PACIFIC NORTHWEST AQUATIC MONITORING PARTNERSHIP

2015 Annual Report

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Executive Summary

The Pacific Northwest Aquatic Monitoring Partnership (PNAMP) continued to promote integration of monitoring resources and development of tools to support monitoring in 2015. Improved coordination and integration of goals, objectives, and activities among Pacific Northwest monitoring programs is essential to improving the quality and consistency of monitoring in the region.

PNAMP operates through inter-organizational teams to make progress on a variety of projects identified to support partner needs and PNAMP goals. These teams are largely ad hoc and formed for the specific purpose of achieving the objectives of the identified projects. For each project, the PNAMP Coordination Team identified interested Steering Committee (SC) members and subject matter experts to form the working teams that provide guidance and leadership. In addition, the teams acted as an intermediate between the larger group of interested participants and the SC, thus maintaining the concept of better SC/participant exchange. The PNAMP Coordination Team continued to facilitate dialog among experts to move forward with ongoing and new projects. In addition, the Coordination Team continued their efforts to track in-kind contributions of time from participants at meetings, workshops, and other PNAMP hosted events; in 2015 this estimate amounted to 2,580 hours by 116 organizations.

In 2015, PNAMP focused on projects related to data management, integration of monitoring, monitoring design, species and watershed monitoring, and technologies to advance monitoring. PNAMP advanced its coordination goals and objectives for these topics by hosting workshops, work sessions, and meetings. Steering Committee members and subject matter experts participated in these meetings to exchange information about their own programs, coordinate existing projects, and initiate new tasks, including:

- supporting data management at multiple scales for aquatic monitoring
- planning a series of meetings and workshops for coordinating data management and exchange to support improved assessment reporting of salmon and steelhead populations in the Columbia River Basin
- development of the Monitoring Metadata Exchange (MMX) template for exchanging monitoring site level metadata
- coordinating with municipal stormwater managers in Southwest Washington to develop an integrated status and trends monitoring design for the Lower Columbia region
- managing a monitoring protocol and method library (with 977 protocols and 1,688 methods in the system at the end of 2015)
- developing online tools to support monitoring design and site management
- providing training and support related to the use of online tools
- moderating a community forum to discuss protocols and methods
- developing a standard taxonomic effort agreement for the Pacific Northwest to facilitate the sharing of macroinvertebrate data
- maintaining the PNAMP website for better information discovery and delivery
- initiating expanded use of web tools by supporting BLM's use of the designer tool for a new national scale monitoring program
- planning additional work related to web tools and resources

Although there was a great deal of progress made in 2015, PNAMP projects will always benefit from increased participation from the PNAMP steering committee members, subject matter experts, and community stakeholders. In particular the MonitoringResources.org web applications, the Monitoring Metadata Exchange

(MMX) standard, and habitat data sharing activities would all benefit from additional practitioner engagement and lead to improved RM&E coordination.

Lastly, in addition to specific project tasks, PNAMP continued to emphasize communication as a tool to support collaboration and provided a forum where monitoring practitioners and policy staff could interact and exchange information. PNAMP operates by open, inclusive processes and all meetings and documents are readily accessible on the PNAMP website.

The opportunity provided by the PNAMP forum to allow its partners and participants to collectively focus on issues, results, and future needs related to monitoring increases coordination and collaboration and over time increases effectiveness and efficiency of aquatic resource monitoring on a regional scale.

Introduction

Federal, state, tribal, local, and private aquatic monitoring programs in the Pacific Northwest have evolved independently in response to different organizational mandates, jurisdictional needs, issues and questions. Planning and coordination of monitoring activities have evolved slowly, but steadily over the past eleven years. The Pacific Northwest Aquatic Monitoring Partnership (PNAMP) became a formal institution in 2004, charged with providing a forum for coordination of aquatic monitoring efforts in the region. The geographic area of this coordination includes the Pacific Northwest region from Northern California to Canada where participating entities are implementing monitoring efforts. Currently, 19 state, tribal, federal, and regional entities are signatory partners of the PNAMP charter (Appendix A).

The guiding principles behind PNAMP are that monitoring will be improved if all programs:

- use consistent monitoring approaches and protocols
- follow a scientific foundation
- support monitoring policy and management objectives
- collect and present information in a manner that can be shared

These goals require considerable effort and commitment to collaboration by many entities and individuals. PNAMP strives to provide the forum where this collaboration can occur and to facilitate the exchange among subject matter and policy experts that is necessary to accomplish these goals. Although we are always supportive of more participation, we believe PNAMP has a good combination of participants to address these goals.

The different mandates driving monitoring and subsequent management, policy, and reporting responses require collaboration with other regional and national organizations as well as many individual participating organizations. Regardless of the complexity involved, PNAMP believes that support of coordination and collaboration based on the four guiding principles is important for a successful regional monitoring network.

PNAMP's organizational structure includes a Steering Committee (SC), staff (aka Coordination Team) to serve as coordinators and facilitators for specific topics of interest, and a number of subject matter experts participating in working teams that focus on specific projects and their related tasks. The SC is composed of representatives from all organizations that are signatory to the Charter (link to PNAMP Charter page) and working team leads, a combination that allows the interface of technical and policy interests. The representatives are responsible for communicating their respective organizations' work and needs to PNAMP,

as well as delivering PNAMP progress and challenges to their organizations. Participants from the working teams largely contribute in-kind hours to support PNAMP projects. PNAMP has found that in some cases it is necessary to secure dedicated time from individuals in order to move forward quickly on the tasks related to a project. In these instances, time may be supported by PNAMP funding, usually for a person to serve as a lead for a particular task.

The PNAMP Steering Committee, Coordination Team, and participants share the responsibility to work together to accomplish our goals efficiently and consistently. We encourage those in the region who seek assistance with aquatic resource monitoring issues to contribute to PNAMP. Coordination on complex topics with many partners takes time and hard work. Since PNAMP is a voluntary organization, our progress is directly correlated to participation. Support and open communication are essential for PNAMP to be able to respond to needs of the region. We need to hear from both subject matter and policy experts on what is needed for better coordinated aquatic resource monitoring.

Coordination Team Activities

The PNAMP Coordination Team is employed by the U.S. Geological Survey (USGS), Northwest Region Executive Office. In 2015, the PNAMP Coordination Team included a Coordinator (Jennifer Bayer), and three staff biologists (Amy Puls, Becca Scully, and Katie Pierson). Midway through the year, an additional staff biologist, Megan Dethloff, joined the coordination team. In October of 2015, Katie Pierson resigned from the Staff Biologist position. Sheryn Olson will be joining the PNAMP team in late January 2016.

The Coordination Team's goals are to facilitate the transfer of information within PNAMP and across all relevant organizations, support relationships between science and monitoring, and promote communication among organizations to help assure that monitoring plans and information are coordinated across the Pacific Northwest. The Coordination Team works to initiate and facilitate the development, presentation, and distribution of products aimed at heightening understanding of PNAMP issues, successes and problems, and to serve as a clearinghouse for PNAMP activities and products.

The Coordination Team is responsible for administrative requirements of PNAMP activities (e.g. meeting logistical support, record keeping, and maintenance of participant information). At least one member of the Coordination Staff serves as a lead or co-lead for all PNAMP projects to ensure the project moves along in a timely manner. The PNAMP Coordinator is responsible for convening quarterly Steering Committee meetings.

In 2015, organizational support was provided by developing and negotiating fiscal support with government and non-government entities and managing budgets and associated contracts with those entities. Required progress reporting regarding the Coordination Team's activities (within PNAMP) and PNAMP activities to interested external parties was completed.

The Coordination Team continued to seek appropriate outlets for communicating PNAMP's work beyond required progress reporting. The Coordination Team represented PNAMP at several external meetings, workshops, and conferences in 2015. In addition, the Coordinator conducted briefings at meetings and for individual organizations and their executives regarding PNAMP activities throughout the region as requested.

The PNAMP website (www.pnamp.org) remained a vital communication tool to provide up to date information about PNAMP events and projects, and increase the availability of biological and natural resources

information at the regional and national level. While the content of the website was maintained by PNAMP staff, technical support and hosting of the website was provided through Sitka Technology Group.

In addition to the pnamp.org website, the Coordination Team also managed development of MonitoringResources.org as described in the Monitoring Resources Project below.

In-Kind Contributions

PNAMP is a dynamic, growing association of state, federal, and tribal partners and includes a variety of participants from other organizations. Projects are supported by PNAMP staff and inter-organizational working teams, who are almost entirely supported by in-kind contributions from their respective organizations. While managing projects in this volunteer-based environment is challenging, the results are very rewarding.

It is important to us to acknowledge the generosity of in-kind contributions from participants. Over the years, the Coordination Team has tried various ways to track in-kind contributions. We have found it to be relatively easy to track meeting hours and assign in-kind contributions based on attendance at PNAMP meetings and estimates of meeting prep or drive time. For 2015 we calculated over 2580 hours of in-kind contributions of time from 116 participating organizations (Appendix B). Table 1 shows in-kind contributions by topical category, and illustrates how using meeting time to represent participation is imperfect. The eight hours of in-kind time recorded for meetings on the topics of effectiveness monitoring and IMWs is a large underestimate of the amount of time participants spent on these topics. In 2015 the well-attended effectiveness monitoring and IMW events coordinated and facilitated by PNAMP took place at large regional conferences where participation is not tracked. Figure 1 shows in-kind contributions by organization type for 2010 through 2015. The spike in in-kind contributions in 2014 was the result of a two-day IMW workshop that was attended by a large number of people. While tracking meeting participation is an imperfect measure of in-kind contributions, it remains our best option. It is much harder to track time contributed outside of meetings. The Coordination Team asks task leads and participants to track hours spent on PNAMP activities during the year, but not many do. Since we are not able to come up with an accurate assessment of these hours in 2015, we are not reporting any estimates here. The Coordination Team plans to continue requesting in-kind estimates from participants in the future.

