pacific northwest aquatic
monitoring partnership

Strategy for Coordinating Monitoring of Aquatic Environments in the Pacific Northwest

(Northern California, Oregon, Idaho, Washington)

Revised April 2019

Pacific Northwest Aquatic Monitoring Partnership Members

Tribal Entities

Columbia River Intertribal Fish Commission

Confederated Tribes of the Colville Reservation

Northwest Indian Fisheries Commission

State Agencies

California Department of Fish and Wildlife

Idaho Department of Fish and Game

Oregon Watershed Enhancement Board

Washington Recreation and Conservation Office

Washington Department of Ecology

Washington Department of Fish and Wildlife

Washington Governor's Salmon Recovery Office

Federal Agencies

Bonneville Power Administration

National Oceanic and Atmospheric Administration Fisheries

U.S. Army Corps of Engineers

U.S. Bureau of Land Management

U.S. Bureau of Reclamation

U.S. Environmental Protection Agency

U.S. Forest Service

U.S. Geological Survey

Regional Entities

Northwest Power and Conservation Council

Pacific States Marine Fisheries Commission

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Introduction

Most federal, state, tribal, and private natural resource monitoring programs in the Pacific Northwest have grown in response to different organizational mandates, jurisdictional needs, issues, and questions. Consequently, relatively unique independent monitoring efforts that address questions and management problems important to each entity have evolved. While some issues are unique to particular agencies, there are many common needs. Where commonalities exist, reducing duplication of effort and sharing information will help create efficiencies and should result in more cost-effective programs.

The use of consistent approaches and protocols in monitoring programs across the region can result in the collection of information in a manner that can be more easily shared and cumulatively support broader policy and management objectives. By coordinating monitoring efforts, the region can more effectively share resources and information and provide increased scientific credibility, cost-effective use of limited funds, and greater accountability to stakeholders. Recognizing this situation, a broad range of state and federal government agencies, tribal organizations, and non-governmental organizations voluntarily formed the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) in 2004. The purpose of PNAMP is to provide a forum for coordinating state, federal, and tribal aquatic monitoring programs.

PNAMP's organizational structure (Figure 1) includes staff to serve as coordinators and facilitators for specific topics of interest, a Steering Committee made up of representatives from the organizations that are signatory to the Charter, and subject matter experts and stakeholders participating in project teams and tasks. The PNAMP Steering Committee provides the science-policy interface between the executive network and project work teams and is responsible for communicating their respective organizations' work and needs to PNAMP, as well as communicating PNAMP progress and challenges to their organizations. The Steering Committee directs the activities of PNAMP Staff and helps obtain resources to accomplish projects. The Steering Committee aids PNAMP initiatives by participating on project leadership teams and assisting in the formulation, development, and review of recommendations resulting from project tasks.

Support for regional coordination of aquatic monitoring comes from the governors of the Northwest states, Congressional oversight of recovery programs, federal Endangered Species Act Biological Opinions relevant to the region, and regional independent scientific review panels (Action Agencies 2005, Boydstun and McDonald 2005, Kershner et al. 2004, Reeves et al. 2004, and WMOC 2002). Many entities working in Oregon, Washington, Idaho, and northern California have signed the PNAMP Charter (PNAMP 2004a) and many more entities participate in PNAMP activities and tasks.

