model to capture site configuration information, providing additional context to standard interrogation data. It is currently developed as a .NET Framework application using C# and a SQL Server client database. SxC features of M4 have been developed concurrently with all non-SxC features and target an embedded subsystem to perform real-

			time tasks on standard Microsoft Windows platforms. In addition to implementing the control logic for routing fish, this subsystem requires complex programming for communication with transceivers, a PLC device for controlling gates, and the M4 Windows monitoring service that collects and writes interrogation data to a database as well as publishes information to a graphical user interface. Details on M4 development are available on the PTAGIS wiki.
Uploader	Utility	Internal Release	A client software utility used at data collections sites to upload data files created by MultiMon application to the PTAGIS server. This software utilizes the same library developed for MiniMon and P3 to submit PTAGIS data and includes a simple user interface to allow end users to change configuration settings.
Load Emulator	Utility	Internal Release	An internal client software utility used by PTAGIS staff to emulate large data collection sites without additional hardware and is used for performance testing of M4, MultiMon and MiniMon software in laboratory situations. This utility system can broadcast tag codes from all supported types of "virtual" RFID readers at very high rates. It can also be configured to read actual data files created by the MiniMon application to emulate real-world scenarios of fish passage at a site. Staff also uses this software for "throughput testing" to verify the PTAGIS goal of collecting 100% valid data
Logix Scraper	Utility	Internal Release	In order to set the performance benchmark for M4 separation-by-code features, PTAGIS needed to measure the actual performance of the MultiMon application currently used at separation-by-code (SxC sites). A black-box testing procedure was developed in the Kennewick lab to use a specialized PLC device to measure the latency between the input of a tag code and the output of a gate control signal using MultiMon. This latency can be calculated iteratively over time and use LoadEmulator to emulate real-world conditions within a laboratory. LogixScraper was developed by PTAGIS staff to capture the latency measurements computed by the PLC device and provide statistical analysis. This tool provides the means to perform regression testing throughout the stages of M4 development to identify any performance bottlenecks as SxC features are added.

2008 O&M Client System Development Activities

This section describes any development, operational and maintenance activities performed for each client software system in the fiscal year of 2008 (March 1st 2008 through February 28th 2009).

System	2008 O&M Client System Development Actives

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P3	1. Version 1.4.5 was released in May of 2007 and it was announced in May 2007, PTAGIS announced the end-of-life for the P3 client system; any new releases of this software will include only minor fixes– new features will not be added to this program. This software will eventually be replaced by P4. 2. Staff provided phone and email support for this software throughout FY 2008. 3. A major request from the PTAGIS community is to evolve this software to allow more than 9,999 records per tagging session. This requirement is not related to the client software; rather it is a PTAGIS Server requirement due to restrictions in the PIT Tag Specifications Document.
P4	A P4 project plan was created for in fiscal 2007 outlining the initial development phase for gathering software requirements. This plan is published on the PTAGIS wiki. Resources were dedicated to the development and release of M4, so no further action was taken on this project. NOTE: Staff recommends to the PIT Tag Steering Committee that major upgrades to the PTAGIS Server infrastructure were required to fulfill the proposed requests from the PTAGIS community regarding this software.
MultiMon	Standard operations and maintenance activities only. No modifications or upgrades were performed on this system in 2008.
MiniMon	1. MiniMon version 1.5.1 was released in FY 2008 to resolve compatibility issues with the new Windows Vista platform. 2. PTAGIS announced the MiniMon application has entered the end-of-life stage and is to be replaced by the new M4 system in FY 2007. Any new releases of MiniMon software will include only major fixes to existing features – new features will not be added to this program. 3. Staff provided phone and email support for this application throughout FY 2008.
M4	1. January 2008: M4 Committee and PTSC is presented a review of the current M4 beta and project schedule at the 2008 PTSC meeting in Kennewick, WA. Documentation and notes from this meeting are provided on the PTAGIS wiki. 2. A key performance task is identified requiring expertise in INtime subsystem and PLC Ethernet communication. A contractor (Priority One Solutions) is selected to perform this task and is given specifications developed by staff (See appendix item SxC Prototype Specification). 3. April 2008: PTAGIS staff agrees upon a proposal for M4 to produce PTAGIS Spec-Doc formatted interrogation files as an interim solution for uploading data to PTAGIS while a more sophisticated data transfer service is developed. A version containing these features was released for testing 4 weeks later. 4. May 2008: Kennewick O&M staff approve of final Failover/Cluster features of M4 interrogation file features. 5. July 2008: update to M4 to support latest firmware for the FS1001M transceiver (2.0). 6. August 2008: Separation-By-Code requirements are updated, reviewed and

