StreamNet 2019
Annual Report

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II. Executive Summary

The Pacific States Marine Fisheries Commission (PSMFC) hosts the StreamNet project and its databases, which provide access to regional fish data by maintaining a coordinated, standardized, web-based distributed information network. The need for regionally coordinated and readily accessible data has been identified by the Bonneville Power Administration (BPA), the National Oceanic and Atmospheric Administration Fisheries Program (NOAA), and the Northwest Power and Conservation Council (NPCC). To ensure access to these data, StreamNet supports technical staff within the agencies (data stewards) who compile and submit these data in standardized, publicly accessible, regional data repositories. StreamNet also collaboratively leads and coordinates a number of initiatives to assure a regional approach to data management among federal, state and tribal fish and wildlife agencies.

This annual report summarizes the work performed during calendar year 2019, which spans fiscal years 2019 and 2020. StreamNet's FY2019 (Oct 1 2018 – Sept 30 2019) budget was reduced as agreed to during the June 2018 StreamNet Executive Committee meeting to assist BPA in finding budget savings to address their FY19 budget concerns. This BPA reduction was also applied in FY20 (Oct 1 2019 – Sept 30 2020). The budget reduction to assist BPA prevented restoration of the StreamNet budget to FY 17 funding levels as was described in the original FY19 budget plan. As a result, partner agencies did not receive the expected budget increases. This lower budget resulted in reduction of partners' staff time allocated to StreamNet which affected delivery of data to the Coordinated Assessments Exchange (CAX), fish distribution data set, and response to in-year user requests. Similarly, this budget reduction also resulted in reduction in PSMFC staff from 4 FTE to 2.8 FTE with portions of PSMFC staff shifted to other, non-BPA funded PSMFC contracts. Like most Fish and Wildlife Program projects, StreamNet has received no cost of living or inflation adjustments for over 10 years. StreamNet partners' estimated cost share amount for FY19 support of StreamNet was about $365,000.

During calendar year 2019 StreamNet continued to implement the Coordinated Assessments (CA) with the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and engaged in collaborative efforts with all partners to advance the quality of shared data. Below is a highlight of these 2019 accomplishments:

- **Coordinated Assessments** – the StreamNet Executive Committee adopted the revised Five Year Plan for CA (adopted August 1, 2019). This document provides prioritization guidance that informs CA and StreamNet activities. For CA we continued to focus on the BPA identified priority populations and their related high-level indicators (HLIs) and metrics required for BPA progress reports on implementation of the Federal Columbia River Power System Biological Opinion. Priority trend data for NPCC and related to CA population HLIs were also addressed in 2019 as resources permitted.
- **Improvement in Data Systems** – StreamNet subcontracts with partner tribal and state agencies all contributed to development and improvement of internal agency/tribal data storage systems in 2019. A one-time NOAA funding opportunity during FY20 that began October 1, 2019 also allowed StreamNet to aid in the advancement of data sharing capacity from the Shoshone-Bannock Tribes, Confederated Tribes of Warm Springs, and the Confederated Tribes and Bands of the Yakama Nation through one-time subcontracts started late in CY2019. This investment advances progress towards the long-term goal of developing agency capacity to provide data in the regional standard and share these data via web services and/or to transfer these to StreamNet via web services.

- **Increased Data Conversion Efficiencies** – focus continued to be on increasing the speed and efficiency of data conversion to the regional data exchange standard, and then submission to the StreamNet hosted databases. StreamNet staff, as requested by partners in 2018, began development of the filter-able trend application programming interfaces to share "trend" data that are related to CA populations.
- **Data Trends** – updates of prioritized CA data trends and traditional data such as those related to the CA or informing the NPCC Program reporting tools were completed as partner agency time permitted.
- **StreamNet Data Store** – staff continued to maintain the Data Store. The Data Store serves as a data repository for data collected by any BPA funded project, especially those that do not have another identified repository. The Data Store is a secure back-up location for data storage for projects throughout the region and provides access to data that are not of data types in the StreamNet databases.
- **System of Record** – StreamNet is now recognized by BPA as the System of Record for fish facilities and the StreamNet fish distribution layers, providing a comprehensive location for Columbia River basin information from partners.
- **Guidance on Citing Aquatic Monitoring Data Set** – StreamNet co-authored with the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and NOAA Fisheries Service West Coast Region West Coast Region a white paper on citing aquatic monitoring data sets (released August 15, 2019). This white paper provides guidance for the proper crediting of data providers, and metadata recommendations for multi-contributor data sets, making it a valuable resource for contributors and users of the CAX web-based query.
- **Workshops** – StreamNet staff assisted PNAMP with the planning and organization of the Smolt Estimation and Analytics Workshop which was held November 6-7, 2019. StreamNet staff are also assisting PNAMP in the organization of the Emerging Technologies Workshop planned for November 2020 or later. [At the time of writing, the spread of the COVID-19 virus is interfering with scheduling events.]
- **Recommendations**
    - *StreamNet Members* – lack of funding restricts the ability of many tribes to participate directly in the StreamNet Committees, thus expansion of the StreamNet Committees and engagement in the CA requires additional resources.
    - *Budget* – implement NPCC 2019 budget recommendation to support implementation of the project as recommended by the NPCC and as outlined in the Five-Year CA Plan.
    - *Data Stewards* – continue support of embedded data management staff paid for through StreamNet as these data stewards are instrumental in assisting data flow and ensuring that relevant BPA-funded data are submitted on a regular basis to the StreamNet database.
    - *System of Record* – establish StreamNet as the System of Record for NPCC Program, aligning with BPA on this matter, and thus ensuring consistency of information across BPA and NPCC as well as other partners.
    - *CA* – expand CA data content to support regional reporting both in terms of data categories and geographic scope.
    - *Metadata* – document information about data sets, including analysis approaches, to ensure that the documentation and the data needed to inform future assessment/analytical processes are accessible and stable overtime.

III. Introduction

The need for effective and timely access of information to inform regional decision-making continues to be prominent in the Columbia River basin and the Pacific Northwest as a whole. Specifically, the Bonneville Power Administration (BPA), the National Oceanic and Atmospheric Administration Fisheries Program (NOAA), and the Northwest Power and Conservation Council (NPCC) have all identified an ongoing need for regionally coordinated, securely stored, and readily accessible data to inform their reporting and decision-making processes. Furthermore, the Northwest Power Act, which established the NPCC, calls for decisions to be made using the best available science, which requires the best available information. StreamNet provides regional standardization and access to data throughout the Columbia River basin through development and maintenance of regional data repositories for fish and habitat.

A. Project Background

StreamNet is a collaborative data sharing project that works among the federal, state and tribal agencies to locate, assemble, and share, in a standardized manner, specific data and indicators from the local scale to inform regional needs. StreamNet also has an important role in archiving data sets and providing access to historical information, especially those that support policy decisions such as the NPCC's Protected Areas, system and subbasin planning data, wildlife Habitat Evaluation Procedure (HEP), and US Congress funded Hatchery Reform Group and Hatchery Scientific Reform Group (HSRG) reports and data sets. Data submitted to StreamNet have been recently focused on the Columbia Basin but began as region-wide coverage and may soon find itself evolving back to the region-wide coverage through the CA. To properly address regional reporting and decision-making processes there is an ongoing need to include information from other areas of the Pacific States, such as for the NPCC's Protected Areas and NOAA 5-year status reviews for listed salmonids. Information from outside the basin is also submitted to StreamNet when it is more efficient during the data submittal process because the geographic coverage for many of StreamNet's partners overlap the CRB but extends well beyond its boundaries. The overarching goal of StreamNet is to make river-related information collected in the Pacific States, with an emphasis on the Columbia River basin, standardized and accessible, in order to inform management questions and strategies (Figure 1). The data disseminated represent primary fish related data, regardless of the funding sources responsible for supporting the work of field collection. Thus, all data of a given type are included, both those paid for under the BPA funded Fish and Wildlife Program and similar data that are obtained based on other funding. This is important because in order to conduct assessments or monitor population status and trends, all data relevant to each population must be used, regardless of funding source or agency collecting the data.

Figure 1: StreamNet focuses its data sharing efforts on data within the Columbia River basin. However, data from other Pacific States are included as well to better support partners' information needs such as the NPCC Protected Areas and NOAA's 5-year salmon and steelhead status assessments.

The genesis of StreamNet was the call for standardized information to support the NPCC's 1984 Columbia River Basin Fish and Wildlife Program (Program) and 1983 Northwest Conservation and Electric Power Plan (Plan) Hydro Assessment Study (HAS) to document the environmental health and energy potential of the basin's rivers. At that time, when StreamNet began in 1983 albeit under a different name, it was intended to be the region's Rivers Information System. The HAS was a cooperative regional effort by the BPA, the NPCC, the four Northwest states, the region's Indian tribes, and Federal land management agencies. The goal of this effort was to assess the significance of the region's rivers in a standardized fashion with the public's input, and to document those results. The HAS consisted of three distinct, coordinated efforts. For one, BPA, the NPCC, and the U.S. Army Corps of Engineers cooperated to develop the Pacific Northwest Hydropower Data Base and Analysis System (NWHS). For another, the NPCC led the effort to design the region's first anadromous fish data system called the Coordinated Information System (CIS; 1987 Program states needed database content and 1992 Program section 7.6 describes CIS). For the third, BPA began coordinating the inventory and analysis work on the remaining environmental categories, called the Pacific Northwest Rivers Study (PNWRS). Data generated by these efforts covered all four states (comprehensive) and contained the same data elements for each state (consistent structure and content). The HAS efforts resulted in detailed natural resource data sets for the region and the technical and administrative infrastructure to ensure the maintenance and use of the information housed in the Northwest Environmental Database (NED) and in the Coordinated Information System (CIS). These cooperative data collection efforts spanned across agency and state lines with information updates transmitted from the states to the regional system biannually. Source data were maintained at the state level to ensure accuracy and ties to other state data collection efforts.

StreamNet originated following the integration of: the Coordinated Information System (CIS) and the Northwest Environmental Database (NED), with the NED having previously integrated data from the Hydro Assessment Study (HAS), specifically data from the Northwest Hydropower Data Base and Analysis System (NWHS) and Pacific Northwest Rivers Study (PNWRS). Over time the original StreamNet project continued to evolve to adopt technology that facilitated data sharing and to respond to information needs from regional decision-making efforts (Figure 2).

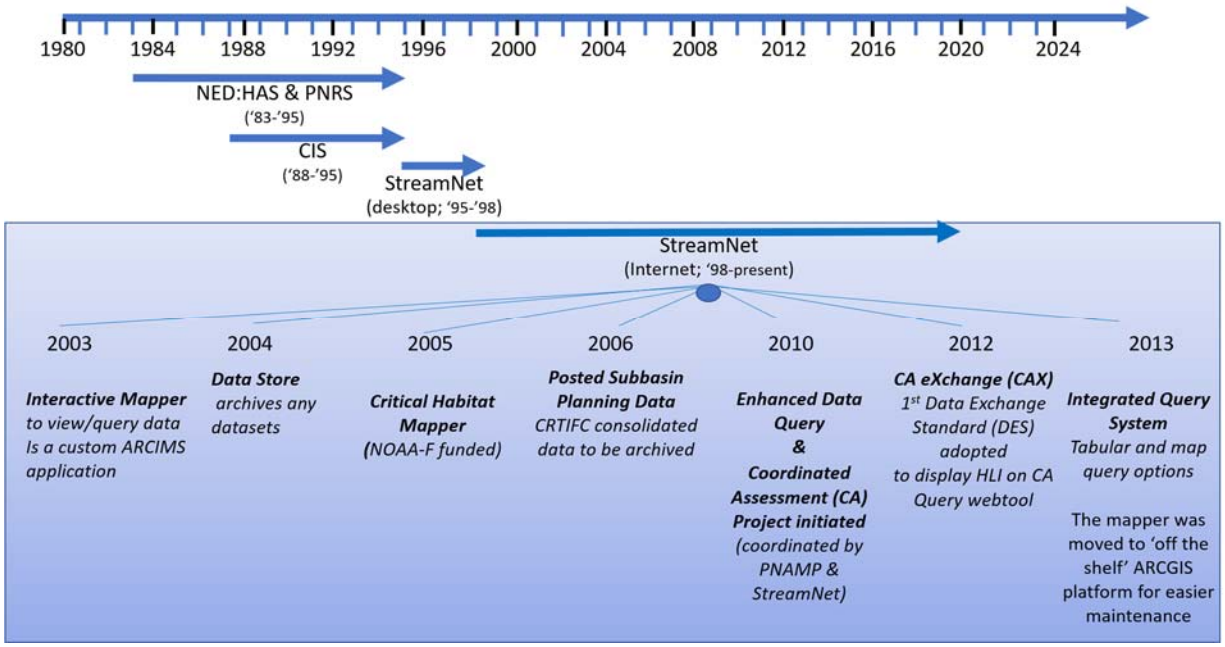


Figure 2: Timeline showing the merging of CIS and NED in 1995 to form the StreamNet project and its subsequent evolution to current day StreamNet data sharing project.