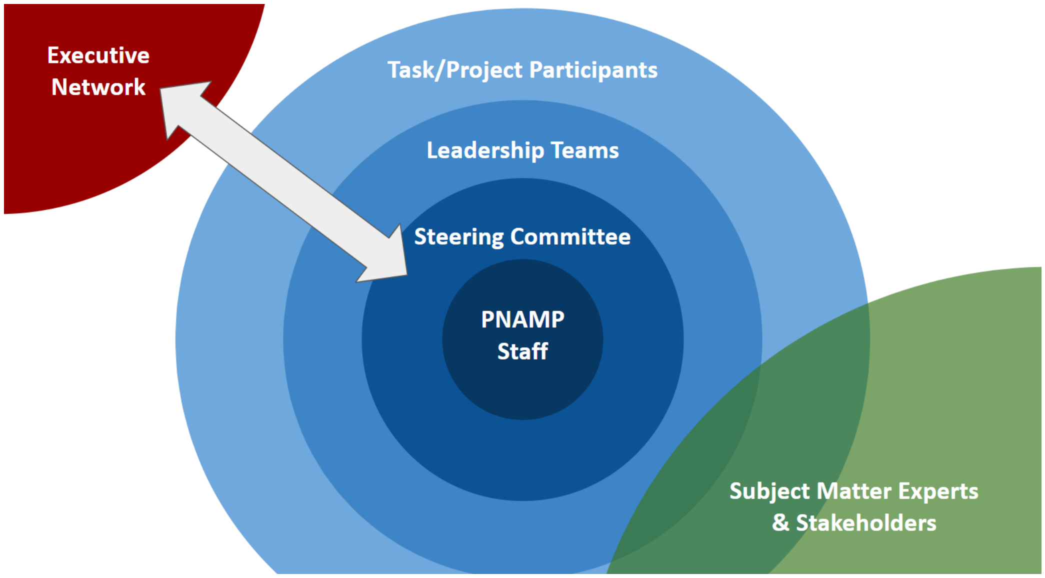

Figure 1. PNAMP's organizational structure. See text above for further details.

Monitoring information is collected and analyzed at different scales in response to performance metrics and management questions at different hierarchical levels of detail. This hierarchy of information can be visualized as a pyramid with lower levels of information supporting higher levels of reporting and analyses (Figure 2). PNAMP is responsive to partners' needs with respect to policy and management-level decision making and strives to help partners coordinate information up and down this pyramid, as well as common information across programs within one level of the pyramid. The PNAMP Strategy includes objectives aimed at identifying management questions and supporting monitoring information to be coordinated at these various levels of scale.

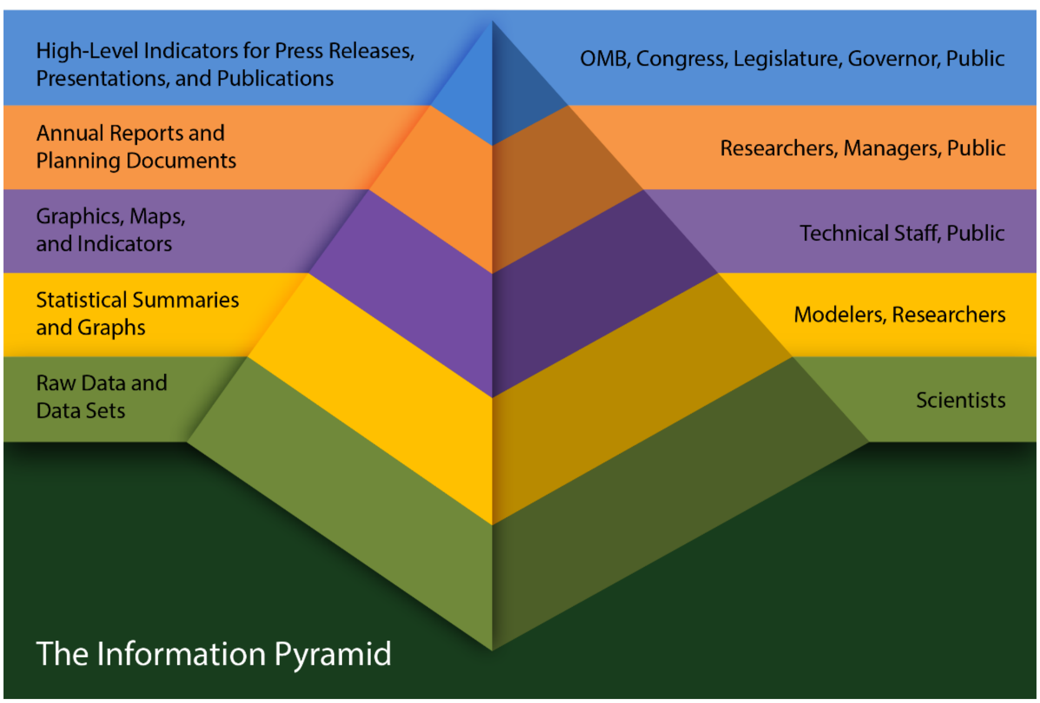

Figure 2. In the monitoring information pyramid, examples of types of information are on the left and related users or generators of that information are represented on the right.