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	approved by the M4 technical committee. 7. October 2008: Priority One Solutions completes a working prototype of Ethernet PLC communication for the INtime library. Staff reproduces performance goals with limited success. 8. December 2008 a version of M4 is released for internal testing that includes Failover Cluster features. 9. December 2008: A draft SOP for deploying M4 is written by Kennewick staff. 10. January 2008 through March 2008: M4 development is slowed by a subsequent PTAGIS Server audit requiring extensive effort from the PTAGIS Software Engineer working on this project.
Uploader	Uploader is used at all MultiMon site operations to upload data to PTAGIS. No upgrades were performed on this system in FY 2008.
Load Emulator	This tool was used extensively for M4 development testing and performance evaluation. A minor upgrade was performed on this system in FY 2008 to support emulation from PTAGIS interrogation files.
Logix Scraper	This tool was used for performance evaluation of MultiMon and other SxC software and hardware components. No upgrades were performed on this system in FY 2008.

2009 Planned O&M Client System Development Activities

This section describes next year's activity planning of development, operational and maintenance activities performed for each client software system.

System	2009 Planned O&M Client System Development Activities
P3	Standard operations and maintenance activities only. Unless a major issue is discovered requiring a new release, any minor issues with this software will be documented and work-around procedures will be published to the PTAGIS web site.
P4	P4 development is on hold until the production release of M4. P4 will reuse common libraries developed in M4, such as the code to interface with hardware devices and upload data PTAGIS.
MultiMon	Standard operations and maintenance activities only. No upgrades are planned for this software. System virtualization products may be evaluated to allow this DOS software to run on newly manufactured Windows PCs.
MiniMon	Standard operations and maintenance activities only. No upgrades are planned for this software. An SOP will be developed for deploying this software on systems without administrative privileges.
M4	1. Due to staff reorganization and internal systems audit, M4 development schedule will be impacted. A revised schedule will have a beta version deployed by the end of FY2009 for in-situ testing. 2. To maintain development schedule and improve performance and operability, the following key development tasks are identifier for 2009: a. Standardize on SQL Server Compact database to run on embedded and PC platforms. This also reduces the complexity of deployment

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	for non-administrative installs. b. Evaluate the performance of off-the-shelf PLC device drivers to reduce the complexity and costs associated with the INtime subsystem and custom PLC Ethernet communication. c. Upgrading the PTAGIS Server system to a more flexible architecture will reduce the complexity of both M4 and P4 software applications in regards to data capture and submission features.
Uploader	Standard operations and maintenance for this utility software. No plans to upgrade this software in 2009.
Load Emulator	Upgrade for this software is planned in mid-2009 for minor bug fixes.
Logix Scraper	Standard operations and maintenance for this utility software. Upgrade for this software is planned in late 2009-2010 for minor bug fixes.

O&M Web Systems Development

The PTAGIS web site (www.ptagis.org) serves all of the PTAGIS data and includes real-time updates and audits of current PIT tag data collection activities. The PTAGIS web site was redesigned and deployed about 5 years ago with the goal to make it easier for researchers to find the data they're looking for. Advanced data management features are available through individual user accounts. Users can generate database queries store them to rerun at a later time. Often researchers need megabytes of data from the system to perform in-depth analysis.

Additionally the PTAGIS web site provides a portal for downloading and online help for all PTAGIS client applications released to the community. An online library contains the latest PTAGIS Specification Document and other useful information is maintained as well.

2008 O&M Web System Development Activities

This section describes any development, operational and maintenance activities performed for major components of the web application system in the year of 2008.

After it became clear that certain classes of users were finding the PTAGIS query builder to be limiting, it was re-written from scratch to gain better flexibility, speed, and dependability. Many small changes were also made to the user interface to improve usability.

Table 7

System	2008 O&M Web System Development Activities
Web	Implemented query metrics report in Java.
TFS	Assisted in Tag Forecast email submission.
QueryBuilder	Enhanced QueryBuilder to allow end-users to filter by Coil-ID field.

PTAGIS 2008:

QueryBuilder	Enhanced the maximum size of the query definition produced by QueryBuilder.
Web	Implemented specialized web-based O&M efficiency graph that includes data from the Automated-Read-Range-Tester equipment at the Bonneville Corner Collector (BCC) facility.
Ingres	Installed a patch on Ingres database to allow end-users to perform a select on a time-stamp field.
Web	Migrated BCC reports to a new web server.
QueryBuilder	Rewrite QueryBuilder to use JDBC instead of StyleReport, gaining flexibility, speed and dependability.
Audit	Develop report on PTAGIS web architecture for PTAGIS system audit.