During its most recent significant evolution, following the 2012/2013 NPCC programmatic recommendations for Regional Data Management Projects[i] and those specific to the StreamNet project, as well as the NPCC recommendations generated from the follow-on Program Evaluation & Reporting Committee (PERC) process[ii], the StreamNet project:

- Established an Executive Committee with representatives of NPCC, BPA and fish and wildlife managers to direct data management direction and priority,
- Prioritized efforts on making synthesized information, such as population estimates, accessible through StreamNet with emphasis on the high-level indicators (HLIs) identified through the Coordinated Assessments (coordinated by PNAMP and StreamNet),
- Continued to evolve towards a more accessible platform for various users and optimize web-services to facilitate coordinated data-sharing and data depiction, including updating its main website and developing application programming interface (API) that allows different systems to talk to one another and exchange data.
- Expanded its participants to include additional managers and data collecting entities that are not directly funded through the StreamNet project,
- Focused its BPA funds on providing data needed for BPA and NPCC reporting needs such as NPCC HLI reports and BPA FCRPS BiOp reports for priority populations.

The most recent NPCC recommendation, the August 2019 programmatic and project recommendations[iii], continues to support the StreamNet project and further recommended that StreamNet continue its effort to expand its steering committee membership to agencies managing fish data and to initiate work on other priority NPCC program indicators including hatchery indicators. To this end StreamNet continues to seek opportunities for expanding the CA HLIs to other categories and fish species. StreamNet's prioritization of work continues to be informed by the Five-Year Coordinated Assessments (CA) Plan.

Figure 3: StreamNet is hosted by PSMFC and largely funded by BPA to promote efficient data sharing from member agencies and tribes in support of the NPCC Columbia River Basin Fish and Wildlife Program.

B. Coordinated Assessments

The Coordinated Assessments' (CA) goal is to develop efficient, consistent, and transparent data-sharing among the co-managers (fish and wildlife agencies and Tribes) and regulatory/funding agencies (BPA, NOAA, and USFWS) of the Columbia River basin (CRB) for fish-related data. The CA was designed (in part) to assist and streamline state and tribal data contributions to regional decision-making processes (e.g. NOAA 5-yr status assessments) and reports (e.g. NPCC Program Tracker; BPA FCRPS BiOp reports). The project has been coordinated by PNAMP and the PSMFC StreamNet project since its inception in 2010 (see: https://www.pnamp.org/project/coordinated-assessments-for-salmon-and-steelhead). The development of the CAX was partially funded by a 2015 EPA Exchange Network grant (Salmon Coordinated Assessments Data Exchange project #83546401, closed). Close contact with HLI users (BPA, NPCC, NOAA, others) and with regional fish and wildlife managers is maintained and is crucial to the success of the project.

The project is focused on sharing standardized regional high-level indicators (HLIs) for the health of fish populations. CA is a collaborative effort amongst many partners and its scope, both jurisdictionally and species topics, remains flexible to address emerging regional data and reporting needs. The intent is for the CA to be a collaborative, consensus-based effort. Parties involved in the CA remain flexible so that participants with the required expertise (e.g. resident fish managers, habitat managers, etc.) will be recruited as needed, as CA moves to additional indicators. Since 2010, the agencies and tribes within the Columbia River basin participating in the CA have successfully developed the Coordinated Assessments Exchange (CAX). The CAX has effectively communicated and made accessible natural-origin salmon and steelhead population HLIs to decision-makers and other interested parties. The CAX is valuable in providing timely access to CRB HLIs used in federal reports and research, as well as reporting needs of the Washington State Governor's Salmon Recovery Office, NPCC and BPA (see Appendix C for crosswalk

between NPCC populations and CAX populations). Funding has been the limiting factor for expanding the CAX beyond natural origin HLIs.

The second five-year plan for the CA was discussed in June 2019 by the StreamNet Executive Committee and adopted in August 2019[iv]. The plan is revisited annually to ensure alignment with regional priorities and changes as needed if regional priorities change. The 5-year Coordinated Assessments Plan guides the implementation of this project by prioritizing data for contribution from partners. The CA plan currently focuses on natural origin salmon and steelhead populations in the Columbia Basin with emphases on BPA priority populations. The primary data types contained in and disseminated through the CA that relate to abundance and Viable Salmon Population (VSP) parameters are five VSP indicators including population scale estimates of natural spawner abundance, smolt to adult ratio, adult recruits per spawner (spawner to spawner ratio) smolt outmigrants and presmolt abundance (Figure 4). In addition to high level indicator data, related data (aka Trends) is also curated by StreamNet, including spawner counts, juvenile counts, redd counts and dam and weir counts. These trends data relate to the population scale estimates of VSP parameters, summarized to annual totals. The CA Plan also indicates other fish species, e.g. sturgeon, and category of data, e.g., hatchery indicators, as priorities, and these will be explored as additional funding and resources becomes available. Implementation of the plan will require resources from a diversity of sources to provide access to the data approved by the Executive Committee. To this end the CA members secured a USEPA Exchange Network grant in 2015 and continue to seek other funding opportunities.

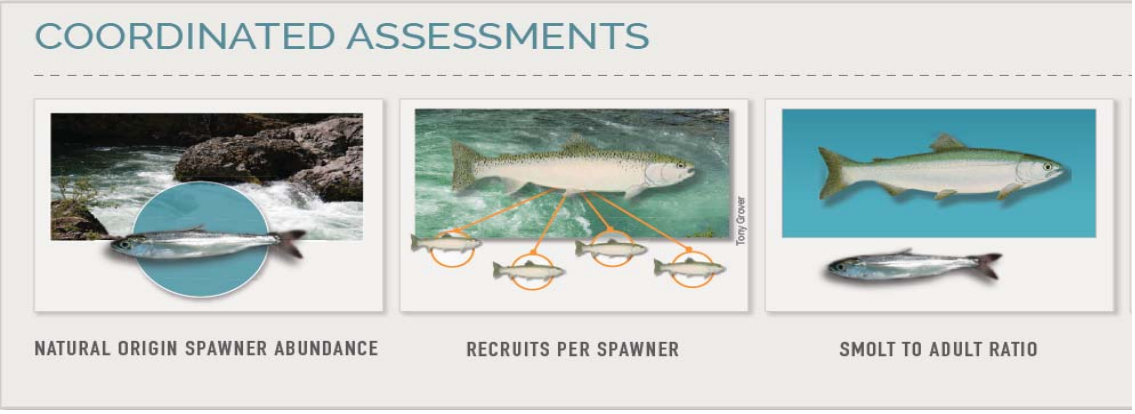


Figure 4: The three main HLI categories currently shared through the CAX database.

C. Policy Guidance

The StreamNet project is implemented following the guidance provided in the 2015 StreamNet Strategic Plan[v] and through the collaboratively developed Five-Year Coordinated Assessments (CA) Plan which is adopted by the StreamNet Executive Committee. The CA Plan is updated annually, while considering a 5-year implementation period. The direction provided by the CA Plan considers guidance from NPCC Program and Project Recommendations, which in turns stipulate a need for StreamNet to address the reporting needs of NPCC and BPA. Below are excerpts of the current NPCC Program and related NPCC and BPA data priorities that inform the CA Plan and work implemented by StreamNet.

1. Data Management Principles and Measures

StreamNet follows the 2014 NPCC Fish and Wildlife Program's guidance for data management (Program Part Four and its draft 2020 Addendum Part 1B) by making information accessible to the public and for decision-making at a regional-scale. The Program guidance implemented by StreamNet includes:

- Data are managed in a manner that is search-able and usable by interested parties.
- Metadata associated with data are properly documented and accessible through web-links or attached documentation when data are accessed.
- Provide access to categories of data, such as fish abundance, through a single centralized website.
- Derived estimates and indicators (e.g. population estimates) are produced from preliminary data collection (e.g. redd counts) and made publicly accessible along with supporting data.
- Working collaboratively to refine indicators that can be used consistently to inform decisions and reporting needs, providing these data in regionally consistent formats to all interested parties in a timely manner, and preserving these data beyond the longevity of a project.
- Facilitating collaboration among agencies, tribes, and tribal consortium, as well as with other monitoring entities in the Basin, which contribute and consume data to inform decisions. To effectively support the Program indicators and objectives, which include hatchery, anadromous and resident fish, it is essential to prioritize which information need to be addressed first based on the Program's guidance.
- Refining content of the data management system to align with partners' reporting needs including the NPCC
- Maintain data and products supporting the NPCC FW Program, both historical and current, in a structured manner that facilitates public access such as information related to Protected Areas information, habitat evaluation procedures, and GIS layers.

2. Priority Populations

BPA's Environment & Fish and Wildlife division, in 2016, identified priority populations that were associated with data needs for the FCRPS BiOp. These were categorized by BPA as either Tier 1 (18 highest priority populations) or Tier 2 (51 next highest priority populations). BPA requested that StreamNet, including all StreamNet partners, focus efforts on obtaining as much data as possible for these priority populations[vi]. StreamNet continues implementing this guidance and it is reflected in the CA Plan.

3. High Level Indicator Priority Categories

The priority high level indicators (HLIs), which have guided the work of the CA since its inception, were focused on providing derived indicators to address the Viable Salmon Population (VSP) data needs for NOAA's 5-year status reviews. These also aligned with the specific indicators and metrics for reporting progress on implementation of the reasonable and prudent alternatives (RPAs) identified in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp)[vii] and related documents. These HLIs, as well as others identified in the CA Plan, continue to be a priority.

4. Trend Data Set Priorities

The 2014 NPCC Fish and Wildlife Program's provides guidance on the information needed to track the status of the basin's fish and wildlife resources (Part Two, section V), report on the program's approved high-level indicators (see 2014 Program Appendix E), and assess progress towards Program goals, objectives and indicators (see 2014 Program Appendix D and its draft 2020 Addendum Part 1A). During 2018, the Executive Committee directed the StreamNet project to resume updating selected, high priority traditional data sets, such as long-term sets that support CA indicators and those that are used to maintain the NPCC dashboards. This continues to be a priority for StreamNet as available resources allow.

5. GIS Data Layers Priorities

PSMFC's GIS Center supports the management and publication of StreamNet's spatial data layers related to fish populations, monitoring sites, fish facilities and stream survey reaches associated with time-series data stored in the StreamNet database. This centralized GIS provides a comprehensive location referencing system for finding and accessing Columbia River basin fisheries information compiled by the StreamNet partnership. It enables discovery and display of the CAX HLI at the population scale and drives the web-based mapping components of the CAX Query system and StreamNet Query systems. StreamNet's core GIS data layers are recognized as BPA's system of record for mapping fish facilities (e.g., hatchery, weirs) and fish distribution within the basin. PSMFC's centralized GIS also supports the Columbia Basin PIT Tag Information System (PTAGIS) and the Regional Mark Processing Center (RMPC), providing consistency and synergy across projects.

D. Budget Considerations

At the June 14, 2018 StreamNet Executive Committee[viii] meeting BPA outlined a significant budget issue confronting the F&W program in FY 19 and requested participants' assistance in finding budget savings. PSMFC had initial savings due to the anticipated retirement of one employee. In the previously approved FY 19 budget, these savings were used to restore partner funding to where it was in FY 17, fully fund all remaining PSMFC staff on 100% BPA – StreamNet dollars, and add back 1 month of Administrative Assistant time and a small subcontract for a Tribal liaison to coordinate with the tribes and the CRITFC Inter-Tribal Monitoring Data project (ITMD 2008-507-00). Under the revised BPA budget reduction proposal, the anticipated budget was reduced (Figure 5), and the partner agencies did not receive the anticipated increase. In addition, two months of StreamNet Program Manager's time was shifted to another, non-BPA funded PSMFC contract. The PSMFC GIS support, since FY13, has not been funded through StreamNet's budget.

To alleviate the financial constraints experienced by StreamNet partners, PSMFC StreamNet staff are continuously seeking alternative funding sources even if this translates to reduced PSMFC staff time dedicated to the StreamNet Project. Similarly, the CA Core Team seeks funding from alternative sources as feasible. For instance, in 2015 the CA benefited from a multi-year grant received by WDFW from the EPA. StreamNet was a sub-contractor under that grant. The purpose of the grant was to automate data flow on the key VSP indicators across the region and foster collaboration. The CA Core Team and StreamNet Steering Committee are currently in the process of submitting another proposal to EPA to advance sharing of hatchery indicators through the CA. This proposal will be submitted in 2020 by Washington State Recreation and Conservation Office / Governor's Salmon Recovery Office with StreamNet as one of the sub-awardees.