Since 2004, PNAMP has been working to facilitate a coordinated approach to regional monitoring through the development and advancement of recommendations and agency level agreements that are considered for adoption by participating agencies. Starting with the PNAMP *Recommendations for Coordinating State, Federal, and Tribal Watershed and Salmon Monitoring Programs in the Pacific Northwest* (PNAMP 2004b) and an initial planning Strategy in 2005 (PNAMP 2005), PNAMP has developed documents to facilitate and advance a coordinated approach to regional monitoring, provide a vision for coordination, and guide the development of work plans. Approximately every five years PNAMP holds a strategic planning workshop to review and revise the strategy document to reflect current goals and objectives and to highlight the linkage between essential aquatic monitoring components within an adaptive management framework. This document reflects the most recent version of the strategy that resulted from the September 2018 PNAMP Steering Committee Strategic Planning Workshop.

Mission

PNAMP's mission is to provide a forum and functions to enhance the capacity of multiple entities to collaborate to produce an effective and comprehensive network of aquatic monitoring programs in the Pacific Northwest based on sound science designed to inform public policy and resource management decisions.

Goals

The members of PNAMP recognize there are many challenges to successful coordination of monitoring programs. Support of the following goals at the policy level will help participating agencies recognize common program elements and objectives:

- Improve communication among monitoring programs across state, tribal, and federal organizations.
- Advance access and understanding of scientific information needed to inform resource policy and management questions and decisions.
- Seek efficiencies and cost-effectiveness across monitoring programs through compatible and cooperative monitoring efforts.
- Promote science-based credibility of monitoring and assessment efforts.
- Share resources and information among monitoring programs across state, tribal, and federal organizations.

Objectives

To meet the goals outlined above and help fulfil its mission, the PNAMP Steering Committee has identified 27 objectives to guide PNAMP's work over the next five years. In the following pages the objectives are organized using PNAMP's adaptive management monitoring wheel as a conceptual framework. This conceptual framework is intended to clarify the relationships between the identified objectives and the diverse array of monitoring activities that are happening throughout the region and identifies eight elements that represent focal areas for PNAMP (Figure 3).

The eight elements and associated objectives described below address key areas of regional coordination and together define the PNAMP Strategy. The design and implementation of the elements and objectives is expected to make coordination of monitoring efforts more effective, efficient, and meaningful. Listed under each element are objectives that describe how we will achieve the high-level ideas embodied by the elements. Though all objectives are considered necessary to meet PNAMP goals, over the next five years some objectives are considered a higher priority than others (see Appendix). Under each element, objectives are listed from highest to lowest priority.

PNAMP's specific actions that will be undertaken to accomplish the objectives will be tracked in annual work plans as projects and tasks. Through the Steering Committee, PNAMP intentionally connects this Strategy to partners' management and policy decision making processes to ensure the partnership is adapting and responding to needs as they arise.

Figure 3. The conceptual framework for PNAMP's 5-year strategic plan, based on the adaptive management monitoring wheel. The framework identifies eight elements that represent focal areas for PNAMP and is intended as a way to organize the objectives and clarify the relationships to the diverse array of monitoring activities that are happening throughout the region.

Element 1. Develop and Maintain a Monitoring Coordination Framework for the Region

Element 1 is depicted as the outer ring of the monitoring wheel consisting of the “three Cs” - collaboration, coordination, and communication – which are the essential components of the monitoring coordination framework. The three Cs hold together the remaining seven interconnected elements at the heart of the conceptual framework.

Collaboration, coordination, and communication, within and among aquatic monitoring organizations, is necessary to effectively and accurately address management questions. Short term benefits of the three Cs include resource and information sharing, enhanced assessment tools that are more widely applicable, increased quality and quantity of data and information, and reporting consistency. In the longer term, the three Cs result in monitoring that is consistent, comparable, scientifically defensible, and information that is accessible and facilitates sound decision making by all stakeholders (Markowitz et al. 2003).