Table 1. Estimated hours contributed to PNAMP meetings by topical category. Hours were estimated for each meeting attendee for every PNAMP meeting from January 1 to December 31, 2015. For teleconferences the meeting duration was used to estimate the contribution of time from each participant. For in-person meetings contributions were calculated as 1.5 times the meeting duration to help account for travel and prep time. Hours were then grouped by topical category.

Project or Topical Category	Total Hours
Lower Columbia Habitat Status & Trends Monitoring (HSTM)	641
Coordinated Assessments	577
Steering Committee Meeting Series	461
Data Management and Sharing Best Practices	460
Monitoring Resources	227
Outreach and Communication	99
Macroinvertebrate Data Sharing	69
High Level Indicators	23
Methods Review	18
Effectiveness Monitoring Coordination, IMWs	8

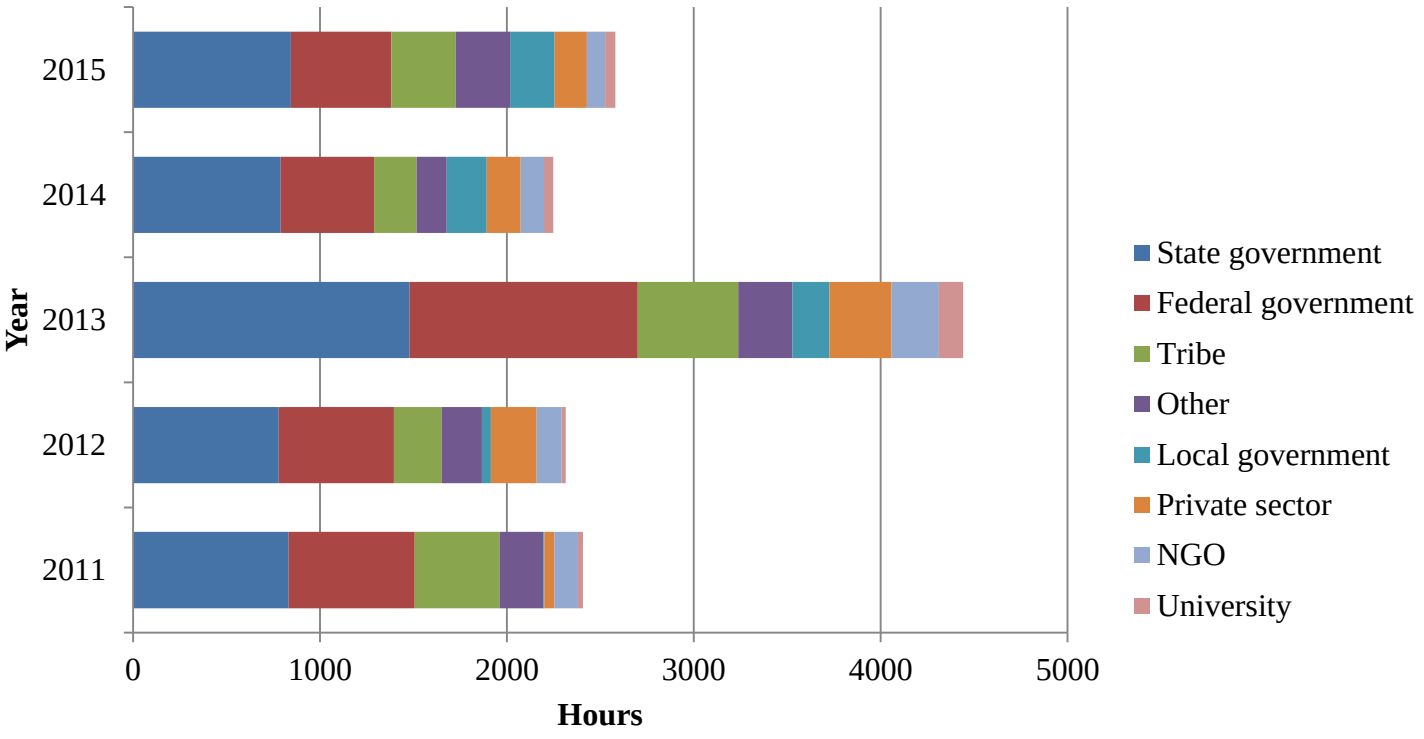

Figure 1. Estimated hours contributed to PNAMP meetings for 2011 to 2015. Hours were estimated for each meeting attendee for every PNAMP meeting from January 1, 2011 to December 31, 2015. For teleconferences the meeting duration was used to estimate the contribution of time from each participant. For in-person meetings contributions were calculated as 1.5 times the meeting duration to help account for travel and prep time. Hours were then grouped by their entity type and year. The entity type of "other" was used in cases when the other seven categories were not appropriate.

Project Activities

For several years, PNAMP's work and associated meetings and work sessions have been driven by ongoing and new projects. This is in contrast to the previous approach of standing work group meetings (organized around topics) throughout the year. The project-focused structure allows for better information distribution among participants in cases where a project cuts across multiple topical areas.

Using a project-focused structure, PNAMP is able to gather interested SC members and subject matter experts to form working teams that focus on completing specific tasks for the project. These teams guide the progress of the project and act as intermediaries between the larger workgroup and the SC. We have found that this structure allows better SC/workgroup exchange without asking every SC member to track every activity. It also allows support from a larger forum of subject matter experts who are able to contribute to an open, inclusive process if they choose. The project-focused structure recognizes the smaller work teams while maintaining the framework of a larger forum of interested participants

In addition, PNAMP has found that it is important to have a dedicated lead for all projects, whether it is someone from the Coordination Team, a SC member, or subject matter expert who participates in PNAMP. In the absence of a lead who can dedicate time to move things along, PNAMP has found that final products can be significantly delayed, much to the frustration of interested parties. In cases where no volunteer lead has been identified via in-kind time contribution, PNAMP has distributed funds to support the time of a lead, as the budget allows.

PNAMP meetings and work sessions in 2015 focused on tasks related to these main projects: Monitoring Resources (includes all web applications and development), High Level Indicators, Effectiveness Monitoring Coordination and Assessment, Methods Review, Lower Columbia Habitat Status and Trends Monitoring Project, Data Management and Sharing Best Practices, Coordinated Assessments, Stream Habitat Data Sharing, and Macroinvertebrate Data Sharing. Several smaller work teams met regularly to focus on specific tasks identified with these projects. Details for each project are described below. Topics or projects not listed above that have been mentioned in previous PNAMP annual reports are still being tracked; however, they were not a focus in 2015.

MonitoringResources.org

For several years, PNAMP has partnered with Sitka Technology Group to develop online resources to create a network of information and tools to support a variety of monitoring needs. The Monitoring Resources site is the base for this network of tools and information. It is intended as a place to integrate existing and future PNAMP web resources so they work together to provide an efficient interface for users. This year updates were made to the organization, usability, and look of the Monitoring Resources tool set. The updates are intended to improve user experience and update the visual appeal of the site.

Monitoring Resources contains the framework that provides central user and organizational management and houses all other PNAMP applications, including Monitoring Methods, Sample Designer, Site Manager, Monitoring Explorer, Monitoring Advisor, and the Metadata Builder. The features and functions within this web application are designed to be modular in nature so that users can take advantage of a single feature without necessarily using other features of the system. At the same time, the individual modules of the application are designed to be able to work together for end-to-end management of the monitoring workflow and to integrate with data collection applications such as GeoOptix.

The Monitoring Resources tools are intended to help monitoring practitioners plan and implement effective, efficient, and high quality monitoring projects. They provide guidance and support for design and documentation of a monitoring project from the early design stage through implementation and generation of descriptive statistics. Using these tools allows practitioners to easily document information about their projects and programs and share it with many partners. Resource managers, funders, and policy makers benefit by getting a comprehensive view of existing and proposed monitoring projects across the region that allows them to better understand how well priorities are being met, as well as where there are gaps and overlaps in monitoring.

This year, PNAMP continued outreach, training, and user support for all of the tools. The number of users with Monitoring Resources accounts, which provided them access to all tools, grew in 2015 to 3,513; up from 1,460 at the end of the 2014. User support involved responding to help requests submitted through the site itself or via emails or phone calls directly to staff. We continued to look for other opportunities to implement a project tracking process for other organizations, similar to what BPA has done. This included outreach efforts to increase awareness of the tools, such as briefings with the Oregon Department of Environmental Quality, Upper Columbia Salmon Recovery Board, Puget Sound Partnership, US Environmental Protection Agency Exchange Network Region 10, Oregon Watershed Enhancement Board, and Washington Department of Ecology.

Staff shared two presentations and one poster on Monitoring Resources web tools at the 145th Annual American Fisheries Society (AFS) meeting in Portland, OR, a presentation and poster at the Organization of Fish and Wildlife Information Managers (OFWIM) Conference, and a presentation the AFS Idaho Chapter. PNAMP also hosted booths at the Salmon Recovery Conference and the 5th Annual Field Technology for Data Collection in Forestry, Fisheries, and Natural Resources Conference to promote one-on-one conversation about Monitoring Resources.

PNAMP completed a five-part webinar series focusing on the Monitoring Resources functionality. Each webinar focused on an individual feature of Monitoring Resources highlighting Monitoring Explorer, Site Manager, Sample Designer, Documenting Protocols, and Methods and Tool Integration. All presentations can be found on pnamp.org. There were over 60 participants; many individuals attended multiple webinars. Participants ranged from local biologists to national project leaders. Due to the success of the webinar series and the redesign of the Monitoring Resources, PNAMP will continue the webinars in March 2016.