The reduction in StreamNet's budget in FY19, which is compounded by a declining and/or flat-budget since 2004, makes it difficult for partners to maintain and recruit staff with the required data management expertise in the face of increasing cost of living and expenses. This ongoing budgetary constraint results in a decrease in full-time-equivalent (FTE) hours dedicated to the StreamNet project, and severely restricts the ability of the CA to standardize the data exchange for other data categories to inform NOAA, NPCC, and BPA assessments, decision-making and reporting. For example, due to funding constraints, only one additional high-level indicator has been added to the CAX since its inception in 2010. These financial challenges continue to make it difficult, and in most situation impossible, for StreamNet to address the new information and tasks requested by BPA on a regularly basis.

In 2019 the NPCC provided a project recommendation[ix] for StreamNet that included restoring the planning budget to the FY17 amount of $2,145,483, as originally expected prior to BPA's request for assistance in addressing BPA's budget issues in FY2019 (Figure 5). The NPCC planning budget sets an expectation that the recommended work will be funded at or near the level listed in the planning budget column over the next four years. The FY20 StreamNet budget has not been restored to the FY17 amount and there has yet to be discussions related to the NPCC recommended restoration of the StreamNet budget.

E. StreamNet Data Sharing Partners – Providers and Consumers

Current partner agencies funded through this project are: The Confederated Tribes of the Colville Reservation (Colville Tribes), Idaho Department of Fish and Game (IDFG), Montana Fish, Wildlife& Parks (MFWP), Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fish and Wildlife (WDFW). Colville Tribes joined in 2013 when they began receiving funding through StreamNet.

Other partner agencies that are not funded directly through StreamNet include: US Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), Columbia River Inter-Tribal Fish Commission and its member tribes, Columbia Basin Fish & Wildlife Library (previously the StreamNet Library), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP). The Shoshone Bannock Tribe recently were provided a small 1-year contract to assist them with data sharing that informs the CAX database. The USFWS, up until 2017 were funded through StreamNet, but no longer receive funding through StreamNet. In calendar year 2018 BPA and the USFWS reached agreement on funding these activities through a direct contract focused on integrating USFWS hatchery databases.

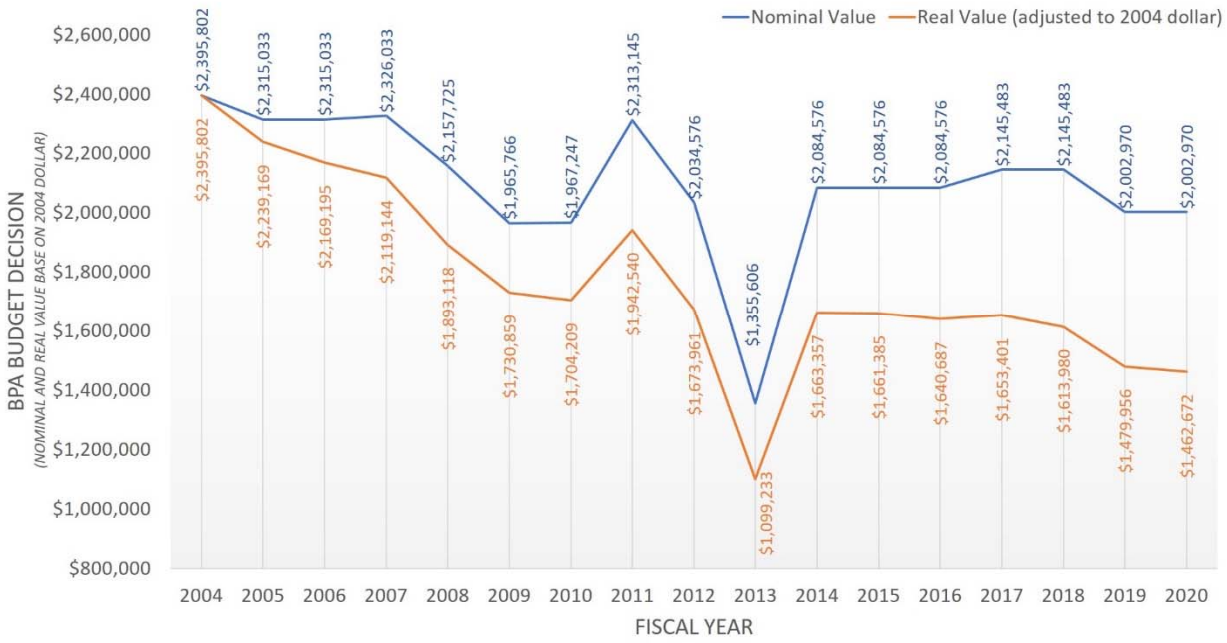


Figure 5: BPA annual budget decision for the StreamNet project between 2004 and 2020. In 2008 the Library was split from the StreamNet project and assigned its own project number and budget (BPA project # 2008-505-00). The sharp decrease in 2013 arose from the percent cut made by BPA across all projects to address a BPA financial crisis. StreamNet experienced a larger percentage cut in 2013 than other projects. The cut in 2013 resulted in substantial PSMFC staff time being reallocated to other PSMFC

projects until the budget was readjusted to a higher amount in 2014. Additionally, the 2013 cut resulted in all PSMFC GIS support no longer being funded through the StreamNet budget from 2013 to the present. The 2019-2020 decrease in the budget reflects the reduction agreed to by the Executive Committee in 2018 to assist BPA with another budget issue. When comparing the nominal budget value to the real budget value this further highlights the StreamNet budgetary constraints. The real budget value is adjusted to the 2004-dollar value considering inflation and calculated using https://www.usinflationcalculator.com/

IV. Approach and Methodology

StreamNet[x] supports a regional approach to data management, coordination, and standardization by increasing partner capacity and by improving access to fish data (Figure 6). The majority of fish-related data originate with the region's state, tribal and federal fisheries agency fish monitoring programs. StreamNet participates in or leads a variety of teams of data management professionals from states, tribes, and agencies that coordinate regional data sharing. Data flow has been streamlined through the implementation of application programming interfaces (APIs) for various data types.

StreamNet facilitates submittal of data and high-level indicators to its regional databases at PSMFC by supporting technical staff inside these agencies to help increase the capacity of these partners with managing, standardizing, and geo-referencing these data to the regional stream network (hydrography). PSMFC and StreamNet funded agency employees and subcontractors locate data, standardize data reporting through the cooperative development of protocols, complete QA/QC of data, and then assure the flow of data from state, tribal, or agency repositories to and through StreamNet. StreamNet supports individual agencies and tribes to work collaboratively to improve regional decision making.

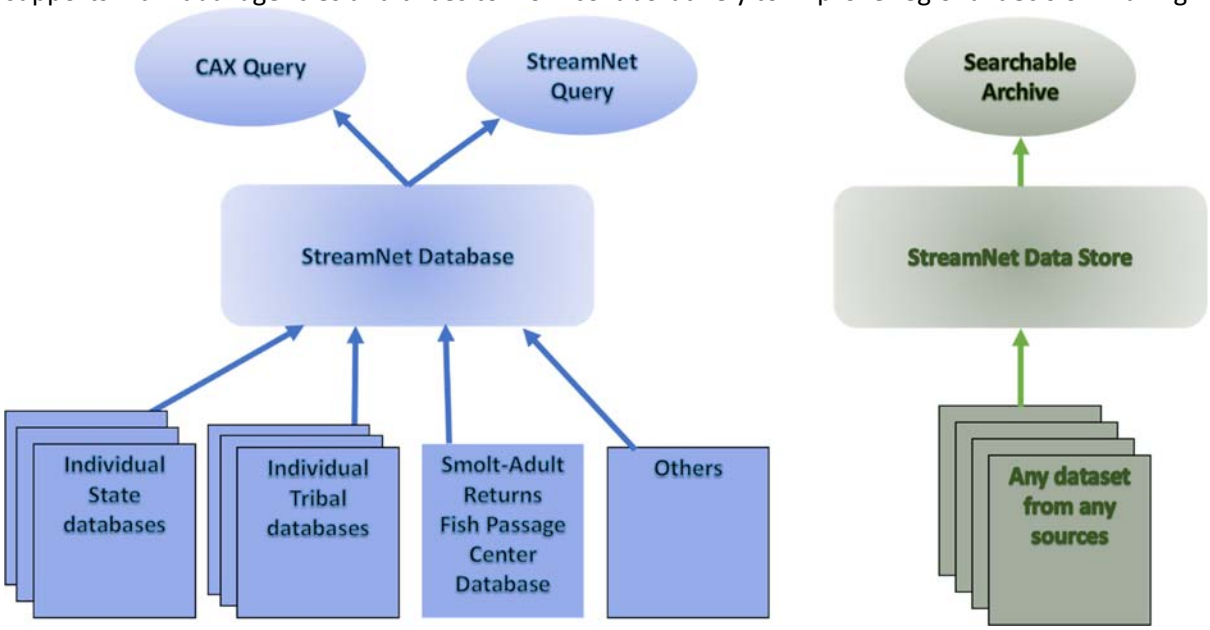


Figure 6: Flow of data from StreamNet members' agency/tribal databases, sub--regional databases, and other sources to the StreamNet database and Data Store and the StreamNet online data access tools.

A. Standing Committees for StreamNet and Coordinated Assessments

Work Elements:	C. 189 CA Data Coordination I. 189: Coordination

There are several committees and teams that contribute to the implementation of StreamNet, including an Executive Committee and a Steering Committee, and supporting teams (Figure 7). The Coordinated Assessments co-implemented by StreamNet and PNAMP involves a broader set of partners than the StreamNet project alone, and provides a broader jurisdictional engagement to address partners' Pacific Northwest information needs.

There are specific teams and workgroups associated with StreamNet to provide guidance and coordination for the CA. The Coordinated Assessments and StreamNet are both discussed and considered by the StreamNet Executive Committee when developing annual work plan and the 5-year Coordinated Assessments Plan to inform data priorities.

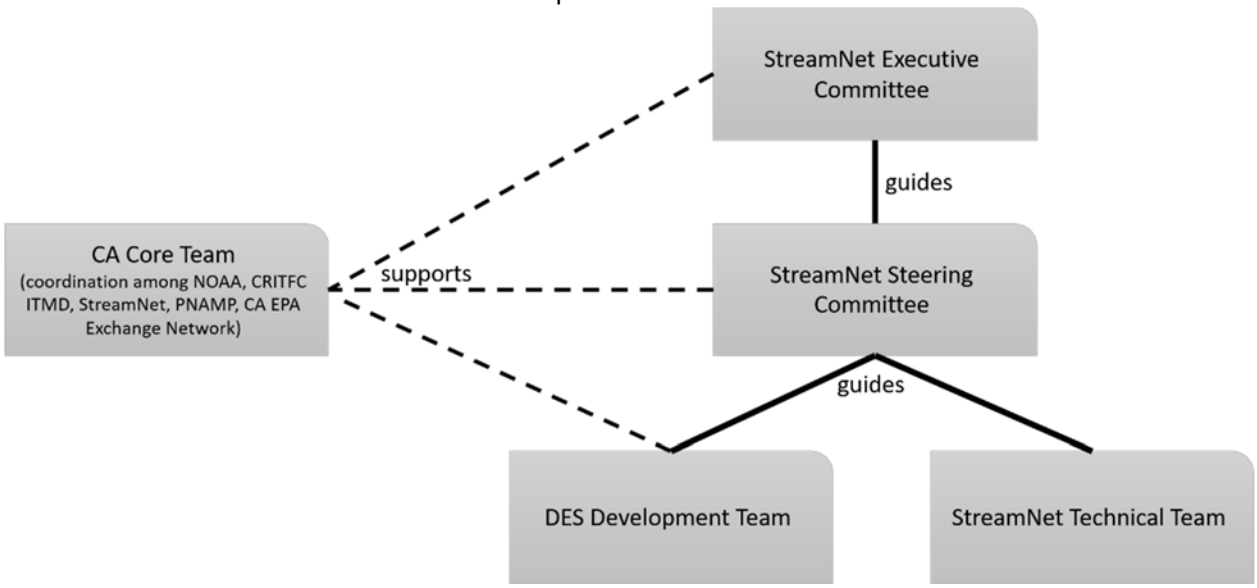


Figure 7: Relationship among the StreamNet Committees and Teams and their connection to the Coordinated Assessments work.