Element 1 Objectives

1.1 Promote scientific discussions and opportunities for sharing information between researchers, managers, and policy makers about existing tools and resources for aquatic monitoring topics including: data management, design, analysis, collection, reporting, and field data capture devices
1.2 Provide a forum for partner collaboration with respect to guidance and support for the adaptive management process
1.3 Promote and support clear, consistent documentation of project information and associations to the data
1.4 Support integration of monitoring programs in order to: identify organizations’ monitoring responsibilities, how best to combine data, find causal links, help practitioners determine what they want to do and how to do it (post data collection)

Element 2. Coordinate Identification of Monitoring Goals, Objectives, and Regionally Agreed Upon Indicators

A critical first step in developing a monitoring project or program is to clearly define the goals and the objectives needed to achieve the goals. Ultimately, the goal of monitoring is to inform management decisions and objectives and measurements of how to meet the goals. Monitoring projects and programs will often address multiple goals and objectives to try to inform a broad scope of management decisions. However, monitoring designs may not be able to achieve all objectives simultaneously. Given that budgets are limited, it is important to coordinate on local and regional scales to plan for upcoming monitoring activities, so we can more effectively address management questions.

PNAMP will help identify the common goals and objectives of regional aquatic monitoring programs and projects through facilitated discussions that support identification of key management questions and development of recommended lists of common indicators.

Element 2 Objectives

2.1 Coordinate the development of standard lists of regional scale indicators, related to but not limited to the following topics: watershed condition, species/lifestage status/abundance, habitat status

2.2 Facilitate discussions to identify key management questions and information needed to inform them; identify organizations with similar needs

Element 3. Support Development and Documentation of Compatible Monitoring Designs

In designing a monitoring program, most researchers will be faced with limited budgets. The challenge is to optimize the allocation of sampling efforts across a potential set of spatial and temporal units during the overall study period. It can also be important to allocate sampling to a finer scale during each data collection event both spatially and temporally to obtain an adequate estimate of the metric and/or to evaluate the variation introduced by data collection.

Developing a monitoring design involves an iterative process where researchers must balance the requirements of the following four design components:

- Spatial design (how we select monitoring sites)
- Temporal design (how we select when we monitor)
- Response design (what, how, where and when attributes of interest will be measured)
- Inference Design (how we analyze the data)

PNAMP will help monitoring practitioners develop monitoring designs that support the goals and objectives of their program.

Element 3 Objective

3.1 Provide access to and education and outreach for statistical tools, resources, and guidance for design development that will advance partner capacity to share information about design details

Element 4. Coordinate Regional Data Collection Best Practices

Data collection is the implementation step of a monitoring program or project and must be underpinned by clearly articulated goals and objectives and a strong monitoring design. Once this foundation is built, it is essential that project staff make every effort to implement the planned design in the field. In contrast to the Design step, there is not a defined process for selecting specific data collection methods. Monitoring funding is scarce, which heightens the importance of using proven data collection approaches and procedures that are built on a solid design foundation to increase the project's value and likelihood of funding.

PNAMP will emphasize the need to use consistent or standardized methods and well- designed Quality Assurance and Quality Control (QA/QC) procedures, consistent metrics, and standardized metadata templates, which ensure that data collected can be more effectively shared or aggregated.

Element 4 Objectives

4.1 Facilitate documentation of data collection methods through consistent terminology and online tools. Develop and share standardized set of attributes and methods for collecting field data and to derive indicators.
4.2 Coordinate across programs to collect common attributes
4.3 Encourage the development of more simplified, streamlined data collection processes, and reduced data processing time between collection and QA/QC
4.4 Encourage partner entities to coordinate their investigations to reduce duplication and costs

Element 5. Coordinate Regional Data Management and Sharing Best Practices

Coordinating regional data management and sharing best practices helps to identify solutions that improve documentation, access, sharing, and coordination among different collectors and users of fish and aquatic habitat monitoring data. It provides a data reporting foundation that would lead toward coordinated agency reporting, uniform monitoring protocols, and improved data quality and quantity. Data collection, and interpretation of the resulting data, can only be fully realized through an effective approach to managing data.