Substantial efforts were made in 2015 to conduct outreach with the BLM AIM program; as a result the BLM is using the Monitoring Resources tool to document, share, and implement GRTS designs, including uploading two master samples. The BLM have funded development improvements, which will benefit the full Monitoring Resources community.

PNAMP has worked to integrate the tools into PNAMP's coordination tasks by providing overviews of the tools' capabilities at project team meetings. To help with the general outreach, PNAMP staff updated the Monitoring Resources fact sheet to be distributed at workshops, briefings, and meetings. Additionally, PNAMP coordinated with the USGS efforts to improve data management within programs such as the National Fish Habitat Partnership (NFHP), North American Bat Monitoring Program (NABat), and USGS Core Science Analytics, Synthesis, and Libraries (CSAS&L). PNAMP was invited to present the Monitoring Resources tools at USGS Community for Data Integration Monthly Data Management Series. With funding support from USGS

CSAS&L, updates were made to the visual layout and structural organization of the Monitoring Resources tools. This improved user experience and streamlined the work flow for documentation. Because of CSAS&L's support we were also able to start creating training videos to be shared on Monitoring Resources; they will be completed in 2016. Finally, we worked to start the process of updating the Monitoring Resources web APIs from SOPE to RESTful web APIs. This will benefit the entire user community by streamlining the documentation processes, improving work flow, and offering new ways for outside systems to integrate existing documentation into our work.

There are many remaining tasks that need to be completed in order to make Monitoring Resources fully functional. We are seeking input and feedback on the tools to improve usability. We will focus on creating resources to improve usability such as training videos, recorded webinars, information pages, and face to face trainings. Additionally, these tools are intended to support information sharing across other online systems, so we are seeking input with respect to what systems and organizations would mutually benefit from connecting via web services to Monitoring Resources. We feel that it is imperative to the success of these tools to find additional partners who share our vision for better documentation and information sharing and provide support by encouraging or requiring use of the tools within their own organizations. Continued outreach will be key to get this support. PNAMP will continue to outreach to monitoring practitioners and look for other opportunities to promote the Monitoring Resources tool set. Internally, we will also pursue ways to integrate PNAMP's other projects into the Monitoring Resources tools, specifically focusing on integrating the Coordinated Assessments project's analysis only protocols. (Monitoring Resources project page; Monitoring Resources application)

MonitoringMethods.org

As of October 2015, the MonitoringMethod.org tool no longer exists. All data and functionality were merged into MonitoringResources.org to improve user experience and streamline the documentation process. This effort was part of PNAMP's overall goal to streamline the documentation processes, focus on usability, and create a comprehensive infrastructure to move data from planning processes through collection and finally to assessment and decision-making.

PNAMP originally developed Monitoring Methods to promote improved business practices around documentation and to support standards development. In 2015, PNAMP with the support of Sitka Technologies merged Monitoring Methods and Monitoring Resources. PNAMP redesigned the web tools to improve user experience and streamline documentation. The backend data systems behind MonitoringMethods.org were merged with MonitoringResources.org; methods and protocol library documentation tools are now integrated into the Monitoring Resources work flow. All data and functionality of MonitoringMethods.org was retained and integrated into MonitoringResources.org. Users can now go to Monitoring Resources.org to document methods and protocols or find information about others' methods and protocols, as well as definitions of monitoring terminology. PNAMP makes Monitoring Resources information available to other regional systems via web services.

By promoting collaboration and standardization through online services like Monitoring Resources protocol and method documentation tools, the need to perform expensive and error prone crosswalks will be reduced. This will lead to timelier, less expensive, higher quality, and more widely used monitoring data across agency boundaries. The data collection method descriptions in Monitoring Resources are used to build data dictionaries that drive electronic form displays and data collection on Sitka's GeoOptix mobile devices.

PNAMP recommends additional development in 2016 as funding allows. Development would be based on needs already identified or additional feedback from users. Some additional feedback received this year included:

- Increase usability based on user feedback
- Remove study design information from the protocol allowing for protocols to be used by multiple entities
- Improve links between protocols and the Sample Design tool, allowing for more general documentation of protocols
- Allow upload of figures, forms, documents on customized methods
- Allow ordering of methods in protocol to match how methods are implemented in field
- Support for documentation of analysis only protocols
- Support for documentation of high level indicators methods

In 2015, significant staff effort was put into content management of Methods and Protocols. By the end of 2015, there were 1,688 methods and 977 protocols in the system. Of these, there were 868 published methods and only 96 published protocols. PNAMP feels it is important to urge users to finalize (i.e., publish) their content instead of letting it sit for months or years in a draft or proposed state. In addition, it is important to the success of Monitoring Resources to have content in the system that will draw in new users, not turn them away.

In 2015, PNAMP staff identified poorly documented methods. For methods that were widely referenced, but poorly documented, PNAMP staff contacted users and recommended alternative methods in the system. For methods that were well documented, PNAMP staff asked users to assume ownership or PNAMP took ownership in order to work towards publication. In 2016, PNAMP will continue to identify poorly documented methods or ones that are not being actively maintained, and follow a similar process to move towards a more complete and robust documentation of information. PNAMP recommends continuing to manage content by doing yearly reviews of unpublished methods, searching out common methods, and working with users to improve and publish content.

The creation of duplicate methods in the system creates unnecessary clutter. In order to maintain a more organized library of methods, PNAMP will continue to identify better ways to highlight well documented methods to use as examples for what level of detail should be documented. We also recommend that program managers be identified in the system and begin 'approving' well documented methods for use in their programs. In addition, staff recommend that methods be entered (or poorly documented methods be updated) to fill any gaps in content. In 2015, PNAMP staff conducted a Method Review of an Electrofishing method; the details of this work are reported in the Method Review section. We recommend continuing to conduct Method Reviews to improve documentation of universally applied methods.

To facilitate the publishing of protocols in 2015, PNAMP staff and RM&E support selected projects, such as the BPA Action Effective Monitoring (AEM) Program, Columbia River Habitat Monitoring Program (CHaMP), and Integrated Status and Effectiveness Monitoring Program (ISEMP), and worked directly with protocol owners and project sponsors to publish methods and protocols. This one-on-one interaction helped streamline the publishing process. PNAMP recommends that in 2016, we continue to seek out programs with unpublished protocols and work directly with the protocol owners in one-on-one work sessions. PNAMP will also focus on documenting standard protocols applied by more than one regional partner such as pit tagging, smolt trapping, and redd surveys.

To better understand users' needs as related to documentation of analysis only protocols, PNAMP staff worked with individuals from Oregon Department of Fish and Wildlife to document analysis protocols used to calculate the Coordinated Assessments Project high level indicators. Working with staff from ODFW and Colville Confederated Tribes, we broke down the processes into documentable methods and created generic analysis methods that users can customize. PNAMP staff will continue to support ODFW in the documentation of these "analysis only" protocols, and we will look for other organizations involved in the Coordinated Assessments project that are willing work with us to repeat and improve the documentation of analyses methods.

PNAMP staff also continued the work to support users in documenting their protocols and methods in Monitoring Resources. Staff spent approximately three to seven hours per week supporting requests received via email, phone, or the support page on the website. Requests included help with login, content entry issues, support with how to structure protocols and methods for specific projects, responding to discussion board comments, reviewing methods, and responding to requests to add new organizations or monitoring programs.

Regarding reviewing methods, when a user requests publishing of their methods, PNAMP staff review individual methods for completeness in the step by step instructions, ensure the description mostly follows a generic format, and look for duplication in the system. Staff then provides feedback via the comments section of the method in Monitoring Resources. PNAMP staff are not experts in all methodologies documented in Monitoring Resources; therefore, we recommend that PNAMP build a network of professionals who are willing to review methods in their area of expertise. With enough people participating, it may only be a time commitment of one to two hours per month per individual. Method reviews by subject matter experts would provide more of a scientific review than what is currently being implemented by staff. It would be beneficial for PNAMP partners to encourage technical staff to share their expertise by volunteering to be method reviewers.

(Document Methods; Document Protocols)

Monitoring Sample Designer, Site Manager

Over the last several years, PNAMP has pursued development of two discrete, but integrated tools to support documentation of monitoring sampling designs and locations of data collection events. These applications, the Monitoring Sample Designer and the Monitoring Site Manager, were release in October 2012. These tools aid users in the creation of permanent, sharable online documentation of their designs. In 2015, Monitoring Resources was redesigned, the functionality of the tools and the users' data was retained, but the organization of the site was updated to improve user experience. PNAMP and Sitka staffs are currently working on updating workflow documentation, information pages, and training videos.

The Sample Designer supports users in building sample designs. It supports probabilistic site selection (using an algorithm called Generalized Random-Tessellation Stratified (GRTS)) to generate a spatially-balanced set of sites for status and trends monitoring, defining the target frame, stratification, site evaluation, and creating panels. The Sample Designer also supports non-probabilistic designs. All designs created in the Sample Designer can be transfer to Sitka's data collection system (GeoOptix), to facilitate the creation of data collection events and the collection of field data.

Probabilistic designs in the Sample Designer leverage the work of Don Stevens and Tony Olsen in the application of the General Randomized Tessellation Stratified (GRTS) algorithm to facilitate selections of sites within a sample frame in a manner that is spatially balanced. The GRTS algorithm developed by Stevens and Olsen is also capable of "densifying" existing master samples and integrating sites selected by non-probabilistic means into probabilistic designs and adjusting weights accordingly.