1. StreamNet Executive Committee

As part of the effort to improve coordination, in 2014 StreamNet instituted an Executive Committee. This committee is made up of policy staff and project leaders from the StreamNet partner agencies as well as other related organizations involved in managing and using fisheries data, primarily in the Columbia Basin (Table 1). The chair is the PSMFC Executive Director who is represented by the StreamNet Program Manager. This group provides the high-level guidance and decision-making for StreamNet and the Coordinated Assessments. This guidance includes review of the high-level goals and products of the Coordinated Assessments, data set trends for the StreamNet Query, and making decisions on species, populations, indicators, and priorities on a long term and an annual basis. The Executive Committee reviews and annually approves the 5-year Plan Coordinated Assessments Plan to

ensure that the regional data priorities are being addressed through the Coordinated Assessments and StreamNet databases.

Table 1: Calendar Year 2019 members of the StreamNet Executive Committee

Current Members	Affiliation
Randy Fisher (Chair) and Stan Allen	PSMFC
Zachery (Zach) Penney	CRITFC
Patty O'Toole	NPCC
Jeff Lane and Jody Lando	BPA
Greg Sieglitz	NOAA-Fisheries
Tom Stahl and Art Martin	ODFW
Dan Rawding	WDFW
Lance Hebdon	IDFG
Don Skaar	MFWP
John Arterburn	Colville Tribes
Roy Elicker	USFWS

2. StreamNet Steering Committee

The Steering Committee helps to implement the decisions of the StreamNet Executive Committee, particularly as it relates to the content of the StreamNet databases and the queries it supports: StreamNet Query and CAX Query systems. This committee includes active participation by StreamNet and non-StreamNet members at the data manager level (Table 2). This includes NOAA, BPA, NPCC, state agencies and some tribal representatives. The committee is made up of technical project leaders from the StreamNet partner agencies as well as other related organizations involved in managing fisheries data, primarily in the Columbia Basin. The chair is the PSMFC StreamNet Program Manager.

Table 2: Calendar Year 2019 members of the StreamNet Steering Committee

Current Members	Affiliation
Nancy Leonard (Chair)	PSMFC
Denise Kelsey and Tami Wilkerson *(Denise Kelsey replaced Colleen Roe in Feb. 2020)*	CRITFC
Mark Fritsch	NPCC
Tom Pansky, Russell Scranton, and Matt Schwartz	BPA
Mari Williams	NOAA-Fisheries
Cedric Cooney	ODFW
Brodie Cox	WDFW
Angie Schmidt and Evan Brown	IDFG
Dawn Anderson	MFWP
George Batten	Sitka Tech representing Colville Tribes
Doug Threloff	USFWS
Jen Bayer	PNAMP

3. StreamNet Technical Committee

The Technical Committee is composed primarily of PSMFC and state and tribal agency staff from StreamNet partners that implement data management actions (Table 3). The chair is one of the PSMFC StreamNet staff, with the staff assigned depending on the team's current task. This team has the

responsibilities dealing with the programming details necessary to adequately flow data from partner data systems to the StreamNet database and associated CAX and StreamNet queries.

Table 3: Calendar Year 2019 members of the StreamNet Technical Team

Current Members	**Affiliation**
Greg Wilke and Mike Banach	PSMFC-StreamNet
Van Hare	PSMFC-GIS Center
Denise Kelsey, Tami Wilkerson (*Colleen Roe served until Feb. 2020)*	CRITFC
Jon Bowers, Peter Robinson, Jake Chambers, Nadine Craft, and Kasey Bliesner	ODFW
Michelle Groesbeck, Greg Lippert, and Leslie Sikora	WDFW
Chris Harrington, Randy Walsh, Evan Brown, and Rebecca (Bekki) Waskovich	IDFG
Ace Riverman (*replaced Ryan Alger during 2019*)	MFWP
Todd Gilmore and David Hines	USFWS
George Batten (Sitka Tech consultant)	Colville Tribes

4. Data Exchange Standard Development Team (DDT)

The Data Exchange Standard (DES) Development Team (DDT) meets as necessary to maintain existing data tables and develop new indicator tables. This team consists of both data technicians and biologists that are responsible for calculating indicators. The DDT determines DES content and import/export guidelines. Actual team membership is fluid and depends on the species/indicators/geography of the data (Table 4). New teams may form as the CA effort moves to other data categories, such as Bull Trout or hatcheries. The chair of the DDT is the PSMFC StreamNet biologist.

Table 4: Calendar Year 2019 members of the DDT

Current Members	**Affiliation**
Mike Banach (Chair) and Nancy Leonard *(Nancy replaced Chris Wheaton in November 2019)*	PSMFC
Denise Kelsey	CRITFC
Russell Scranton and Jeffery Stier	BPA
Mari Williams, Monica Diaz and Craig Busack	NOAA-Fisheries
Ace Riverman	MFWP
Cedric Cooney Jake Chambers, Nadine Craft, Jim Ruzycki, and Kasey Bliesner	ODFW
Brodie Cox, Andrew Murdoch, Dan Rawding, and Michelle Groesbeck	WDFW
Evan Brown, Rebecca Waskovich, and Lance Hebdon	IDFG
Jennifer Miller and George Batten (Sitka Tech consultant)	Colville Tribes
Jay Hesse and Ryan Kinzer	Nez Perce Tribe
Bill Bosch	Yakama Nation
Jen Bayer	PNAMP
Brandon Chockley	Fish Passage Center

5. Coordinated Assessments (CA) Core Team

The CA Core Team meets regularly to coordinate CA amongst several BPA funded projects. The Core Team is made up of representatives from BPA, PNAMP, StreamNet, a StreamNet partner agency/ EPA Exchange Network representative, and the CRITFC Inter-Tribal Monitoring Data project representative. A NOAA representative was added in 2019 to this team. The CA Team are important leaders in ensuring

that CA produces results (Table 5). The Core team facilitates discussion amongst projects, directs requests for work to the appropriate CA level (as needed), and generally serves to maintain forward momentum. The team manages and implements periodic CA Workshops.

Table 5: Calendar Year 2019 members of the CA Core Team

Current Members	**Affiliation**
Nancy Leonard *(Chris Wheaton served until November 2019)*	PSMFC
Colleen Roe *(Denise Kelsey replaced Colleen in Feb 2020)*	CRITFC
Russell Scranton and Matt Schwartz	BPA
Mari Williams	NOAA-Fisheries
Brodie Cox	StreamNet partner representative (WDFW)
Jen Bayer	PNAMP
Tom Iverson	StreamNet Tribal Outreach

B. StreamNet Data Specialists within Agencies

Work Elements:	B 159: Support transfer of data into secure and accessible repositories D. 160 CA Data – DES and database E. 159: CA Data – compile data F.160: CA Data -automated data exchange H. 159 Compile high priority traditional StreamNet data J. 160 Enhance data efficiency – system development

The StreamNet project uses subcontracts to support data stewards inside StreamNet member agencies. These data stewards operate within the agency or tribe for which they work, and coordinate with biologists across that organization to identify and collect data of interest to StreamNet.

These data stewards locate and acquire data, convert these to the DES adopted by StreamNet, perform Quality Assurance/Quality Control (QA/QC), add geo-referencing to tie the data to the stream network (hydrography), and assist with development and utilization of database systems within agencies to streamline the data flow process. Once these data are properly formatted and validated, these data are then submitted to the StreamNet database at PSMFC, where they are quality checked and managed so they become available to the StreamNet online data query systems. These data are then made publicly available for viewing and download in standardized format through the project website, www.streamnet.org. The data submitted by these data stewards may also include data from other agencies and tribes, because state agencies often collect data from partners to calculate estimates, metrics, or indicators that are reporting on the CAX query system.

C. Archiving Data Sets and Information

Work Elements:	B 159: Support transfer of data into secure and accessible repositories G. 161: Data - dissemination

StreamNet staff continues to maintain public access to structured information for the NPCC FW Program including the Data Store, Subbasin Plans, Protected Areas, HEP and the HSRG. StreamNet's Data Store, the online searchable data archive, continues to provide access to historical and recent data collected by BPA funded projects as well as other data sets from partners and the CRB.

Data Store – StreamNet maintains the Data Store archive service[xi]. The Data Store is a secure location for data storage for projects throughout the region and provides access to non-standardized data. The StreamNet Data Store is a searchable archive of data sets related to fish and other aquatic resources. These data sets come from many different sources and are provided for download in their original formats. StreamNet facilitates data submittal to the Data Store by providing a data publishing service which guides the data submitter in how to describe their data set and submit it. The Data Publishing Service is for submittal of data sets. Those that want to archive a report with summary graphs and tables are directed to the Columbia Basin Fish & Wildlife Library[xii] hosted by CRITFC. Because the Data Store is a data set archive, data sets housed there are generally not updated after the first version is submitted.

Subbasin Plans – StreamNet maintains documents and data sets[xiii] used in the NPCC subbasin planning process. The NPCC (formerly the Northwest Power Planning Council) led the 2001-2004 effort to develop comprehensive subbasin plans throughout the Columbia River basin. StreamNet both provided data to support subbasin planning and also received and distributed compilations of the data used in the plans. After the plans were completed, StreamNet, the Technical Outreach and Assistance to Subbasins Team (TOAST), the CRITFC, and the Northwest Habitat Institute captured new data that were developed for use in the aquatic portion of each subbasin plan. Resources archived by StreamNet include the spreadsheets, maps, GIS layers, subbasin planning modeling input and results, tools, and databases developed for subbasin planning. Included is a large majority of the EDT and QHA modeling information used in subbasin planning, as well as GIS layers that define the EDT/QHA reach codes.

Protected Areas – StreamNet maintains access to the NPCC Fish and Wildlife Program's documentation of the river reaches designated as areas protected from hydroelectricity development[xiv]. This protection was assigned by the NPCC FW Program based on the determination from extensive Pacific Northwest river studies conducted during the 1980s that these areas are to be protected to avoid the unacceptable risks of loss to fish and wildlife species of concern, their productive capacity, or their habitat. To this end the NPPC FW Program states that the Federal Energy Regulatory Commission (FERC) cannot license a new hydroelectric development in a Protected Area, and 2) calls on BPA not to acquire the power from such a project should one be licensed by FERC, nor to allow access to the Pacific Northwest-Pacific Southwest Intertie (the "power grid") in a way that would undermine the Protected Areas policy. The last update to the Protected Areas list was promulgated in 1992, and it remains in effect through the current NPPC FW Program.

HEP – StreamNet also maintains the NPCC's Columbia River Basin Fish and Wildlife Program's (Program) Wildlife Habitat Evaluation Procedures (HEP) documents and data[xv]. The NPCC FW Program policy guiding wildlife mitigation to compensate for hydrosystem development relies on the HEP data to support the mitigated habitat unit, where this tool was applied. HEP was used to quantify the impacts of development, protection, and restoration on terrestrial and aquatic habitats by assessing changes, both negative and positive, in habitat quality and quantity. The HEP informed the NPCC FW Program progress in BPA's mitigation for loss habitat units related to the construction and operations of the hydrosystem dams. StreamNet maintains access to this critical information for the NPCC FW Program and BPA. The NPCC FW Program also relies on settlement agreements between BPA and partners for mitigating for loss habitat and these are tracked by the NPCC.

HSRG – StreamNet staff continue to maintain the Hatchery Reform Project website[xvi] to ensure that its content, including the HSRG's documents remain accessible to the public. The NPCC FW Program policy guidance for its *Fish Propagation including hatchery programs*[xvii] strategy includes in its rationale the HSRG outcomes and the Program guidance encourages the application of these HSRG recommendations for FW Program funded hatcheries, thus maintenance of the HSRG website and documents[xviii] is needed to inform implementation of this policy guidance

D. Access to Trend Data Sets

Work Elements:	B 159: Support transfer of data into secure and accessible repositories D. 160 CA Data – DES and database E. 159: CA Data – compile data G. 161: Data - dissemination F.160: CA Data -automated data exchange H. 159 Compile high priority traditional StreamNet data

StreamNet Query System[xix] provides access to all trends data set submitted to the StreamNet database (excluding content from the Data Store). The StreamNet Query System integrates both tabular and map-based query approaches into a single system. This allows the user to query data in different ways to suit their needs and download the resulting data. The content of StreamNet's Integrated Query System includes fish abundance estimates and indexes at the local scales for native and non-native species, many of which as focal species for the 2014 FW Program, as well as information on hatchery returns, redd counts, and harvest. Data sets relating to monitoring activities such as redd counts and dam counts are generally updated annually.

For current data types that have a Data Exchange Standard (DES), trends are updated annually and other data types that are more static are updated as needed. The project is trying to expand data development to additional data types and develop exchange formats for them. These data are also georeferenced.