The overall PNAMP data management goal is to assist monitoring practitioners in the identification, development, and consistent use of data standards as they relate to the monitoring of fish and aquatic habitat. PNAMP will facilitate strategic conversations among data collectors, data stewards, and data users to promote best practices within the data life cycle for regional monitoring efforts. PNAMP will support development of products and guidelines that result in a strong data management foundation of monitoring programs, which ultimately allows more effective information sharing and communication of monitoring results.

Element 5 Objectives

5.1 Coordinate regional agreement on standard data reporting and access formats for metrics and indicators identified by partners
5.2 Coordinate information sharing so that organizations can answer key management questions by aggregating results across different spatial and/or temporal scales and gaps in monitoring can be addressed

5.3 Interact with regional monitoring programs to provide outreach, education, and training to support standard, programmatic best practices for data management
5.4 Facilitate connections among data repositories, project tracking systems, and PNAMP and partners' online tools (help connect metadata to data collected)
5.5 Facilitate development and share data management standards and strategies; ensure new guidance aligns with existing national, state, regional, and partner-based standards

Element 6. Facilitate Forum for Data Analysis Best Practices

Many researchers would benefit from more detailed discussions or training on topics related to statistical techniques for summarizing data associated with monitoring. To be valuable as a scientific contribution, results must be summarized, analyzed, and interpreted in order to help decision makers and the public understand the results relative to key management questions. By supporting a forum to consider current techniques for analysis, synthesis, and interpretation of data to inform high level reporting, PNAMP can benefit the monitoring community and allow for more effective communication to funders, managers, and the public.

PNAMP will promote opportunities for technical training sessions and facilitate information sharing related to best statistical practices for analyzing and synthesizing aquatic monitoring data.

Element 6 Objectives

6.1 Facilitate discussions about tools available for analyzing data
6.2 Support sharing and publication of analytical methodologies
6.3 Facilitate discussions of analytical steps for estimating high level indicators, other indicators, and metrics

Element 7. Coordinate Reporting of Results in a Consistent Manner Throughout the Region

Data collected by monitoring programs are often complex and technical. It is necessary for researchers to communicate their monitoring results clearly and effectively so that the results can be used in multiple venues, potentially by people from a variety of backgrounds. In addition, it is important for individual monitoring programs to report results in a consistent manner to allow for clear communication about progress and performance and support adaptive management across the Pacific Northwest with respect to regional salmon recovery and aquatic habitat monitoring. Consistent reporting will allow programs to more easily identify possibilities for alignment and integration, and opportunities to realize efficiencies in current and future work.

PNAMP will support efforts to enhance efficient and consistent reporting of results by monitoring programs. More consistent reporting will support decision makers and other users in making informed decisions.

Element 7 Objectives

7.1 Identify who is reporting what indicators, when they have to report them, and identify common information needs

7.2 Convene forum of researchers and managers who collect or are interested in similar data types or indicators to discuss how to clearly and consistently convey information to interested parties

7.3 Facilitate development of a short list of indicators common to the region that can be integrated to produce summarized reports suitable for describing regional progress to the public and to the highest levels of government

7.4 Facilitate sharing monitoring results from PNAMP Partner monitoring programs relevant to management and decision making

Element 8. Coordinate a Review of Monitoring Programs in the Region

PNAMP partners are interested in coordinated evaluations of monitoring program results and how well they meet regional monitoring needs. As directed by partners, PNAMP will support review of monitoring programs with the understanding that recommendations resulting from these reviews will be utilized by each participating entity per their respective jurisdictions and mandates.