2009 Planned O&M Web System Activities

This section describes next year's activity planning of development, operational and maintenance activities performed for each client software system. Implement any recommendations based upon the FY2009 PTAGI S server audit, including leveraging SQL Server reporting tools.

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 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.

Although we identified another work element, C: 158 Mark/Tag Animals in anticipation of M4 prototype testing of separation by code capabilities, we had to reschedule the activity because of the M4 delay.

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.

In addition to providing O&M support in 2008 for most of the PIT tag interrogation sites in the mainstem Snake and Columbia Rivers, the PTAGIS project also coordinated, implemented, and supported all of the Separation-by-Code (SxC) activity conducted at the eight sites with SxC capabilities in the Columbia River Basin. The Separation-by-Code protocol is used to divert specific tagged fish, based on their individual tag codes, away from the general population of tagged or untagged fish. Separation-by-Code was originally developed to allow researchers to identify, divert, and trap specific tagged fish as they were detected in the juvenile bypass systems and adult fish passage facilities at the federal hydroelectric dams.

In 2008, researchers used the SxC systems to recapture individual PIT-tagged smolts in the juvenile bypass systems at Lower Granite, Little Goose, McNary, John Day, and Bonneville dams. Researchers also used the SxC systems to re-capture tagged adult salmon and steelhead at the Bonneville Dam Adult Fish Facility and in the trap in the Lower Granite Dam fish ladder.

Table 8

Research and monitoring projects requesting SxC actions in 2008

SxC ID	Project ID	Project Title	Project Description
2008001	FWP: 1991-028-00	Monitor wild Salmon River Chinook salmon migrations – NMFS	Sample fish at Little Goose Dam marked in the Salmon River basin during 2005-2006.
2008002	COE:	Chinook salmon transportation and life history studies.	Transport subyearling Chinook; subsample smolts at B2J; collect all target tags at GRA.
2008003	NMFS/COE:	Compare effects of PIT and acoustic tags	Evaluate acoustic tags for system wide survival studies, relative to PIT tags.
2008004	NMFS/COE:	Evaluate modified turbine intakes at BON PH2	Evaluate post-passage condition and gatewell retention time of Chinook salmon.
2008005	BPA: 00-GS-75064	Estimate SARs for steelhead planted in the Touchet and Tucannon rivers	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LMN or MCN.
2008006	FWP: Multiple	Johnson Cr. Project # 199604300; LSCRP agreement # 14110-3-j010; Imnaha R. SMP project # 199701501	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LGR, LGS, LMN, and MCN dams.
2008007	LSRCP: See Title	SRCP M&E # 14110-6-J009; Clearwater/Sawtooth/Pahsimeroi hatchery spring/summer Chinook	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LGR, LGS, LMN, and MCN dams.
2008008	See Title	Eval. the Responses of Snake and Columbia River Basin fall Chinook Salmon to Dam Passage Strategies	Treat PIT-tagged fall Chinook similar to the untagged population when detected in the JFFs at LGR, LGS, LMN, or MCN dams.
2008009	COE: See Title	Estimate of hydrosystem latent mortality associated with barge and in-river life-history strategies	Treat most tagged fish similar to the untagged population. Collect and sample some fish at GRJ, MCJ, and B2J as scheduled.
2008010	FWP: 1996-200-00	CSS: Comparative Survival Study	Proportional transportation of Chinook groups at LGR, LGS, LMN, and MCN dams.
2008011	USFWS: 2005-002	Evaluate spring Chinook salmon releases from Kooskia National Fish Hatchery	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LGR, LGS, LMN, and MCN dams.
2008012	14-07 NWFSC-11	Fish Passage and Survival at Lower Monumental and Ice Harbor dams	Provide survival estimates for radio-tagged Chinook and steelhead releases.
2008013	BPA: See Title	2003-017-000: Lemhi ISEMP-RME Pilot Project: Integrated Status and Effectiveness Monitoring Program	Collect Lemhi River origin PIT-tagged adult Chinook salmon at Lower Granite Dam and implant target fish with radio transmitters.
2008014	UW: No ID	Latent mortality project with yearling Chinook	Collect up to three groups of 84 latenty mortality study controls at BON.
2008015	BPA: 00-GS-75064	Smolt timing and survival for LSRCP steelhead from the Grande Ronde and Wallowa basins	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LGR, LGS, LMN, and MCN dams.
2008016	FWP: 2002-053-00	Monitor Passage of Asotin Creek Steelhead at federal transportation facilities	Treat PIT-tagged fish similar to untagged fish when detected in the JFFs at LGR, LGS, LMN, and MCN dams. Trap adult fish at LGR.
2008017	PCSRF:	Pre-and post migratory energy storage and use in upriver coho salmon	Sample coho early in the migration and as they arrive at their spawning grounds. Floy-tag sampled fish.