The StreamNet Application Programming Interface (API) requires that users request access and get issued a unique programming key to interact with data via this method. This is a case of programming best practice rather than limiting data access.

An older version of StreamNet's Integrated Query System, the "classic", is currently still accessible. During CY 2019 work was initiated to provide users of this older system with an API filter that would fulfill their data needs and allow the "classic" to be removed moving forward. Currently, this "classic" query utilizes a tabular approach for requesting and viewing or downloading data from the StreamNet database. An interactive map application allows location of data from the main database by navigating to an area of interest, then using a 'get data' tool to view and download all data that are associated with features at that location, such as for a stream, county, HUC or hatchery. Maps and GIS layers are also available.

E. Maintenance and Access to GIS Layers

Work Elements:	B 159: Support transfer of data into secure and accessible repositories D. 160 CA Data – DES and database E. 159: CA Data – compile data G. 161: Data - dissemination F.160: CA Data -automated data exchange

There are three mappers associated with StreamNet[xx]. The first, the StreamNet mapper allows exploration of regional fish distribution and stream referenced survey data. The second, the Protected Areas mapper displays streams protected from hydroelectric development by the NPCC. The third, the Fish Facilities mapper shows the location and some descriptive information about fish facilities located in the Columbia Basin that submit fish data to PSMFC's data projects, including StreamNet. Facilities that are not linked to data housed at PSMFC currently are not included on this map.

StreamNet's interactive mapping applications are useful resources for Fish and Wildlife Program-sponsored projects and related watershed and stream-specific projects. The applications enable users to: 1.) Explore baseline information on fish abundance and distribution, 2.) Identify the location of surveyed stream reaches and important fish facilities (e.g., dams, hatcheries, weirs, traps, etc.), 3.) Create custom data and map products, and 4.) Summarize data by subbasins and areas of interest.

PSMFC's GIS Center staff maintain and update StreamNet's core GIS layers as new data becomes available from partners. In general, the GIS Center staff checks about twice a year for available updates from partner agencies.

F. Access to High Level Indicators – Coordinated Assessments

Work Elements:	B 159: Support transfer of data into secure and accessible repositories G. 161: Data - dissemination

HLIs and associated trend information for population level estimates are available through the CAX Query system[xxi]. Development of the CAX Query system was initiated in 2016 with the intent of

providing access to HLIs and associated trends. The CAX Query system provides access to these data by having the user select a species and run and complements the tabular data with a dynamic map that displays the geographic population distribution and summary information in a pop-up box.

StreamNet coordinates closely with PNAMP in providing technical guidance to the CA which follows the 5-year CA Plan. This technical guidance includes development and modifications to the Data Exchange Standard (DES) which is needed for submitting standardized data that will be displayed on the CA Query. The Data Exchange Standard (DES) specifically identifies the data elements that are to be shared for each indicator, along with definitions, formats, and business rules for each element. The DES is used to guide the organization of data to be shared via any specific medium, whether by spreadsheet, CSV file, database file, or web service. The data elements being hosted by the originating agency in DES format and shared via web services accessed by an exchange network hosted by StreamNet.

As part of the CA, staff at PSMFC and subcontracting agencies coordinated with state, federal and tribal agencies in support of increasing data flow in the region and to encourage increased use of information technology to improve the efficiency of data sharing. The StreamNet Application Interface (API) facilitates submittal and access of CAX HLIs. CAX HLI and supporting trend data sets are updated at a minimum of once a year, but as automation advances, more partners are submitting more frequently such as on a daily basis by the source agency.

To access the information on the CAX Query system, users are asked to agree to an End User License Agreement which reflects the data sharing agreement conditions agreed to by parties providing data to StreamNet for the CAX Query system. The data sharing agreement is presented for agreement as data are uploaded and shared. The purpose of these data sharing agreements are to articulate how data that are shared are to be interpreted, analyzed, and attributed correctly. Furthermore, if users use the StreamNet Application Programming Interface (API) to access the CAX data, the API requires that users request access to be issued a unique programming key to interact with data via this method. Additionally, if a user accesses the StreamNet CAX Query system content from the EPA Exchange Network (EN), the EN requires that users register before accessing any data sets. This is a requirement imposed by the EPA and not StreamNet. The EPA Exchange Network for the CAX Node is accessible http://www.exchangenetwork.net/data-exchange/columbia-river-basin-coordinated-assessment/

G. Validation Process for Data and HLIs Submitted to the StreamNet Database

Work Elements:	B 159: Support transfer of data into secure and accessible repositories E. 159: CA Data – compile data F.160: CA Data -automated data exchange H. 159 Compile high priority traditional StreamNet data K. 160 Infrastructure and base operations

Data exchange standards, a data sharing agreement, and rigorous QA/QC protocols are all part of the data compilation and reporting process. Data, including reference documents, in the StreamNet database must conform to StreamNet Data Exchange Standard (DES) , which precisely defines the data elements, their organization in tables, and required formats. This document serves as the common

denominator for the specific data types contained in the database. Adherence to the DES assures that data can be loaded into the database, can be queried accurately, and are equivalent for further analysis by users. Conversion of agency data to the DES and assuring that they conform before submission is the responsibility of the project's data stewards/compilers in the data source agencies. Additions or changes to the DES are made following a formal documented procedure adopted by the Steering Committee ftp://ftp.streamnet.org/pub/streamnet/Projman_files/ExchangeFormat/CurrentDraft/DES-Change-Process.pdf .

QA procedures are applied at the agency data steward level. An automated data validation and loading system has been implemented at StreamNet. This system provides real time feedback on the success (or not) of data validation. Data are submitted to the StreamNet database one record at a time, and real-time data validation is run on them at two levels (with a third level planned). First, each field has its own set of rules. Examples include ensuring numeric fields do not contain text, ensuring codes fall within the group of allowable values, and ensuring text strings are within acceptable length ranges. The second level of validation ensures that values in the different fields within a table are compatible. For example, if a record appears that says it is for spring run coho salmon, the record is rejected because there is no such run. The third level of validation, once implemented, will look for data problems between rows of data within a table. This will primarily be to find and flag duplicate data. A useful feature of the automated validation routines is that the data may be run against the validation rules and an error report obtained without actually submitting the data for inclusion in the database. This feature allows data submitters to check entire sets of data, fix all errors, and then submit an entire data set after it is known it will pass validation. The interface used for data submittals allows for new records, for changing existing records, and for deleting existing records.

H. Enhanced Metadata Documentation by Connecting to Complementary Data Systems

Work Elements:	B 159: Support transfer of data into secure and accessible repositories K. 160 Infrastructure and base operations

Documentation of metadata for information submitted to the GIS Database, Data Store and StreamNet database has always been a priority to StreamNet as this ensures the appropriate use of these data outside of the original project that created these data.

GIS – Metadata for the GIS data comply with the Federal Geographic Data Committee (FGDC) International Organization for Standardization (ISO) standard and are packaged in ArcGIS file geodatabase format for use with desktop GIS software.

Data Store – Metadata for data sets in the Data Store are provided by the entity that uploads the data set. The BPA Data Management Strategy directs StreamNet to store links to associated protocols and designs to ensure data downloaded and used by third parties can be understood and properly used. The Data Store process requests the user to provide a BPA Project number if relevant. When a BPA project

number is provided the Data Store provides the user with options from the BPA www.cbfish.org and the PNAMP www.monitoringresources.org to facilitate connecting the data set to contact information and documented protocols and methods.

StreamNet Database – Preferably metadata for the tabular data should meet the requirements of the FGDC Biological Extension, but we often lack the required level of detail from the source agency, as many agencies have not placed high priority on creating metadata. Depending on the data being submitted different levels of metadata are captured.

For CA HLI and related trend data submitted to the StreamNet database to be displayed on the CAX Query, some metadata components are required from the data source agencies as part of the DES. Specifically, information on 'calculation method' used is requested in the DES, and this information is presented with all data displays and in data downloads. There is also information captured by the DES related to general categories or types of methods, rather than detailed descriptions. Additionally, StreamNet now also captures URL information to link to monitoringresources.org for the specific method used for a particular component of data related to population-scale HLIs.

For the data submitted to the StreamNet database that are not related to the CAX Query, there is frequently a lack of formal metadata from the data source agencies. To compensate for the lack of formal metadata, StreamNet obtains source documents for all data entered into the database which are subsequently stored in the Columbia Basin Fish & Wildlife Library. Links to these source documents are presented with all views of the data and with all data downloads. Many source documents contain methods sections that provide the detail about how the data were collected. When viewed online, there are links to the Library's online catalog record for the document, which include a link to the digitized version of the document. In 2019 the Library began a reconciliation project to ensure the accuracy and accessibility of its links to StreamNet source documents.

At a minimum, StreamNet has gathered the source document or report that detailed the protocols used to collect these data and, working collaboration with CRITFC staff, have made these accessible through the Library. With the regional recognition that protocols and methods described in reports are not always sufficient for fully understanding the origin and uses of the data, a tool to support full description of methods and protocols was developed through PNAMP (BPA project #2004-002-00) with support from BPA. StreamNet has established a link between PNAMP's tool and information on the CA CAX database. In the absence of metadata provided by the Library and/or MonitoringResources.org, StreamNet database will at a minimum point to the originating agency as the source.

StreamNet data and metadata are provided online as web services, allowing users to locate and obtain data through automated means such as national or regional clearinghouses, and in fact, the StreamNet database harvests our own web services as part of the new, more efficient approach to querying our data.

1. PNAMP MonitoringResources.org

In 2008, PNAMP began efforts that lead to the development of MonitoringResources.org. PNAMP leveraged work by National Park Service and USDA Forest Service which developed a tool for documenting protocols[xxii]. The further development of this tool aimed to provide detailed information about protocols, methods, study design, and metric documentation to inform the NPCC's project review process, and BPA's RM&E needs and for project tracking[xxiii]. The current version of MonitoringResources.org promotes transparency and greater understanding of monitoring through a

standard process of documentation and information management, which is facilitated through online tools that provide guidance and support design and documentation of monitoring projects from beginning to end[xxiv].

The StreamNet database contains a field associated with the CAX data to allow the submitter to include a URL link to metadata, this can include providing a link to the protocols and methods documented in monitoringresources.org.

2. Columbia Basin Fish & Wildlife Library

The Columbia Basin Fish & Wildlife Library (Library) was founded in 1995, to support the StreamNet Project which originated with the consolidation of two projects, NED and CIS. Originally the Library was part of the StreamNet project and was named the StreamNet Library. In 2008 the Library was separated into its own project and is now hosted by the Columbia River Inter-Tribal Fish Commission (CRITFC; project #2008-505-00). The Library serves as a centralized repository for the information created by tribal, federal, state, local agencies, private and contract researchers, and advocacy groups on Columbia Basin fish and wildlife projects and issues. The StreamNet project continues to rely on the Library to provide access to documents that provide details related to the data submitted to the StreamNet database. In turn, a primary objective of the Library continues to be making StreamNet source and data reference documents in print and digital format, as well as those related to data for the Coordinated Assessments, accessible. StreamNet and Library staff work together to ensure that all StreamNet references have complete and accessible digital records.

I. Data Backup Systems

Work Elements:	B 159: Support transfer of data into secure and accessible repositories K. 160 Infrastructure and base operations

The StreamNet databases are backed up on the PSMFC organization-wide system which entails sending backup copies to the Kennewick PSMFC office.

The StreamNet staff also make backup copies on DVD media monthly and stored offsite. Additionally, StreamNet staff sends a differential backup to the cloud on a daily basis.

J. StreamNet Relationship with Mainstem and Sub-regional Data Projects

Work Elements:	B 159: Support transfer of data into secure and accessible repositories C. 189: CA Data -coordination G. 161: Data -dissemination I. 189: Coordination

StreamNet collaborates with existing mainstem/sub-regional data management projects to further enhance the flow of information needed to inform decision-making and reporting. These types of projects are tasked with compiling information from a subset of the CRB, in some cases to support collaborative analysis. StreamNet works with these data management projects to access relevant information needed to inform HLIs. This coordination reduces the work-load placed on individual biologists and data steward by not requiring them to resubmit these data to the StreamNet database.

1. CRITFC Inter Tribal Monitoring Data Project

StreamNet continues to work with CRITFC tribes and specifically with the CRITFC Inter-Tribal Monitoring Data project (ITMD 2008-507-00) to integrate these two projects, along with the Library (project 2008-505-00), to maximize data sharing. Much of the tribal data flow during 2019 was through the respective StreamNet member state agency. Starting in late 2019 and early 2020 the CRITFC tribes will be providing their data directly to StreamNet, as several of the tribes have built the capability to share data with regional repositories.