For probabilistic designs the Sample Designer allows users to define their target frame through any number of spatial attributes that are already present in the system, plus any number of custom-defined attributes that users can append to the system for their particular purpose. The Sample Designer incorporates a sophisticated Boolean logic evaluation engine to narrow the sites desired to match those of the target population.

Once sites are selected, the GRTS algorithm also assigns sites randomly to panels and strata defined by the design. The system automatically determines the range of values in the categorization variable(s) of interest and creates strata accordingly. Assuming that the user understands the parameters of their particular study, a draft statistically valid design can be produced in as little as 15 minutes.

For non-probabilistic designs, users are able to create panels and strata manually and assign sites to them manually. Both design types "pin" the starting panel to a year, which fixes multi-year designs in time and facilitates the transfer and construction of data collection events in the data collection system (GeoOptix).

Once sites are organized into blocks (an intersection of a strata and a panel), the Sample Designer has incorporated into it a feature that allows users to perform site evaluations prior to sending crews out to the field. Site evaluations are conducted to ensure that the site is a member of the target population (e.g. it is in a stream that fish spawn or rear in), is safe for crews to survey, and that the landowner has given permission (in cases where the sites are on private land or require crews to traverse private lands). When sites are rejected, the rejection reason is recorded because the rejection reason is important for post data collection statistical data analysis.

As for the content in Sample Designer at the end of 2015, there were 151 sample designs within the tool, 88 are finalized. Within in Sample Designer there are over 1.3 million sites located on tributaries and the mainstem throughout the basin. Most of these sites represent GRTS master sample sites that are used in probabilistic designs, and some of these sites are loaded by monitoring programs as part of non-probabilistic designs (opportunistic, census, experimental, etc.). GRTS samples have been populated that support line features (stream networks and shorelines) as well as areas (e.g. the reservoirs behind Bonneville and the John Day Dam).

We recommend increased support in the coming year to load additional designs. In 2016, PNAMP will facilitate discussions with users to improve user experience in the designer tool. Additionally, we will work with Sitka to better integrate Sample Designer with the Protocol documentation tool. We will remove the Design section from the protocol making it more generic and applicable by multiple organizations in many different designs. This will streamline the documentation of designs, remove redundancies from documentation, and allow opportunities to collaborate.

Additionally in 2016, we will work to gather feedback and design a work flow and process for users to document their final sample locations post implementation. We will not build a new tool; we will integrate new functionality into the existing Sample Designer tool. This new functionality will allow users to update site

information, post implementation, and add implementation notes on a site by site basis. This will be compatible with the requirements established for the MMX feed; therefore users' data can be linked into the Monitoring Explorer Map viewer. These updates to the Designer tool will increases the number of sites being displayed in Monitoring Explorer, thus improving regional data discovery and creating opportunities for funders and project implementations to identify inefficiencies in sampling.

The Site Manager supports information associated with master samples and sample designs created in the Sample Designer. The goal of the Site Manager tool is to provide an easy to use interface, a simplified list of what master samples are available in a region of interest, a way for users to upload and maintain project-specific sites, and serve as a source for making the locations of these sites transparent to funders and other stakeholders.

The Site Manager stores a variety of master samples from both linear stream networks and area-based water bodies such as estuaries and mainstem rivers in the Pacific Northwest, attribute information for sites in each master sample, and is the where users can explore details about sites in master samples and sample designs used in monitoring projects. Sample Designer also allows users to upload their own sample locations, attributes, and site evaluations.

Currently, we have eight master samples (a combination of linear and area based) in the tool. In 2015, we added two master samples to support the BLM; one is a linear master sample to support lotic sampling, and one is area-based to support terrestrial sampling. These master samples are fully documented and available for all Monitoring Resources users. In 2016, PNAMP will facilitate a workshop discussing the use of Master Samples and GRTS designs.

In addition to managing and documenting master samples, the application also allows users to upload "User Sample Files". We defined User Sample Files as documentation of sites that are not drawn from one of the supported master samples, but instead selected by a monitoring practitioner in any other manner. The Site Manger - User Sample application allows users to import shapefiles of sample locations, document information about those points, add points by dropping the points on a map, and add or modify attributes associated with sites. These sample files can then be used in the Sample Designer tool where the sites can be assigned to panels and blocks, and the user will be guided through the documentation of site selection. In 2015, there were 49 user sample files in the application. In 2016, PNAMP will continue to support the User Sample File application by soliciting feedback from users on the tools, and working to document and fix issues. The two major development issues we will focus on are updating the tool to allow users to create files without first uploading a shapefile and improving guidance and documentation on the Monitoring Resources tools set.

(Site Manager- Master Sample application, Site Manager- User Sample Files application)

Monitoring Explorer

Whereas the Site Manager and Sample Designer are concerned exclusively with pre-data collection processes, the Monitoring Explorer is concerned with post-collection visualizations. In 2013, PNAMP and Sitka began development of the Monitoring Explorer feature. The Monitoring Explorer is a database containing extensive information about the location, method, and timing of data collection events in the field as well as the organization that collected it and specific links to where the measurement or metric data may be downloaded. The Monitoring Explorer database is designed based on the Monitoring Metadata Exchange (MMX) Standard. It currently provides access to a full-featured interactive GIS map that utilizes ArcGIS Server and several

common layers for the region. The work to populate sites (locations) in the Monitoring Explorer began in fall of 2013.

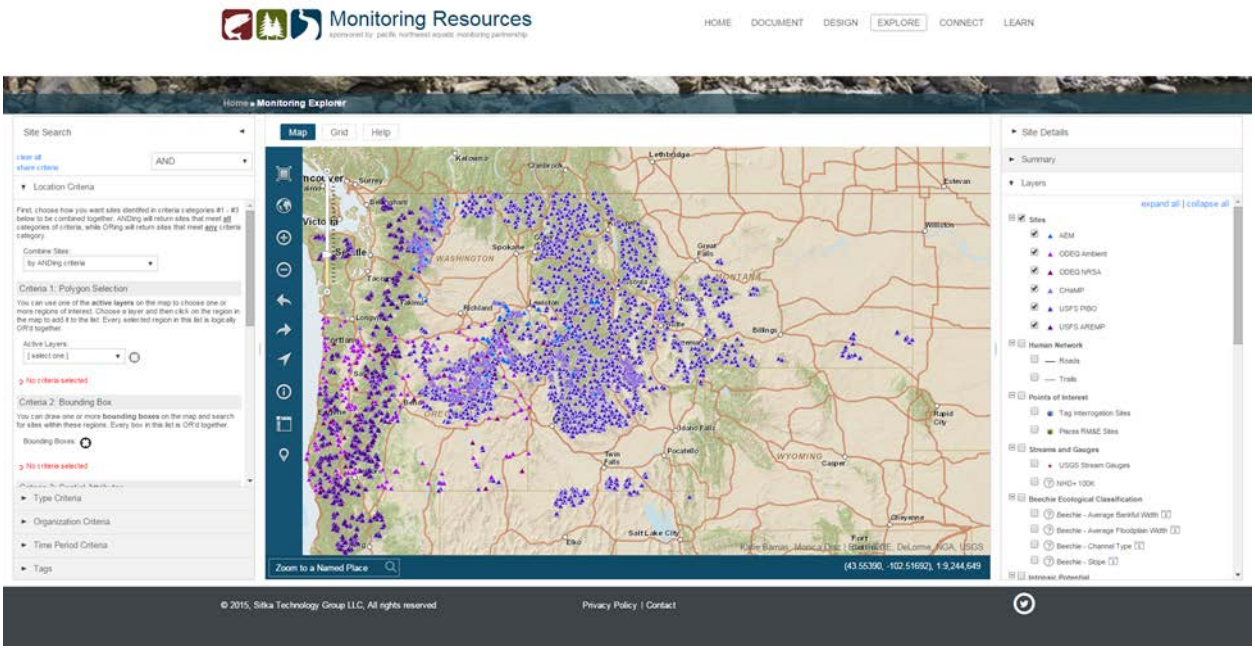

Figure 2. Screen shot of the Monitoring Explorer tool utilizing the Identify feature to display data collection event details.

The idea for the Monitoring Explorer was based on a variety of past PNAMP discussions and new tool development. Since 2005, PNAMP participants have expressed the need for a web-based data system that provides geographic locations in an interactive map-based format with monitoring activities linked to information about who is carrying out the activities and what is being monitored. PNAMP developed an idea for a tool that would provide information associated with project sites from multiple organizations in one online resource so users wouldn't have to search through a variety of project tracking databases to gather the information they need. Proponents envision that this tool would support the ability to summarize current and historic monitoring activities and would assist in coordinating future activities. It should be noted that the intent is not for PNAMP to develop a tool that becomes a system of record for all monitoring location information in the region, but rather to develop a tool that has the ability to display a comprehensive list of monitoring locations and site level metadata information from other systems.

Monitoring Explorer is an interactive web mapping application that displays the location of actual data collection events along with the ancillary information described above. This information is displayed in a "web friendly" way where hyperlinks to other Monitoring Resources pages or the pages of responsible agencies can be quickly called up in a browser.

The Monitoring Explorer uses the power of the ArcGIS Server and the Javascript API to provide advanced mapping and geoprocessing capabilities. This includes a full suite of base map imagery and the ability to quickly add other GIS layers of regional interest (fish population layers, Beechie classification, land ownership, etc.). A sophisticated search tool built to work closely with the map and the database allows users to find sites

that have data that may be of interest to sponsors and stakeholders and quickly allow them to access data collected at that site.

In 2016, we will work with regional partners to prioritize the development of the search capability of Monitoring Explorer. PNAMP has given demonstrations of Monitoring Explorer at regional meetings, trainings, and workshops to help educate potential users about its capabilities and encourage participation in sharing site level data.