Element 8 Objectives

8.1 Facilitate development of a process to align monitoring program priorities and key management questions

8.2 Convene forum to identify and prioritize additional needs with respect to data analysis and regional reporting

8.3 Coordinate across regional organizations to describe roles, responsibilities, and commitments of various natural resource agencies in meeting data needs for adaptive management

8.4 Facilitate discussions to determine a process to verify and recommend regional performance benchmarks for each monitoring indicator or suite of indicators

Conclusion

This 5-Year strategic plan lays the foundation and guides PNAMP's focus for coordinating aquatic monitoring programs in the region. Steering Committee members and PNAMP staff will work together to develop and implement work plans that support the elements and objectives of the Strategy. Project leadership teams will ensure work plans align with and meet strategic plan goals and objectives and ensure necessary resources are adequate to successfully implement the work plans.

This 5-year strategic plan will be reviewed every five years through a Steering Committee strategic planning process initiated by a Steering Committee Strategic Planning Workshop and will be updated as significant need justifies.

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Appendix

Prioritized list of the 27 objectives in this document. Scores are the result of dot voting at the 2018 PNAMP Steering Committee Strategic Planning Workshop. Higher scores indicate higher priority.

Objective	Description	Score
7.1	Identify who is reporting what indicators, when they have to report them, and identify common information needs	14
8.1	Facilitate development of a process to align monitoring program priorities and key management questions	13
4.1	Facilitate documentation of data collection methods through consistent terminology and online tools. Develop and share standardized set of attributes and methods for collecting field data and to derive indicators.	12
5.1	Coordinate regional agreement on standard data reporting and access formats for metrics and indicators identified	11
3.1	Provide access to and education and outreach for statistical tools, resources, and guidance for design development that will advance partner capacity to share information about design details	10
1.1	Promote scientific discussions and opportunities for sharing information between researchers, managers, and policy makers about existing tools and resources for aquatic monitoring topics including: data management, design, analysis, collection, reporting, and field data capture devices.	9
5.2	Coordinate information sharing so that organizations can answer key management questions by aggregating results across different spatial and/or temporal scales and gaps in monitoring can be addressed	7
6.1	Facilitate discussions about tools available for analyzing data	5
7.2	Convene forum of researchers and managers who collect or are interested in similar data types or indicators to discuss how to clearly and consistently convey information to interested parties	5
7.3	Facilitate development of a short list of indicators common to the region that can be integrated to produce summarized reports suitable for describing regional progress to the public and to the highest levels of government	5
1.2	Provide a forum for partner collaboration with respect to guidance and support for the adaptive management process	4
4.2	Coordinate across programs to collect common attributes	2
6.2	Support sharing and publication of analytical methodologies	2
8.2	Convene forum to identify and prioritize additional needs with respect to data analysis and regional reporting	2
8.3	Coordinate across regional organizations to describe roles, responsibilities, and commitments of various natural resource agencies in meeting data needs for adaptive management	2
1.3	Promote and support clear, consistent documentation of project information and associations to the data	1
2.1	Coordinate the development of standard lists of regional scale indicators, related to but not limited to the following topics: watershed condition, species/lifestage status/abundance, habitat status	1
5.3	Interact with regional monitoring programs to provide outreach, education, and training to support standard, programmatic best practices for data management	1
8.4	Facilitate discussions to determine a process to verify and recommend regional performance benchmarks for each monitoring indicator or suite of indicators	1
1.4	Support integration of monitoring programs in order to: identify organizations' monitoring responsibilities, how best to combine data, find causal links, help practitioners determine what they want to do and how to do it (post data collection)	0

Objective	Description	Score
2.2	Facilitate discussions to identify key management questions and information needed to inform them; identify organizations with similar needs	0
4.3	Encourage the development of more simplified, streamlined data collection processes, and reduced data processing time between collection and QA/QC.	0
4.4	Encourage partner entities to coordinate their investigations to reduce duplication and costs	0
5.4	Facilitate connections among data repositories, project tracking systems, and PNAMP and partners' online tools (connect metadata to data collected)	0
5.5	Facilitate development and share data management standards and strategies; ensure new guidance aligns with existing national, state, regional, and partner-based standards	0
6.3	Facilitate discussions of analytical steps for estimating high level indicators, other indicators, and metrics	0
7.4	Facilitate sharing monitoring results from PNAMP Partner monitoring programs relevant to management and decision making	0