The ITMD staff, similar to the work done through the StreamNet project, coordinate with its member tribes and the data stewards who are partially funded by the ITMD and positioned at each tribe. Coordination occurs through monthly conference calls, quarterly webinars, and an annual workshop. Many of the IT tribal staff and the ITMD data stewards attend many of the regional coordination meetings for data management and sharing within the Basin. If they are not able to attend, the ITMD Project staff coordinates with tribal staff to get them the information they need from the meetings and follows-up with any questions or concerns they may have on data management requirements and deliverables. The ITMD Project staff also attend many of the regional coordination meetings for data management and sharing in the Columbia Basin including Coordinated Assessments Workshops and Working Groups, StreamNet Executive Committee, StreamNet Steering Committee, CA Core Team, StreamNet Technical Team, and DDT.

2. Fish Passage Center's Comparative Survival Study Database

The Fish Passage Center (FPC, 1994-033-00) provides technical analysis, data summaries, graphic representations for the state, federal and tribal fishery managers' use in developing their recommendations for fish passage management to the federal operators and regulators. One of the FPC's responsibilities includes management, implementation and assistance in the analysis of the Comparative Survival Study (CSS; Project 1996-202-00) as directed by the Comparative Survival Study Oversight Committee. StreamNet leverages the FPC database to populate the Smolt to Adult Returns (SARs) population high level indicators in the CAX database and provides the URL to the supporting documentation describing the monitoring and analytical methods. StreamNet staff and FPC staff collaborate to ensure that the CSS data are appropriately assigned to the correct CAX populations because this involves deconstructing the annual CSS fish groups and aggregates back to the individual populations.

CRITFC staff worked with StreamNet staff to identify populations so that the CSS SARs for Chinook and steelhead can be submitted to the CAX. To work out an acceptable way to submit these to the StreamNet/CAX system, StreamNet staff has defined 'superpopulations', which are aggregates of populations. These SARs are now updated annually by StreamNet staff who access the FPC database, convert the FPC data into CA format, and upload these into the CAX.

3. US. Fish and Wildlife Service Database

The USFWS used to receive funds from the StreamNet Project prior to 2018. In calendar year 2018, BPA and the USFWS reached agreement on funding the USFWS's previous StreamNet activities directly. USFWS has active members of the StreamNet Steering Committee and Executive Committee.

USFWS staff with the Fish and Aquatic Conservation Program in Oregon, Washington, and Idaho collect data at 14 National Fish Hatcheries (NFHs). Those data are currently stored in three databases that include the Columbia River Information System, Fish Inventory System (FINS), and Fisheries Resource Evaluation Database. Because those databases possess different structures, the ability to aggregate and distribute data in those databases is time consuming and inefficient. USFWS staff in the Pacific Northwest are gradually adopting the FINS database, and will use that database to store fish culture data from the 14 NFHs. The transition to using FINS will improve the efficiency of managing those data, lead to the standardization of those data, and substantially improve the ability to share USFWS NFH data with StreamNet partners in a more timely fashion.

V. Results – Improved Data Sharing and Access

Work Elements:	159: Support transfer of data into secure and accessible repositories 161: Data – dissemination 189: Coordination

StreamNet continued to acquire fish data from our four partner state fish and wildlife agencies (ODFW, WDFW, IDFG and MFWP), our tribal partner (Colville Tribes), one federal agency (USFWS for data from the national fish hatcheries), a tribal consortium (CRITFC[1]), and the Fish passage Center (FPC). Efforts continue to work with other tribes to access population-level indicator data for the CA effort. These data have been created through a variety of funding processes and sources, only some of which are through BPA or other federal programs. As a regional data coordinator, StreamNet strives to provide access to all data of a given type from all sources. Consult Appendix D to view work-element specific results from IDFG, MFWP, ODFW, PSMFC-StreamNet, Colville Tribes, and WDFW.

Use of the StreamNet website consistently remains highest with the general public/rate-payers. This is to be expected as most of the agencies accessing StreamNet database for their reporting are using the more efficient APIs (Figure 8; see Appendix A for previous years).

[1] CRITFC member tribes consists of Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes and Bands of the Yakama Nation.

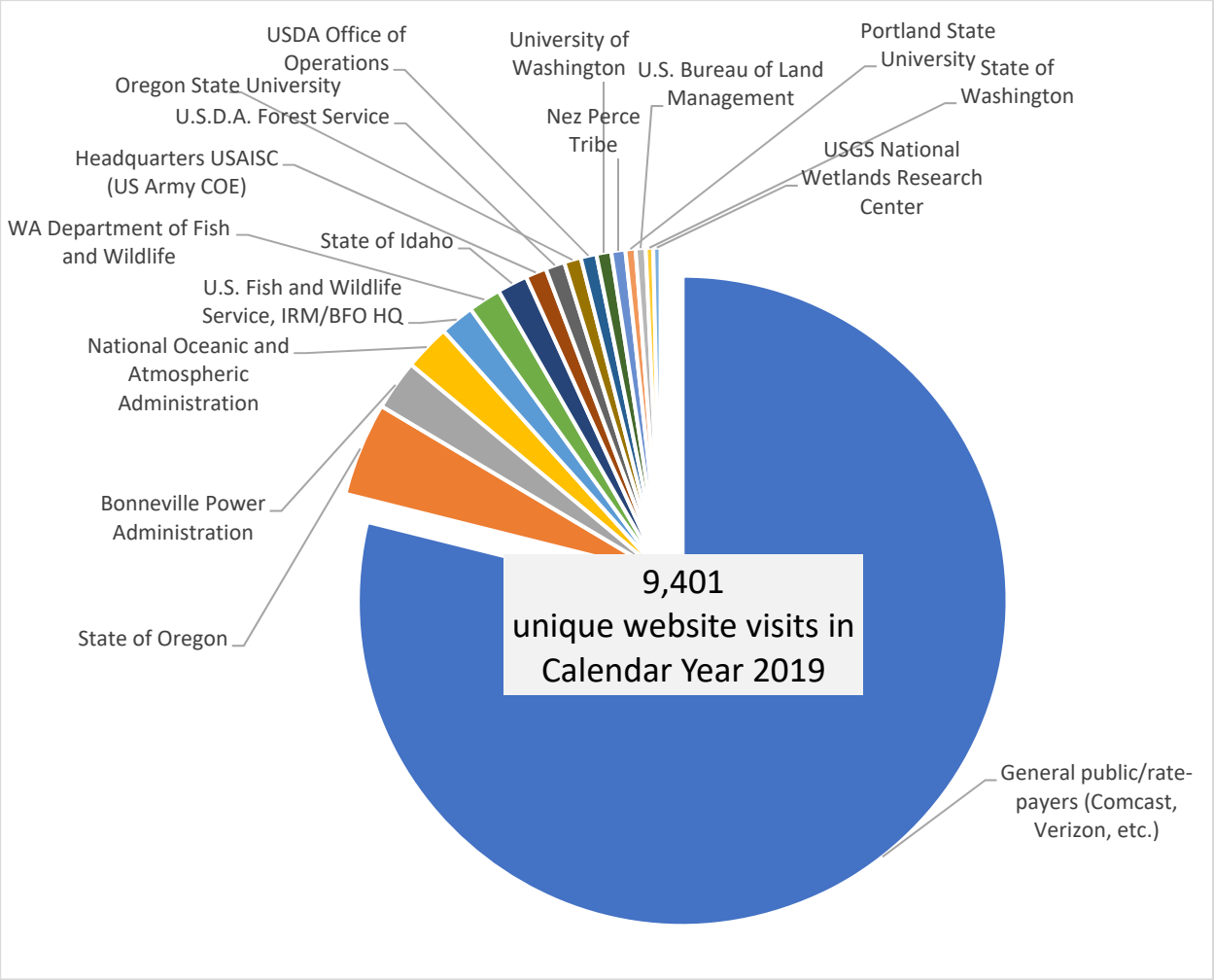
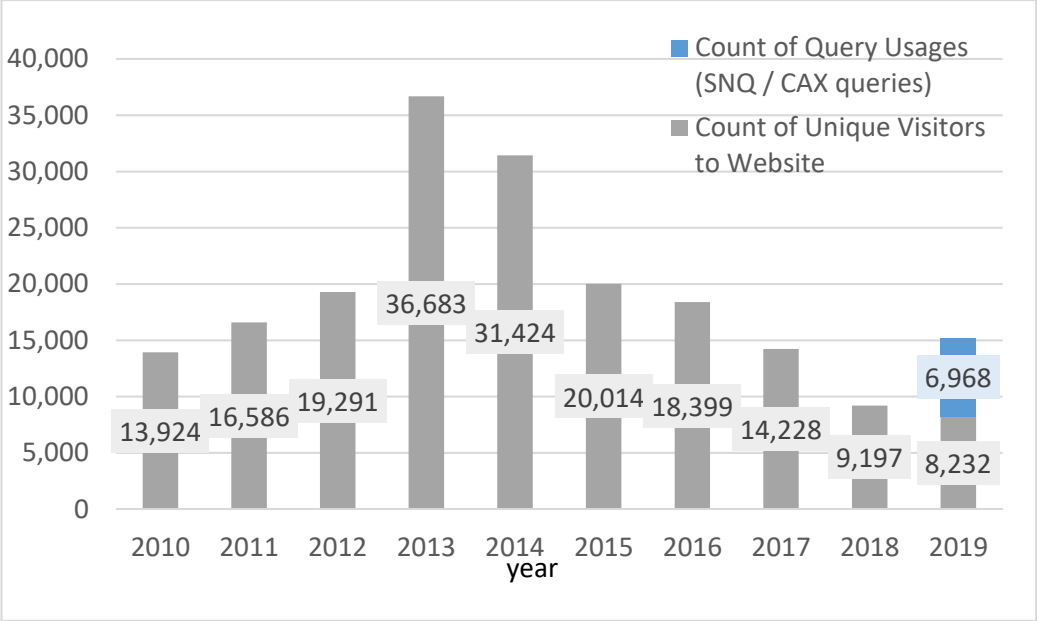


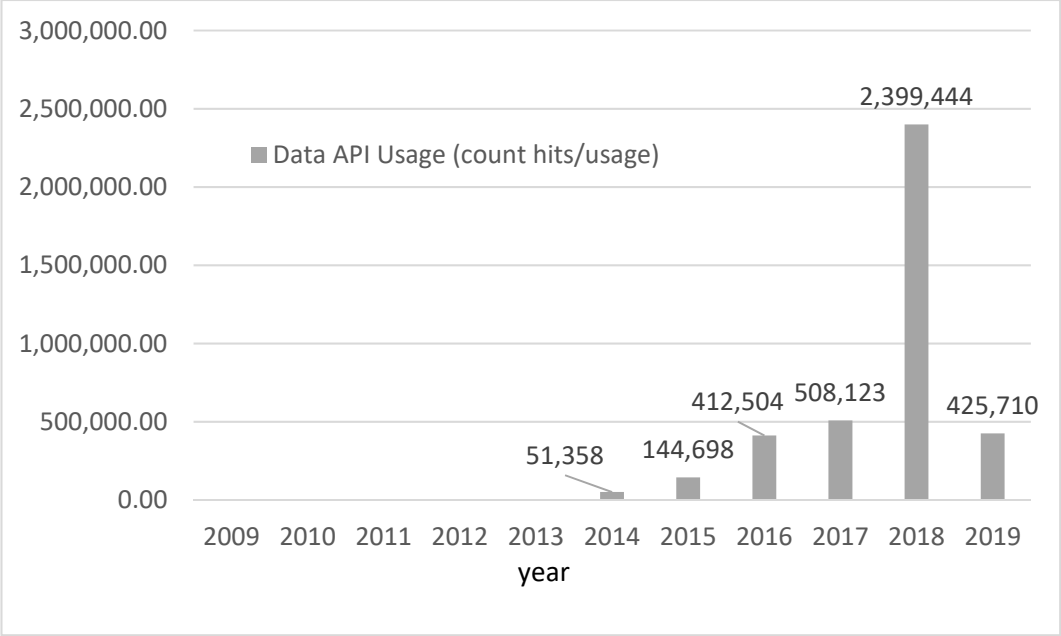
Figure 8:Users accessing the StreamNet website during calendar year 2019 for a total count of 9,401 unique website visits. Identification of user groups/entities was made using the IP addresses.

Use of the API to submit and access data on the StreamNet database has increased since the API became available in 2014. Recent improvements to the API have led to more partners using the API instead of the StreamNet website. One recent improvement to the API that was completed in 2018 allows data submitters to self-validate their data during the submittal process instead of using the website to download and verify their data. Thus, as the API has increased in use, there has been a decrease in StreamNet website user visits, because the API is addressing more of the data submitters'/users' needs. (Figure 9; see Appendix A for previous years).