(Monitoring Explorer application)

Monitoring Metadata Exchange

In 2014 to facilitate integration of monitoring, PNAMP and regional partners including Sitka and StreamNet drafted a data exchange template for exchanging monitoring site level metadata. Monitoring Metadata Exchange (MMX) is a PNAMP standard data exchange mechanism for data collection event level metadata (the who, what, how, where, and when). Monitoring Metadata Exchange was created to be used by both producers and consumers of monitoring data to foster greater visibility and understanding of the diverse range of data collection happening throughout the region. PNAMP staff presented the first version of the MMX to regional partners and incorporated their comments to further refine the exchange. Sitka participated in PNAMP efforts with stakeholders to refined the MMX specification and contributed significantly to its design. Sitka attended EPA Region 10 work sessions relating to ongoing development of exchanges on the EPA Exchange Network (EN) and advocated for MMX to become an Exchange Node standard.

One of the major drivers behind drafting the MMX standard was to facilitate the sharing of site level information to be used in the Monitoring Explorer, but since the data are freely exchangeable, any organization with the desire and resources to do so could create alternative repositories and tools on top of this shared data. To facilitate sharing in 2014 Sitka developed a REST-ful web service implementation of the MMX data exchange standard (complete with a validating xml schema). This implementation is written using Microsoft's .NET technology stack and is actually the mechanism that Sitka is using internally to integrate CHaMP and AEM site level data into the Monitoring Explorer. The source code of this implementation serves as an MMX reference implementation and can be freely shared with any organization that wants to publish their data into this exchange.

The PNAMP MMX working group will refine the MMX standard as necessary. PNAMP has adopted this standard and began seeking participation by regional partners. Since 2014, PNAMP staff has presented the Monitoring Explorer and MMX to various partners and outside organizations, outreach efforts will continue in 2016. PNAMP will seek additional opportunities to collaborate and establish automated transfer of information using the REST-ful web services. PNAMP will target organizations with large publically available databases.

Additionally, PNAMP will investigate ways to integrate the MMX standard into current PNAMP projects including Coordinated Assessments and Habitat Data Sharing Projects. In the effort to increase use of the MMX standard, PNAMP will structure all other data sharing efforts around the established standard; which is incorporating established data, time, location, and metadata elements from the MMX standard into future data sharing efforts.

In 2016, with the goal of adding information to the Monitoring Explorer map viewer, PNAMP will continue to seek partners to exchange information using the MMX standard and the REST-ful web services . PNAMP will also reconvene the working group to assess if updates need to be made to the standard. We will work with the Coordinate Assessments working group to explore the possibility of drafting a proposal for an EPA Exchange Network Grant.

(MMX project page; MMX Draft Standard)

High Level Indicators

Over the past decade there has been increasing interest at the executive level in improving our collective ability to track and communicate changes in environmental conditions and salmon populations in easily understood terms. Doing so fosters accountability, encourages consensus, supports priority-setting and budgeting, and can engender support. High level indicators (HLIs) are typically derived from one or more individual metrics across broad geographic scales and are intended to communicate complex information in easily understood terms for use in reports to Congress, legislatures, governors, and the public.

PNAMP has been working toward improved HLI reporting for many years. In 2007, PNAMP produced a white paper that highlighted the need for collaboration around HLI common reporting. In response to a need identified at the Northwest Environmental Information Sharing (NWEIS) executive summit in 2008, PNAMP produced a report summarizing: 1) high level indicators currently in use in the PNW, 2) who is using the indicator, and to the extent possible, 3) metrics being used to support the indicator (link to report). In 2009 PNAMP produced another report that built upon the earlier work, substantively advancing and providing recommendations for watershed health and salmon indicators (link to report). In 2010 PNAMP began the Coordinated Assessment for Salmon and Steelhead Project (CA) to develop efficient, consistent, and transparent data-sharing among the co-managers (fish and wildlife agencies and Tribes) and regulatory/funding agencies (BPA & NOAA) of the Columbia River Basin (CRB) for salmon and steelhead high level indicators.

At the 2013 PNAMP strategic planning meeting, partners expressed interest in revisiting the recommendations made in the 2009 report and taking steps to advance coordination of habitat indicators at the regional level. In 2015, after recognizing overlapping interests, PNAMP partners and the Northwest Power and Conservation Council staff decided to collaborate to identify regional habitat questions and indicators of common interest that could be informed by existing monitoring. In discussions with PNAMP steering committee members, it was also evident that other broad-scale efforts, both within and across jurisdictions, such as the State of the Salmon Report by the Washington Governor's Salmon Recovery Office, as well as reporting needs for the Clean Water Act and the Columbia River Treaty, would likely benefit from this effort. As a pilot, we have chosen to focus on indictors related to surface water attributes as these are of interest to many reporting efforts; the four indicator topic areas are: flow, macroinvertebrates, temperature, and water quality index. The goal is to come to agreement on a small set of indicators for which data will be efficiently coordinated and communicated to allow comparisons at multiple scales across the region, while respecting the goals and unique mandates of the individual partners. A leadership team was assembled and a work plan was developed outlining the proposed goal, actions, and outcomes for the project. In 2016, Indicator Work Groups (IWGs) will begin meeting to identify management questions and existing metrics, indices, and indicators that can inform them. The first workshop, planned for the summer of 2016, will vet the work of IWGs with regional stakeholders and help identify high priority questions and indicators for further refinement.

Effectiveness Monitoring Coordination & Assessment

This project is an effort to integrate and align existing and new regional effectiveness monitoring efforts, provide more scientifically robust data for use in management decisions, and improve cost efficiency in the implementation of monitoring programs. The focus of this effort is on coordinating approaches, monitoring design, and data management systems to allow alignment and reporting of results; informing a regional network of effectiveness monitoring coverage; and encouraging programmatic-level planning consistency across the region for Intensively Monitored Watersheds (IMW) and effectiveness monitoring projects and programs. Efforts are focused on supporting partner efforts to move away from "one-at-a-time", project-by-project decision making and moving toward coordinated efforts.

In 2013, PNAMP hosted a workshop for IMW practitioners to share their successes, failures, and insights on the challenges of this coordinated experimental approach that integrates watershed-level restoration activities with carefully designed and intensive monitoring efforts. This workshop was an opportunity for IMW practitioners to document and integrate their experiences to strengthen current and future IMW efforts and to identify the next steps PNAMP could take to assist practitioners in the planning and implementing IMWs. The summary information of current IMWs, notes from the workshop, and presentations are available on the PNAMP website. Since the workshop PNAMP facilitated a working group lead by Stephen Bennett to draft a manuscript detailing the result of the 2013 workshop. In 2015, the manuscript has been accepted by AFS Fisheries journal and will be published in the winter of 2016. Additionally, PNAMP has been working towards creating a central hub for IMW information on the PNAMP web page. This effort included gathering information from fifteen individual IMWs, collating it, and posting the information. Currently the web interface is in the design phase. PNAMP has reached out to NOAA to help coordinate IMW outreach efforts, including this web presence. PNAMP recommends continuing supporting these efforts to provide outreach regarding IMW information.

In 2015, PNAMP hosted a session on IMWs at the Salmon Recovery Conference and the National American Fisheries Society Conference in Portland, OR. Participation was positive and feedback from funders, implementers, and PNAMP's Steering Committee indicated that it is time for another workshop. In 2016, PNAMP will convene a planning group to implement an IMW workshop in the fall of 2016.

In addition to supporting the IMW community of practice, PNAMP reinvigorated the standing forum to support effectiveness monitoring interests more generally. In December of 2014, we hosted quarterly teleconferences aimed at providing a forum for experts to discuss issues and identify collaboration opportunities. The first call was well attended – with 21 participants from a wide variety of entities. We agreed to support a session at the 2015 Salmon Recovery Conference on effectiveness monitoring and IMWs and to identify a focus topic for future meetings, which will resume in March. PNAMP intended to continue hosting quarterly calls, but given staffing changes we were not able to continue. We will pick up this effort in 2016, with the goal of identifying an effectiveness topic (not IMWs) to be the focus of a 2017 workshop.

(Effectiveness Monitoring project page)

Methods Review

One of PNAMP's objectives is to understand partners' needs with respect to monitoring methodology and to facilitate collaboration, coordination, discussion, and evaluation of implementation of monitoring methodology. Browsing the library of methods on Monitoring Methods, you will notice measurements may be

collected using different methodologies. Methods may be different because of different study objectives, locations, equipment used, or differing opinions of practitioners about what is the best practice. For collaborative projects or programs that share data, it can be difficult to appropriately combine datasets if there is a lack of understanding of the details of the methods used to collect the data.

Using the Monitoring Methods Community Forum tool, PNAMP hopes to provide more consistency in documentation and therefore a better understanding between practitioners about what everyone is doing. Further, we anticipate discussions on the community forum about implementation of monitoring methods, study design details, etc. It is expected that these discussions will help point out agreements and inconsistencies related to methods, but may not always have a clear resolution. With the Methods Review effort, we used the community forum discussions, as well as previous PNAMP discussions, as a basis to plan for technical discussions focused on the current state of affairs for a particular protocol or method, inconsistencies and disagreements, and how to move forward. All discussions and final outcomes, whether it be agreement to use a particular method or agreement that different methods are necessary, will be documented and available online for future reference.

In 2014, PNAMP staff collaborated with Patrick Cooney, Director of Electrofishing Science, Smith-Root, Vancouver, WA on his 2014 Quebec City AFS meeting talk entitled "Electrofishing in Practice: Variations in Regional, National, and Continental Approaches". The work with Mr. Cooney led PNAMP to initiating the Method Review process outlined in 2012 (link to method review process). PNAMP staff reviewed documented backpack electrofishing methods and prepared a short summary of the basic review findings.