SbyC Field System Support

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 2008, gate reliability has continued with little downtime and few trouble alarms. Gate mechanical longevity has also increased, resulting in cost savings for the operating agencies. Gate diversion efficiency has also continued at a high level in 2008.

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.

- H: 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 PTAGIS field system operations.

Details of the 2008 field systems operations can be found in the Event Logs accessed from the PTAGIS web site. PTAGIS field O&M staff utilizes daily operational reports, which are monitored multiple times each day during the fish migration season. During the portion of the season with high fish migration,

PTAGIS 2008:

PTAGIS field staff performs a weekly, on-site, standard maintenance check at each facility. In periods with lower migration, these maintenance checks are bi-weekly.

In addition to the standard operations and maintenance of interrogation systems at FCRPS facilities, PTAGIS field operations staff was involved in several other efforts. Efforts that were conducted by PTAGIS field O&M staff are described herein.

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 work consists of developing annual work statements and budgets and monitoring and controlling project activities and resources.

Coordination

The PTAGIS project serves as a central support center for the region's PIT tag research programs. PTAGIS staff field hundreds of telephone calls each year to answer questions related to the complexities of the system. In 2008, the PTAGIS project continued an effort to collect and distribute information via Wiki technology through the World Wide Web. The PTAGIS Wiki is proving useful as an easy to use information sharing and collaboration tool. PTAGIS Field O&M and Data Systems Operations Standard Operating Procedures, data models, definitions, system activities, and other technical information are documented and updated in the PTAGIS Wiki.

PTAGIS 2008:

PIT Tag Distribution

During 2008, the PTAGIS project delivered 1,358,400 tags to over sixty Fish and Wildlife PIT tagging projects funded by Bonneville Power Administration. The tag distribution center was moved to the PTAGIS Kennewick Field Office in 2007. The PTAGIS staff has worked with an outside contractor to develop a new program to accurately track PIT-tag inventory. The Tag Distribution System (TDS) came into partial operation in the fall of 2008.

On-going PIT-Tag Testing

An Automatic PIT Tag Test System (APTTS) was constructed in 2006 with the goal of qualifying new PIT-tags and provide ongoing quality assurance of existing tags. The PTAGIS project is exploring various uses of the APTTS for assuring quality of PIT tags purchased for distribution to BPA funded projects. We hope to develop a process to test a 1% sub-sample of all tags delivered. This could be in place by late 2009. If sub-sample testing is efficient and effective; a higher percentage sub-sample could be tested. In addition, we expect to be able to study new tags as they are developed for use in the Columbia River Basin (CRB).

Installation of New PIT Tag Detection Systems

Little Goose Dam Full Flow Detector

The PTAGIS project worked in collaboration with the Walla Walla District of the Corps of Engineers to design and install a PIT tag interrogation system on the full flow bypass line at Little Goose dam. The PTAGIS O&M staff provided technical services to the Corps to locate the PIT tag detectors at a reasonable location and reviewed electrical and mechanical drawings to assure that facilities incorporating PIT tag electronics met PTAGIS standards. This project was completed in March of 2008 and is operating at high levels of detection efficiency.

Klickitat River Project

PTAGIS staff in cooperation with the Yakama Nation launched into a new project to collect PIT-tag data at new facilities to be located at Lyle Falls and Castile Falls on the Klickitat River. The new facilities will include improved fish passage past the falls, research areas, fish handling areas and embedded PIT-tag detectors. These projects are scheduled to come on-line in 2010 and 2011.

PIT Tag Recovery Rewards

In 2008, the PTAGIS project continued its incentive program to encourage people to report PIT tags found by fishers in the ocean or rivers and tributaries. The PTAGIS project offers a "PIT Tag Recovery Program" ball cap, a PTAGIS test-tag key chain 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.

There were three PIT tag recoveries reported to PTAGIS in 2008, all from fish recovered in the Columbia River. Two of the tags were recovered by sport fishers. The third tag was recovered from a sockeye tagged in the Adult Fish Facility lab at Bonneville Dam and sold by a tribal fisher at Cascade Locks. The consumer discovered the tag while eating the fish.

Annual Report

This report is the 2008-09 Annual Report that will be submitted to the PISCES system.