(9a)

Note: data for the SNQ and CAX query system usage are only available for 2019.



(9b)

Note: The increase in API usage show for 2018 corresponds to new partners beginning to use the API as well as a new version of the API being released that allowed individual agencies/tribes to self-validate their data submission using the API prior to submitting their data to the StreamNet database. The self-validation function of the new version of the API in 2018 improved the quality of data submitted to the database. In 2019 the API use returned to a more normal level of use.

Figure 9:Figure 9a illustrates the number of times during 2019 that StreamNet's Integrated Query and the CA Query systems were used to access data (no pre-2019 data available) as well as the total number of unique visitors to the StreamNet website. ***Figure 9b*** *shows the annual count of when the API was used to submit/use data (2014-2019). Although the y-axis scale differs between 9(a) and (b) one can see that as the use of StreamNet API (9a) increased over time there was a corresponding decrease in the query systems (9b).*

StreamNet GIS data are published as downloadable spatial data and as publicly accessible web map services. Those who download StreamNet's GIS data are primarily academics, agency staff, non-profits, private consultants and the general public (Figure 10). Use of StreamNet's interactive mapping applications has gradually increased over time, with the StreamNet Mapper proving to be the most frequently used (Figure 11).

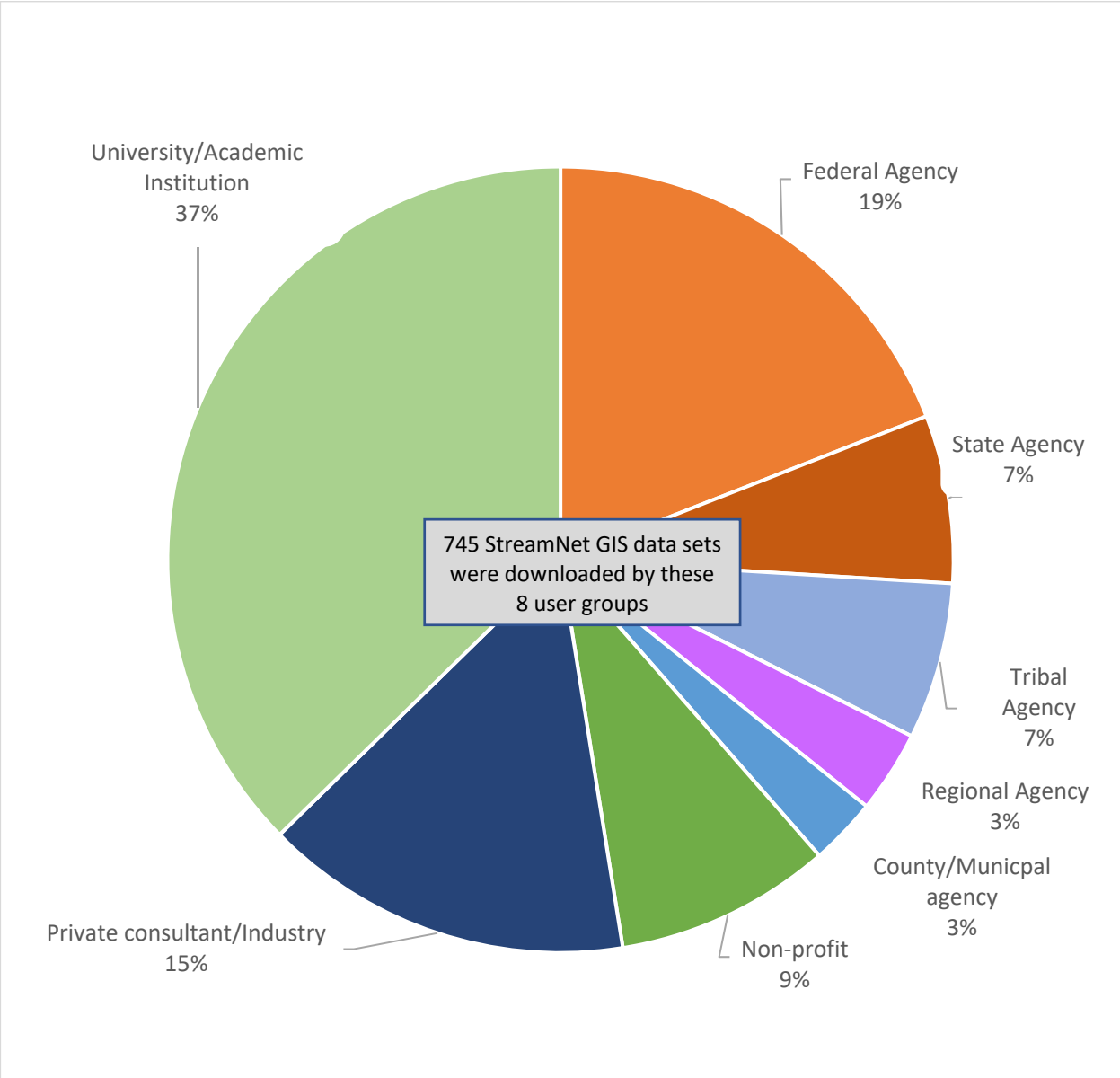


Figure 10 StreamNet's GIS Data sets were downloaded in 2019 by 8 different external user groups. The user groups that downloaded the largest percentage of the 745 GIS data sets was the University/Academic Institution user group that downloaded 37% of the 745 GIS data sets.

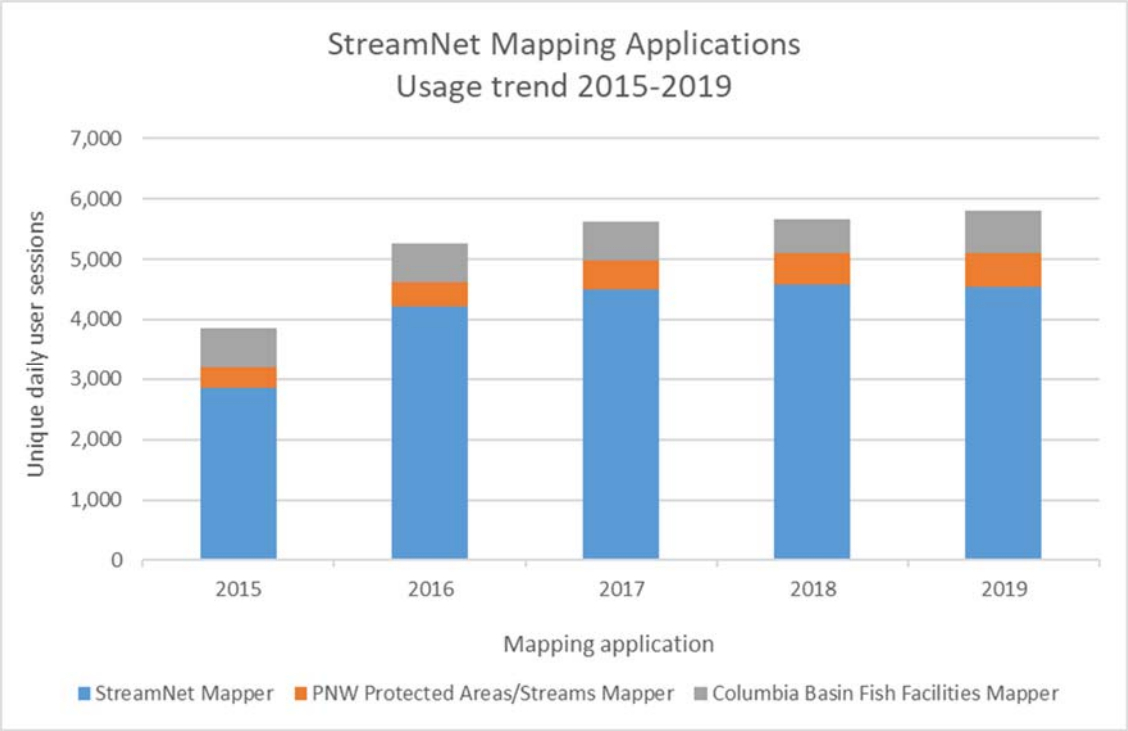


Figure 11: Use of StreamNet's online mapping applications has gradually increased over time, with the total annual unique daily user sessions increasing between 2015 and 2019. The period from 2015 to 2019 uses comparable web analytics for reporting unique users.

A. StreamNet Data Specialists within Agencies – Enhancing Data Access

Work Elements:	159: Support transfer of data into secure and accessible repositories 160 CA Data – DES and database 159: CA Data – compile data 160: CA Data -automated data exchange 159 Compile high priority traditional StreamNet data 160 Enhance data efficiency – system development

StreamNet continued to coordinate within partner agencies to build systems with regional data sharing capability. StreamNet supports data flow and management within the data source agencies through assistance in development of database systems and approaches for improving data management efficiency and data dissemination. StreamNet-funded staff provide significant technical database and data transfer support services to state fish and wildlife agencies. This includes database system development, data translation, serving external data requests, and data capture routine development. The goal is to make it possible to harvest data directly for loading into StreamNet through automated means. When implemented, this will significantly speed the process of obtaining annual data updates, and allow our data stewards to expand to the acquisition of additional priority data types.

The StreamNet subprojects in the state agencies and tribes all contributed to development or improvement of their organizations' data storage systems in 2019. Focus continued to be on increasing the speed and efficiency of data conversion to the regional standard StreamNet DES, and then submission to the StreamNet database. The long term goal is to develop the capacity for the agencies and tribes to host data in the regional standard and share them via web services and/or to transfer data to StreamNet via web services. Because each partner uses different approaches to their data management, actions taken by the subprojects differ accordingly.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes, a StreamNet member since 2013, have improved their capacity for submitting data with the assistance of a StreamNet funded Data Steward, and actively contribute HLI data to the CAX database.

In 2019 the Data Steward maintained and updated the Okanogan Basin Monitoring and Evaluation Program (OBMEP) database, updated the Python script used to sync data between the OBMEP and CAX databases, and worked with the Colville Tribes' staff to streamline calculations for the recruits per spawner HLI.

2. Idaho Department of Fish and Game

The IDFG StreamNet subproject continued assistance with development of the Idaho Fish and Wildlife Information System (IFWIS), and was able to upload data directly from the system in a single step in order to simplify standardization of the data and speed submission to the StreamNet database, saving significant time from the previous approach.

IDFG StreamNet staff assisted BPA project biologists to identify and prioritize data available for entry into IFWIS, or an alternative accessible, backed up information system. IDFG StreamNet staff participated in meetings of the CA planning and development groups. They provided input prioritizing indicators, metrics, and metadata. They coordinated with development between the proposed DES, the prototype database and application, and the web service data exchange. Multiple sources of CA data were consolidated into complete, standardized workbooks on a secure and backed up network drive. SQL queries were written to extract and transform those data into the draft DES for natural origin spawner abundance (NOSA), natural origin juvenile abundance (presmolt abundance), and recruits per spawner. IDFG staff wrote web service routines to enable the transfer of CA data to PSMFC and NOAA databases. Those services were successfully tested and the results shared with the CA Exchange Team. After appending into the IFWIS CA database, those data were then transferred to the PSMFC CA database. IDFG StreamNet staff compiled and submitted hatchery return data for 2018 Chinook, steelhead, sockeye, and the 2019 Chinook index redd counts.

3. Montana Department of Fish, Wildlife & Parks

The MFWP StreamNet subproject continued working with the Fish Division and Application Development staff on MFWP's Fisheries information management system (FIS). Staff assisted with troubleshooting, bug fixes and processes to facilitate better data management and availability of data to the public.

No new development work on the internal database was completed by MFWP Application Development staff in 2019. Existing agency projects have been consuming Application Development as well as Projects Bureau staff time. Given these large agency priorities there has been a decrease in the amount of time for additional project work. This halt on new work also made it impossible to hire a

subcontractor for development work because a subcontractor must work with application development and database administrator staff.

Small enhancements were made to the fish distribution editor tool in the centralized database to accommodate additional species, and trainings were held to assist biologists in entering and updating this essential data set. StreamNet staff have participated in and assisted with trainings dedicated to entering data using the fish distribution editor tool. Use of this tool resulted in 520 fish distribution records entered or updated in 2019.

StreamNet staff continued to assist in converting data files residing with individual biologists to file types that can be uploaded into the centralized database. This has eliminated the need for biologists or technicians to spend their time hand entering historic data into the system. StreamNet staff are also continuing to be a resource to biologists as well as advocates of biologists entering their data into the system. The database currently houses over 4.4 million raw fish records statewide. In 2019, 1,668 fish survey locations were added in the Columbia Basin resulting in over 107,880 individual fish records. Statewide 2,117 new survey locations were added resulting in 386,637 individual raw fish records being added to the database. In the Columbia Basin 1,416 redd counts at 128 locations were added to the database during 2019. All relevant data were submitted to StreamNet databases or the Data Store.