PNAMP solicited electrofishing experts to complete a second expert review, and three members of the scientific community stepped forward. Experts worked with PNAMP staff to gain understanding about the Monitoring Resources tools and due to the complicated nature of electrofishing and regulations, decided that they will work towards sharing a backpack electrofishing methodology template with the larger community.

In 2015, PNAMP worked with electrofishing experts, James Reynolds, Jan Dean, and Alan Temple to develop electrofishing templates. These templates contain questions and provide several choices for designing a framework that creates consistent documentation of information. Because of the complexity of electrofishing regulations, the working group created three templates to guide users through the documentation of electrofishing. PNAMP staff entered the templates into Monitoring Resources as methods, and now we are encouraging users to add the methods to their protocols and customize the method to answers their questions. The templates can be found on Monitoring Resources at: Backpack Electrofishing Method Template, Boat Electrofishing Method Template, and Barge Electrofishing Method Template. Users can print the template and bring them into the field. Once sampling is completed the information can be inputted as a customization in Monitoring Resources. To promote the templates PNAMP sponsored a webinar, featured the templates in the PNAMP monthly mailer, and took copies of the template to the 2015 National American Fisheries Society Meeting in Portland.

PNAMP currently does not have 2016 Method Review tasks planned. We will continue to promote and support the Electrofishing templates. PNAMP will interact with the community to understand their needs for methods review process and move forward when a topic has been identified.

(Methods Review project page, Backpack Electrofishing Method Template, Boat Electrofishing Method Template, Barge Electrofishing Method Template).

Lower Columbia Habitat Status and Trends Monitoring Project

Since October of 2012 PNAMP has partnered with the Lower Columbia Fish Recovery Board (LCFRB) and others to build on progress made in the PNAMP Habitat ISTM project (ISTM Habitat project page) and combine efforts with municipal stormwater managers in Southwest Washington to develop an integrated status and trends monitoring strategy for the Lower Columbia tributaries. The project, funded by the Washington Department of Ecology (WA Ecology), is a collaborative effort being led by the Lower Columbia Fish Recovery Board who has subcontracted with Stillwater Sciences and PNAMP for help with technical and facilitation tasks, respectively. The project is focused on integrating stormwater permit monitoring activities with habitat monitoring efforts to enhance regional coordination in the Lower Columbia tributaries and inform local management approaches. The project will also inform future Municipal Stormwater NPDES Permits in Southwest Washington by producing a monitoring design that addresses multi-scale questions about physical, chemical and biological attributes impacted by stormwater.

Phase 1 of the project, completed in 2013, resulted in a preliminary monitoring design and a list of recommendations and next steps (link to report). In 2014, Phase 2 focused on increasing stakeholder engagement and finalizing the monitoring design (link to report). Phase 3 began in early 2015, with another grant from WA Ecology, to resolve decisions about the appropriate/available level of effort and resources that will be needed to implement the recommended plan, as well as to make final determinations of site allocation and metrics that depend on the fiscal decisions. To help accomplish this work two caucuses were formed, one that focused on recommendations for implementation of the stormwater monitoring portion of the design, and the other caucus focused on recommendations for implementation of the habitat monitoring portion of the design. The caucuses meet every other week from August 2015 – January 2016; the outcomes of these meetings are being summarized in the Roles and Responsibilities documents that will be appended to the primary Implementation Plan. These documents, along with the Quality Assurance Project Plan will be presented at the final workshop in April of 2016.

Data Management and Sharing Best Practices

In recent years, there has been increasing attention on improving data management in the region, with focus on improving practices within individual entities and interest in the ability to share data across entities. Over the years a variety of approaches have been used by PNAMP to help further these goals. In 2015, PNAMP supported two workshops and two webinar series with primary themes of data management best practices.

At the request of the NPCC, we co-sponsored a workshop on data visualization in May 2015. This workshop specifically instructed participants how to visualizing time-series datasets using a raster map approach (how to create, analyze and interpret raster hydrographs). There were over 40 participants in a two part training exercise, designed to provide an overview in the morning and hands on training in the afternoon. We received very positive feedback about this topic as well as the idea of PNAMP hosting training sessions in the future on other topics.

In November 2015, we partnered with Western Forestry and Conservation Association and other GPS professionals to provide a follow-up to the Emerging Technology Workshop that Sitka, PNAMP, and StreamNet organized in 2014. This year we joined their reoccurring conference which has been successful in bringing forestry professionals together for the past 4 years. Our participation resulted in expansion of the conference, including the addition of a fisheries track to the discussion of collecting and managing electronic field data in

an evolving technological field. There were around 165 participants, 30 presentations, and numerous hands on demonstrations.

In 2015, PNAMP approached the USGS Community for Data Integration to be a co-sponsor for a data management webinar series. Webinars were held the third Wednesday of every month throughout 2015 (link to webinar series). Topics included: data management overview, data management planning, data collection, data exchange, data sharing agreements, data documentation, data processing and analysis, data preservation, data citation and publishing and sharing data. Speakers will reach a national audience and come from multiple organizations. PNAMP also completed a five-part webinar series focusing on the Monitoring Resources functionality; more information about this can be found above in the Monitoring Resources section.

In 2016, PNAMP staff will continue to coordinate in-person workshops to be held when there is a topic of interest and resources available to support the effort. (PNAMP Data Management project page)

Coordinated Assessments Project

Since 2011, PNAMP and the Pacific States Marine Fisheries Commission (PSMFC) StreamNet project have collaborated to coordinate the Coordinated Assessments (CA) project, which has resulted in the development of the Coordinated Assessments data exchange (CAX). The CAX defines the framework by which the fish and wildlife agencies and tribes compile and provide data for salmon and steelhead populations for access through the EPA data exchange network. The overarching goal of the CA project is to improve the timeliness, reliability, flow, and transparency of data necessary for regional assessments and management decisions for improved environmental effectiveness. This includes support for biological opinions that affect state and federal agencies. Participants represent 4 states, 6 tribes, an inter-tribal consortium, and multiple federal regulatory agencies; all with an interest in collaboratively sharing fish population data for the Columbia River watershed. The federal Columbia River action agencies and fisheries co-managers have also participated through the CA Working Group; comprised of over fifty additional biologists and data managers across the Columbia River Basin representing 26 different tribal, state, federal, and academic organizations. This work benefits from existing facilitation framework provided by StreamNet, PNAMP, and substantial cost share contributions from the Bonneville Power Administration. In addition, the project has relied on a 3-year grant from EPA for coordination and to develop a virtual node on the Exchange Network for sharing data.

A key output of the CA effort to date has been the development of an agreed upon data exchange standard (DES) describing the data exchange templates (DETs) for specific data elements needed to support the exchange of four VSP indicators and supporting metrics. These include: natural origin spawner abundance, smolt to adult ratio, and recruit per spawner (adult and juvenile). The DETs for these indicators were developed with wide participation of the larger working group; first through an extensive pilot program to document data flows and availability of the indicator and supporting metrics conducted with Oregon, Washington, and Idaho state agencies, six Columbia River Basin tribes, and one tribal coalition (Columbia River Inter-Tribal Fisheries Commission). This was followed by intensive focus on refining the draft DES by a development team consisting of data management and resource management expertise. The draft DES was then vetted and approved by the CA Working Group for implementation. This DES and the partnership behind it demonstrated the feasibility of successful implementation of data flows. Documentation for the specific DETs and supporting materials can be found on the StreamNet website (link to materials). Expansion of the CAX to include additional indicators is under way and made possible due to the initial efforts of the CA Project. Documentation of all project plans and activities may be found on the PNAMP website (Coordinated Assessments project page).

The CA project is designed to improve access to environmental information through the alignment and maintenance of standardized databases for key fish population metrics and indicators for major populations of listed and non-listed salmonids. This information can be shared across multiple agencies and jurisdictions in a common format and with improved efficiencies via the created web services. Information can also be accessed through application programming interfaces (APIs) that make data available in XML and other standard machine-readable formats. Data is shared across programs within the data collecting organizations, between agencies and tribes, and is available to the public, action agencies, and the courts; all of whom are directly involved in expensive and complex management and regulatory arrangements which are made possible and streamlined through this data management approach.

In 2015, the CA project began sharing data via the CAX. Work also began on developing standards for sharing additional indicators. In 2016, PNAMP will continue work with the Coordinated Assessments participants regarding documentation of protocols for CA indicators in Monitoring Methods. PNAMP staff will help guide the development of documentation for analysis methods and protocols. Additionally PNAMP will continue development of the MMX standard. (Coordinated Assessments project page)

Habitat Data Sharing

Organizations throughout the region collect habitat condition data for a number of purposes including management and regulation of activities that affect fish habitat, assessment of watershed health, Clean Water Act applications and landscape metrics to support BiOp requirements. One important driver for the sharing of habitat data is the need of tribes and organizations at all levels to report on status and trends of fish and habitat condition and action effectiveness of restoration work at the project and watershed scales.

PNAMP initiated the Habitat Data Sharing (HDS) project in mid-2011 to improve the collective ability of the region to exchange aquatic-related habitat data in the Pacific Northwest. In 2015, activities were divided into two topic areas, stream habitat data sharing and macroinvertebrate data sharing.

Stream Habitat Data Sharing

Improving data sharing will enable timely access to data, improve data quality, and create clear channels for data management to support better management decisions. Within the Columbia River Basin there are numerous agencies, programs and projects monitoring aquatic habitat; however, these efforts were developed for specific reasons and were not designed in coordination with other efforts. Sharing information between monitoring programs could result in efficiencies, allow for coordination of monitoring, and increase agencies' and tribes' ability to make informed management decisions in the face of ever-changing management and environmental conditions.

In 2015 PNAMP supported the Resilient Salmonid Habitat (RSH) Federal Caucus Focus Area Team as they worked to develop a way to identify salmonid habitat that is resilient to disturbance, particularly climate change. As a pilot, they focused on steelhead in the John Day subbasin in Oregon and identified indicators and thresholds using scientific literature and then applied the thresholds to existing data to identify steelhead RSH within the watershed. Based on the available data and literature, the following six indicators were selected: 1) steelhead presence (adult and juvenile); 2) water temperature; 3) water quantity (flow); 4) habitat complexity; 5) food availability (biotic index); and 6) riparian condition. The pilot was successful in using existing information to display data that was deemed informative in the identifying steelhead RSH; the full assessment

can be found here. By developing the ability to identify RSH the group hopes to apply the findings to a broader geographic scale to protect resilient salmonid populations and their respective habitats.

As part of the pilot, the group developed a number of recommendations for next steps many of which PNAMP is already working on, such as supporting efforts to standardize data collection methods and data exchange standards, as well as working to improve accessibility to datasets. Another recommendation was to participate in a regional conference to discuss salmon habitat resiliency and discuss ecosystem resiliency relative to steelhead and other species. PNAMP will host a workshop in 2016 to address these topics and to make connections with the Riverscape Analysis Project that is working on a climate change vulnerability DSS for aquatic species and their habitat.

Macroinvertebrate Data Sharing

There is agreement among aquatic ecologists in the Pacific Northwest that the sharing of macroinvertebrate data would be aided by a regional standard taxonomic effort (STE) agreement. Data sharing is constrained in part by lack of agreement among organizations that collect and/or process macroinvertebrates samples as to the authoritative taxonomic nomenclature appropriate for collected specimens and the level of taxonomic resolution that is appropriate for different assessment purposes. Following on work done in other regions, PNAMP's Macroinvertebrate Planning Group (MIPG) group decided to pursue development of an STE for the Pacific Northwest in October of 2012.

Work on the STE began in 2013 and continued in 2015. Taxonomists Bob Wisseman (ABA), Sean Sullivan (Rhithron), John Pfeiffer (EcoAnalysts), and Sue Salter (Cordillera Consulting) have been developing the taxa lists that provide standardized nomenclature and 3 levels of taxonomic resolution to use when identifying macroinvertebrate samples. They have also drafted supporting documentation including the rules that were used to build the taxa list and how they will be maintained in the future. In 2015 the STE was promoted and progress was shared in August at the American Fisheries Society Annual meeting in Portland, OR, and in November at the Society for Freshwater Science Pacific Northwest Chapter Meeting in Coeur d'Alene, ID. The first version of the STE is planned to be finalized by spring of 2016. (NWSTE project page)

Also in 2015, MIPG members Ryan Bellmore (USGS), Bob Danehy (NCASI), Amy Puls (USGS/PNAMP), and Seth White (CRITFC) organized a symposium for the 2015 Annual American Fisheries Society Meeting in Portland, OR. The symposium titled "Moving Beyond Water Quality Indices: How Can Macroinvertebrate Data from Fish Habitat Monitoring Programs Inform Food Web Analyses?" featured 12 presentations and out of over 100 symposia was in the top 10 for largest attendance. The symposium and speaker abstracts can be found on the AFS website linked here. Inspired by the great exchange of information and large interest in the topic from the larger community, 6 of the 12 presenters from the symposium began working on a review paper of lotic food web study approaches; in 2016 PNAMP staff will continue to provide facilitation and coordination support to the workgroup.

Outreach and Communication

A large part of PNAMP's work focuses on reaching out to potential participants and informing the aquatic monitoring community of upcoming events and announcements, showcasing new tools, and posting relevant documents. PNAMP's outreach and communications efforts can be categorized into four areas: maintaining the PNAMP website, producing and disseminating the monthly news and meeting summary email, producing fact sheets which describe PNAMP and individual projects, and presentations to interested groups and organizations.

Throughout 2015, PNAMP Coordination Staff updated content on the PNAMP website. Most updates included tracking PNAMP and other meeting details (dates, locations, and online conference and phone information) and posting documents related to meetings and other PNAMP projects. Announcements and jobs openings of interest to the aquatic monitoring community were also posted on a regular basis.

For the past six years, PNAMP has distributed a monthly email to all participants that included a summary of upcoming meetings. In 2016, this monthly communication be updated, but will continue to include one or two short summaries highlighting the latest PNAMP news. The list of participants who receive the news and meeting summary currently contains 800 recipients and continues to grow.

Beyond communicating PNAMP's work via online resources, the Coordination Team participated in several outreach activities in addition to regular PNAMP activities. In 2015, the PNAMP Coordinator gave overview presentations to the follow audiences: BPA executives and staff, Northwest Power and Conservation Council executives and staff, the Columbia River Basin Federal Caucus, state natural resource agency directors, and USGS executives.

The PNAMP staff presented a series of training talks on MonitoringMethods.org and also gave several presentations describing PNAMP's online tools suite, MonitoringResources.org (see the above MonitoringResources.org summary for more details).

Steering Committee Activities

The PNAMP Steering Committee (SC) provides the science-policy interface between the Executive partners and project work teams, reviews work team progress, obtains resources needed to accomplish projects, and directs the activities of the Coordination Team. The SC provides assistance to PNAMP initiatives by participating in the formulation, development, and review of recommendations for activities of PNAMP work teams and integrating these activities with their own organizational activities. The SC facilitates the transfer of information between PNAMP and their respective organizations. By promoting communication among organizations, the SC strives to assure that monitoring plans and information are coordinated across the Pacific Northwest.

The SC is made up of representatives from the signatory partners (Appendix A). There are also several "courtesy members" that are invited to participate in SC meetings. Courtesy members are entities that are considering becoming a formal partner; their participation helps them understand the opportunities, responsibilities, and benefits of signatory membership. Courtesy members in 2015 included: Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Kootenai Tribe of Idaho, Nez Perce Tribe, Great Northern LCC, Shoshone-Bannock Tribes, Nisqually Tribe, Puget Sound Partnership. In 2015, we were delighted to see reinvigorated participation at the SC level by some signatory entities that had been less engaged in recent years. California Department of Fish and Game, NOAA Fisheries, U.S. Forest Service, and Oregon Watershed Enhancement Board are now actively participating on the SC. We are hoping to make similar progress in 2016 with U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and U.S. Bureau of Land Management. Better engagement from these partners would be beneficial to the leadership of the SC and PNAMP staff are formulating a plan to try and get better engagement from these partners. However, many of these entities do have staff engaged in projects or tasks; therefore, we believe PNAMP work is important to these entities.

In 2015, The Steering Committee met in January, April, July, and October. The purpose of these meetings was to track the progress of activities, discuss how new tasks or projects align with PNAMP's goals, and offer guidance when necessary. SC members also report these meetings are a valuable opportunity to network with their peers, who are responsible for monitoring activities in their respective agencies and tribes. These meetings also facilitated information exchange between SC members and work team leads. SC meetings were facilitated by the PNAMP Coordinator and the Coordination Team prepared materials before the meetings and notes following the meetings. Greater participation from Steering Committee members is necessary to sustain PNAMP's continuous evolution.

Adaptive Management and Lessons Learned

Federal, state, tribal, local, and private natural resource monitoring programs in the Pacific Northwest have evolved in response to different organizational mandates, jurisdictional needs, issues and questions. However, while some issues are unique to particular entities, PNAMP has learned there is much common ground. Where common ground exists, improved coordination can avoid duplication of effort and increase cost-effectiveness of expenditures. This cooperation also allows more timely and accessible information and increases the overall quantity and quality of scientific information used to inform public policy and resource management decisions. This common ground and cooperation is central to the PNAMP strategy and mission.

Though considerable progress has been made in some aspects of regional coordination, less progress has been made in others. For example, the Coordinated Assessments Projected has made significant progress towards improving the timeliness, reliability, flow, and transparency of salmonid population data necessary for regional assessments. However, due to a lack of equally clear mandates, significantly less progress has been made furthering those same goals for high-level habitat assessments. And while PNAMP efforts have helped to support improved regional data management standards and structures, much work remains to be done.

It is important to recognize that PNAMP successes are largely attributed to the in-kind participation from member organizations' staff and other interested parties. However, this volunteer approach, combined with the diverse interests of participants, presents many challenges. Although PNAMP has made progress, expectations about scope and pace of work need to be realistic given this framework. A fundamental ongoing challenge has been to balance PNAMP's resources with the level of shared interest in working on potential subject areas. There will always be many more areas of interest than there is the capacity to address them. Expectations of PNAMP members and others should be tempered with these realities, while recognizing that adjustments in approach would yield different results. Most importantly, consistent with PNAMP's guiding principles, PNAMP's expertise and limited resources must be focused on topics of the highest priority to decision-makers.

Improved coordination across the wide spectrum of monitoring efforts of shared interest (e.g., design and implementation, from local to Pacific Northwest scales) will only occur if commitments exist within and among the hierarchy of affected programs. As reflected in the membership of PNAMP, these include local, state, tribal, federal and other entities and programs. Unfortunately engagement at the Steering Committee level has declined in recent years, especially as PNAMP founding members retire and their organizations are slow to designate replacements. Renewed commitment from signatory partners and additional commitment from courtesy members to become signatory partners would strength PNAMP's ability to effect meaningful change.

While the mere existence of PNAMP represents a base level of commitment toward improved coordination, the specifics of how much coordination is sufficient for individual entities or how much coordination is attainable or sufficient to meet management expectations needs further clarification through interaction with and among PNAMP Executives.

Appendices

Appendix A. Entities signatory to the PNAMP Charter in 2015.

PNAMP Partners	PNAMP Steering Committee Rep	PNAMP Executive Network Representative
Bonneville Power Administration	Ben Zelinsky	Lorri Bodi VP Environment, Fish and Wildlife
California Department of Fish and Game	Kevin Shaffer	Neil Manji Northern Regional Manager
Columbia River Intertribal Fish Commission	Zachary Penney	Paul Lumley Executive Director
Confederated Tribes of the Colville Reservation	John Arterburn	Joe Peone Director, Fish and Wildlife Dept.
Environmental Protection Agency	Gretchen Hayslip	Dennis McLerran Regional Administrator
Idaho Department of Fish and Game	Tim Copeland	Jim Fredericks Chief of Fisheries
NOAA Fisheries	Greg Sieglitz	William Stelle, Jr. Regional Administrator
Northwest Indian Fisheries Commission	Bruce Jones	Mike Grayum Executive Director
Northwest Power and Conservation Council	Nancy Leonard	Tony Grover Director of Fish and Wildlife Division
Oregon Watershed Enhancement Board	Renee Davis	Tom Byler Executive Director
Pacific States Marine Fisheries Commission	Chris Wheaton	Randy Fisher Executive Director
U.S. Army Corps of Engineers	Vacant	Colonel Steven R. Miles, P.E. U.S. Army Commander and Division Engineer
U.S. Bureau of Land Management	Vacant	Jerome Perez State Director, Oregon/Washington
U.S. Bureau of Reclamation	Vacant	Lorri Gray Regional Director
U.S. Forest Service	Stephanie Miller	Kent Connaughton Regional Forester PNW Region
U.S. Geological Survey	Steve Waste	Max Ethridge Northwest Regional Director
Washington Department of Ecology	Jessica Archer	Rob Duff Environmental Assessment Program Manager
Washington Department of Fish and Wildlife	Dan Rawding	Phil Anderson Director
Washington Governor's Salmon Recovery Office & Recreation and Conservation Office	Keith Dublanica	Kaleen Cottingham Director

Appendix B. *Estimated hours contributed by entities to PNAMP meeting in 2015.*

Hours were estimated for each meeting attendee for every PNAMP meeting from January 1 to December 31, 2015. For teleconferences the meeting duration was used to estimate the contribution of time from each participant. For in-person meetings contributions were calculated as 1.5 times the meeting duration to help account for travel and prep time.

Entity	Total Hours	Hours for SC Only
Washington State Department of Ecology	155	14
US Geological Survey	153	29
Oregon Department of Fish and Wildlife	150	17
Washington Department of Fish & Wildlife	136	28
National Oceanic and Atmospheric Administration	128	40
Columbia River Inter-Tribal Fish Commission	124	80
Northwest Power and Conservation Council	122	86
US Fish and Wildlife Service	113	17
Pacific States Marine Fisheries Commission	110	41
Idaho Department of Fish and Game	95	65
Sitka Technology Group	77	
City of Longview	71	
Nez Perce Tribe	66	
City of Vancouver	60	
Bonneville Power Administration	59	20
Washington Governor's Salmon Recovery Office	54	54
Confederated Tribes and Bands of the Yakama Nation	52	32
Washington State Department of Natural Resources	50	
Oregon Watershed Enhancement Board	48	44
Clark County	45	
Confederated Tribes of the Umatilla Indian Reservation	32	
Lower Columbia Estuary Partnership	31	
US Environmental Protection Agency	30	27
Oregon Department of Environmental Quality	28	
Oregon State University	26	
Fish First	26	
US Forest Service	25	16
Fish Passage Center	25	
Oregon Department of Environmental Quality	22	2
Colville Confederated Tribes	22	12
Confederated Tribes of the Warm Springs Reservation	21	
Puget Sound Partnership	19	19
Northwest Indian Fisheries Commission	18	17
Washington State Department of Transportation	18	
Grande Ronde Tribes	17	
Oregon Department of Forestry	16	
California Department of Fish and Wildlife	15	11
City of Battle Ground	14	
Plas Newydd LLC	14	
National Council for Air and Stream Improvement	14	
Snake River Salmon Recovery Board	12	
Conservation Biology Institute	11	

Appendix B. Continued. Estimated hours contributed by entities to PNAMP meetings in 2015.

Entity	Total Hours	Hours for SC Only
ICF International	11	
Unknown	11	
City of Kelso	11	
Tetra Tech EC, Inc.	10	
US Bureau of Land Management	10	
Kitsap County	9	
City of Washougal	9	
Lower Columbia Fish Recovery Board	9	
Port of Longview	9	
US Bureau of Reclamation	9	
Utah State University	6	
US National Park Service	6	
Western Forestry and Conservation Association	6	
Washington State Conservation Commission	5	
Cowlitz Tribe	5	
Freshwater Trust	5	
Resource Supply, LLC	5	
Zerion Software	5	
University of British Columbia	4	
Alaska Department of Fish and Game	4	
Aquatic Biology Associates Inc	4	
EcoAnalysts, Inc	4	
Environmental Protection Agency	4	
Michigan State University	4	
Quinnault Indian Nation	4	
Retired	4	
Rhithron Associates, Inc	4	
Smith-Root	4	
University of Montana	4	
Cowlitz County	4	
Atlantic Coast Cooperative Statistics Program	4	
GPS World	3	
Bat Conservation International	3	
City of Bellingham	3	
Cordillera Consulting	3	
Integral Consulting Inc.	3	
Quantitative Consultants Inc.	3	
Statistical Design	3	
Idaho State University	3	
University of Washington	3	
Upper Columbia Salmon Recovery Board	3	
Discovery Management Group, LLC	2	
Colorado Parks and Wildlife	2	
Georgia Department of Natural Resources	2	
Kalispel Tribe	2	
Southeast Aquatic Resources Partnership	2	
Farmers' Conservation Alliance	2	

Appendix B. Continued. Estimated hours contributed by entities to PNAMP meetings in 2015.

Entity	Total Hours	Hours for SC Only
King County Department of Natural Resources and Parks	2	
Northwest Association of Environmental Professionals	2	
Ross Strategic	2	
US Department of Agriculture	2	
World Steward	2	
Birchdale Ecological, Ltd	1	
California Ocean Science Trust	1	
Clackamas River Basin Council	1	
Clemson University	1	
Creative Resource Strategies	1	
GeoS Institute	1	
Hamer Environmental	1	
Iowa Department of Natural Resources	1	
Klamath Basin Rangeland Trust	1	
LiveWater LLC	1	
Montana Fish, Wildlife & Parks	1	
Pierce County	1	
Real Time Research	1	
Ross Taylor and Associates	1	
South Fork Research	1	
Stillwater Science	1	
The Nature Conservancy	1	
Universities Consortium on Columbia River Governance	1	
University of Idaho	1	
University of Missouri	1	
University of Oregon	1	
Washington State University	1	
Total	2580	670

Appendix C. List of documents referenced in this report and associated hyperlinks.

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- PNAMP Charter: http://www.pnamp.org/charter

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- PNAMP website: http://www.pnamp.org/

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- PNAMP website: http://www.pnamp.org/

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- Monitoring Resources PNAMP project page: http://www.pnamp.org/project/3875
- Monitoring Resources Application: https://www.monitoringresources.org/Resources/Home/Index

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- Monitoring Resources Document Methods page: https://www.monitoringresources.org/Document/Method/Index
- Monitoring Resources Document Protocol page: https://www.monitoringresources.org/Document/Protocol/Index

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- Site Manager Master Sample application: https://www.monitoringresources.org/Sites/Master/Index
- Site Manager User Sample File application: https://www.monitoringresources.org/Sites/User/Index

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- Monitoring Explorer application: https://www.monitoringresources.org/Sites/Explorer/Index

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- MMX PNAMP project page: http://www.pnamp.org/project/4849
- MMX Draft Standard: http://www.pnamp.org/document/4854
- 2008 PNAMP HLI Report: http://www.pnamp.org/document/2023
- 2009 PNAMP HLI Report: http://www.pnamp.org/document/2060

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- Effectiveness Monitoring PNAMP project page: http://www.pnamp.org/project/3137

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- Method Review process document: http://www.pnamp.org/document/3885
- Backpack Electrofishing Method Template: https://www.monitoringresources.org/Document/Method/Details/5404
- Boat Electrofishing Method Template: https://www.monitoringresources.org/Document/Method/Details/5405
- Barge Electrofishing Method Template: https://www.monitoringresources.org/Document/Method/Details/5406

- Method Review PNAMP project page: http://www.pnamp.org/project/3131

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- ISTM Habitat PNAMP project page: http://www.pnamp.org/project/3152
- Phase 1 report for the Lower Columbia Habitat Status and Trends Monitoring project: http://www.pnamp.org/document/4244
- Phase 2 draft final design report for the Lower Columbia Habitat Status and Trends Monitoring project: http://www.pnamp.org/document/4997

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- Data management webinar series: https://my.usgs.gov/confluence/display/cdi/2015+Data+Management+Webinar+Series
- Data Management PNAMP project page: http://www.pnamp.org/topics/2
- CA DETs and supporting materials: http://www.streamnet.org/caxct.html

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- Coordinated Assessments PNAMP project page: http://www.pnamp.org/project/3129

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- John Day Pilot Assessment: http://pnamp.org/document/5309
- NWSTE Project Page: http://www.pnamp.org/project/4210
- "Moving Beyond Water Quality Indices: How Can Macroinvertebrate Data from Fish Habitat Monitoring Programs Inform Food Web Analyses?" symposium abstracts: https://afs.confex.com/afs/2015/webprogram/Session3513.html