An additional task moving forward will be to investigate the potential to deliver data as web services. These efforts will lead to a significantly enhanced ability for MFWP to share fisheries data in standardized format with regional entities. This work could not be started in 2019 due to personnel changes detailed below.

MFWP StreamNet staff continued to be involved in the Yellowstone Cutthroat Trout range-wide assessment. During the past calendar year MFWP staff coordinated updates to the database with biologists throughout the subspecies's native range. Discussions were held related to integrating the Yellowstone Cutthroat Trout native trout assessment into the Inland Cutthroat Protocol (ICP) data system. An estimate to reintegrate the data was obtained from the contractor (Wyoming GIS Center) though the work could not be completed in the necessary timeframe. The MFWP native species coordinator also retired in the summer of 2019, leaving the status of this project in a state of uncertainty. There is potential to revive this project in 2020 though it is dependent on the priorities of the fisheries division.

MFWP's genetics lab utilized StreamNet funds to develop a regionally consistent genetic method for bull trout that can be used to address conservation needs within Montana and facilitate data sharing among StreamNet partners. WD FW is developing a bull trout GTseq panel in collaboration with USFWS's Abernathy lab. MFWP worked collaboratively with those efforts and IDFG's Eagle Fish Genetics Lab to further develop that panel such that it is maximally informative in the upper Columbia River basin. This entailed adding new loci, and means that a substantial subset of the loci will be used to consistently genotype all bull trout in Idaho, Washington, and Montana. Thus, this effort will provide a means of monitoring bull trout throughout the vast majority of their range in the United States.

Overall, the development of current GTseq array directly addressed the goals of the project by providing a substantial increase in power/resolution for genetic monitoring projects in Montana, a genotyping platform that will now be used by multiple agencies that manage bull trout in the Columbia River basin, and thus, a straightforward means for consistent data-sharing throughout the region.

Since the sequence has been completed, Montana has been re-genotyping bull trout samples with the new method. This will address immediate conservation needs and the hope is that other entities in the Columbia Basin will also begin genetic monitoring using this approach, thereby facilitating data consistency and sharing at a region wide scale. This project has also laid the framework to expand into other species for which conservation has been a concern.

2019 was a difficult personnel year for the StreamNet program at MFWP. The StreamNet staff person successfully competed for a different position within MFWP. This left the StreamNet position vacant for seven months. The position was recruited for twice during that seven months with one unsuccessful attempt and a successful hire that started in January of 2020.

4. Oregon Department of Fish and Wildlife

ODFW StreamNet performed routine maintenance and updates on existing core databases. In addition, efforts to improve overall agency data storage and flow from the field continued by ongoing development and maintenance of data management and sharing systems. Once created, ODFW's new resource information system will significantly advance the agency in these areas of data management and increase data flow and sharing efficiency. In the meantime, we continue to encourage the implementation of data management best practices related to standards in field and file names, metadata, folder organization, data sharing agreements and data management plans, etc. as time and resources allow, particularly as they relate to priority CA and Recovery Planning efforts.

The ODFW Data Clearinghouse (DC), which makes Oregon's natural resource information more secure and accessible by providing a centralized storage and distribution service, was maintained. During the year, 1,187 new and existing DC records were created and updated. In 2019, using partial funding from other sources, we continued an effort to, where possible, improve the accuracy of and migrate 39,000 records from the old ODFW Library electronic bibliography into the DC in order to preserve this historic record of ODFW documents, and provide access to digital copies of these documents.

The Fish Habitat Distribution and Barrier Data Editor application was modified to facilitate a targeted review of data supporting the identification of Essential Salmonid Habitat. Updates were made to fish distribution data, focused on anadromous salmonids. Additionally, significant changes to steelhead habitat identification were made in the Fifteenmile Creek subbasin where the run was reclassified to summer (instead of winter).

Oregon StreamNet staff continued a partnership with ODFW Recovery Planning staff throughout the year to coordinate data standardization, DES updates, flow configuration and data sharing documents, metadata, data system development, and efficient exchange of CA and Recovery data to StreamNet and the ODFW Salmon & Steelhead Recovery Tracker. In 2019, with other funding, Oregon updated and submitted coastal coho natural origin spawner abundance and adult recruits per spawner estimates to StreamNet. Recovery populations in the Lower Columbia, Middle Columbia, Snake River, and coastal coho (other funding) data were also processed and uploaded to the ODFW Recovery Tracker public website.

StreamNet supported the proposal to develop the Oregon Salmon Recovery Tracker website (http://odfwrecoverytracker.org/) from its inception in 2010, and took over hosting the system upon its completion. Oregon StreamNet continues to maintain the system, which allows users to explore and download information related to salmon conservation and recovery in Oregon. This system is slated to undergo major technical update; therefore, the public website may be unavailable at times during 2020.

A map-enabled data capture system that is incorporated into an existing web application, in part to enhance the flow of data from the field to NRIMP and StreamNet, was maintained. Refining various software and web map applications that support mobile data access, and update and create fish passage barrier data, has been on hold due to staff changes, but exploration may restart in 2020.

Oregon StreamNet's server infrastructure was upgraded to Windows Server 2016 and SQL Server 2017, modern versions with long term support. Software tools used for development were upgraded to the most recent versions. Capacity of the infrastructure continues to be monitored and is currently adequate at least through 2021. ODFW upgraded ArcGIS Enterprise server software to version 10.7.1 on both internally and externally facing installations. The GIS license server was upgraded to version 2019.

Staff developed an 'issues' list as a guide to operational problems with the SQL Server online spawning ground survey database. This system will allow standardization of spawning ground survey data across ODFW. In addition, several local eastern Oregon databases have been revised to prepare them for eventual upload to the SQL online database.

5. Washington Department of Fish and Wildlife

The WDFW StreamNet subproject coordinated with the Biological Data Systems Program in WDFW on ongoing development of the EPA funded Juvenile Migrant Exchange and the Adult Fish Exchange data delivery system, and developing services which will to serve data to StreamNet in the future. WDFW also secured a new EPA Exchange Network grant to facilitate sharing of hatchery and harvest data between tribes and WDFW.

WDFW continued development of an internal CA reporting database and participated in all DES development and technical meetings. Particular attention was paid to integrating new NOSA and SAR data where existing and we began integration of Puget Sound NOSA and escapement data at NOAA's request. In addition to CA systems development, WDFW StreamNet worked with agency HQ staff to implement mobile data collection platforms, staging databases and automated transfer mechanisms for sport and commercial, adult survey, and juvenile data systems. Ultimately these inform the CA exchange as well as other consumers like WA Governors Salmon Recovery Office and tribal co-managers. WDFW continued hydrography mapping to NHD framework. Final adoption of WDFW's draft new stream layer has repeatedly been delayed. When it is adopted, the StreamNet funded Location Manager will fully scope the layer and draft a proposal to integrate mixed scale hydro (MSH) with the new line work.

WDFW continues to communicate with project sponsors, review data storage, and offer assistance in submitting data sets to secure accessible repositories. StreamNet's request to submit geometry instead of event data also prompted work to make basic location data more integral and available to CA and traditional StreamNet data compilers.

B. Archived Data Sets and Information – Current Status

Work Elements:	159: Support transfer of data into secure and accessible repositories 161: Data - dissemination

The StreamNet Data Store serves as the default database for numerous fish population metrics, as indicated in the BPA Data Management Strategy. In addition, StreamNet can function as the interim data storage location during the development of databases for new data sets, such as fish species genetics, blood work, and enzyme analysis. PSMFC also physically hosts other data storage repositories as a cooperator with state and tribal agencies. StreamNet staff now also work to ensure that data not currently located in the StreamNet database are secure and regionally accessible in other approved environmental data repositories.

Data Store – StreamNet staff continued to provide support by phone and email for data contributors to the Data Store. The StreamNet Data Store is a repository for any BPA projects where a BPA recognized environmental data repository is not available. BPA relies on the StreamNet Data Store as a core data repository to secure public access to data where not provided in an alternative, publicly accessible system. When a BPA project data set is uploaded to the Data Store, the project number allows pre-populating project attributes housed in the BPA database system (cbfish.org) such as contact information.

During CY2019 there were 16 data sets uploaded to the Data Store. These 16 data sets consisted of 11 new data sets, and 5 updates to existing data sets.

In general, StreamNet partners encourage BPA project sponsors to secure data in repositories, including the Data Store.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes continues to communicate with Project Sponsors, inventory data storage and aid in securing data in accessible repositories.

2. Idaho Department of Fish and Game

IDFG StreamNet supported state and tribal project sponsors in the transfer of data to secure and accessible repositories.

3. Montana Department of Fish, Wildlife & Parks

MFWP StreamNet continued to communicate with and support sponsors in the transfer of data to secure and accessible repositories. In addition, staff submitted data types without a formal DES such as the Yellowstone Cutthroat Trout Range-Wide assessment, population surveys, and genetic sample information, to the StreamNet Data Store as independent data sets.

4. Oregon Department of Fish and Wildlife

ODFW StreamNet staff continued to assist and encourage BPA funded, ODFW, and local project sponsors to manage or locate their data within secure and accessible data repositories.

5. Washington Department of Fish and Wildlife

WDFW continued to communicate with project sponsors, review data storage and offer assistance to secure accessible repositories.

Subbasin Plans – Documents and data continued to be archived at StreamNet and remain accessible to the public on StreamNet's website.

Protected Areas – Documents and data continued to be archived at StreamNet and remain accessible to the public on StreamNet's website and on the Protected Areas mapper.

HEP – Data and other resources from the HEP project are archived on StreamNet, at the request of BPA and the NPCC. The data and associated materials from this past program remain accessible for regional use[xxv].

HSRG – StreamNet staff continued to make accessible the Hatchery Reform Project website and its HSRG information. The NPCC 2014 Program refers to the HSRG recommendations and thus keeping this content publicly accessible supports the Program's implementation. NOAA's Hatchery Genetic Management Plan (HGMP) development was informed by the HSRG effort, thus maintenance of the HSRG website and documents is needed to provide the details and rationale used in developing the HGMP[xxvi].

C. Trend Data Sets Updated Compilation and Access

Work Elements:	B 159: Support transfer of data into secure and accessible repositories D. 160 CA Data – DES and database E. 159: CA Data – compile data G. 161: Data - dissemination F.160: CA Data -automated data exchange H. 159 Compile high priority traditional StreamNet data

StreamNet's Integrated Query provides access to trend data stored in the StreamNet database. Georeferencing tables are maintained which allow the query systems to find data by HUC, NPCC subbasin, or state/county. StreamNet's Integrated Query system is designed so that users can quickly find and access the data they are looking for by using filters. Some features of note include: integrated maps; flexible and intuitive geographic filtering via maps; the feel of a desktop data explorer application rather than a "database website"; interactive charts with multiple series for comparison; and integrated reference documentation. The user interface (EXTJS) interacts with our published web services (ColdFusion and ArcGIS Server for maps) which interact with the SQL server database.

Updating trend data sets was prioritized by the StreamNet Executive Committee in 2018, with emphasis on trends supporting CAX HLIs and NPCC tools. During 2019 StreamNet data technicians working within the data source agencies continued to identify and update trend data sets associated with CA populations, and selected those that they considered integral to a better understanding of these populations at a more localized level. Trends related to NPCC tools were also updated as feasible with available resources (Table 7).

Table 6: Summary of the number of trends data sets and Protected Areas records in the StreamNet database, by data category. This summary represents all data submitted by the end of calendar year 2019 from any geographic areas in Montana, Idaho, Washington, and Oregon (not limited to the Columbia River basin). The number of Protected Areas records has been stable since the NPCC last

amended the Protected Areas in 1992. Note: beginning in 2018 fish distribution, barriers, dams, and hatcheries are being managed as GIS layers rather than as tables in a database.

Data Category	Available Data	Years	Records
Redd counts	4,963 Trends	1901 - 2019	53,630
Fish counts	438 Trends	1956 - 2018	2,273
Spawner counts	5,099 Trends	1944 - 2018	37,488
Spawning population estimates	3,181 Trends	1901 - 2018	22,197
Dam / weir counts	505 Trends	1926 - 2019	13,997
Fish abundance estimates	128 Trends	1976 - 2018	530
Hatchery returns	1,084 Trends	1906 - 2019	10,361
Freshwater harvest	2,708 Trends	1894 - 2015	45,662
Protected Areas	32,997 Records	n/a	n/a

1. The Confederated Tribes of the Colville Reservation

No significant work on HLI related trend data during 2019.

2. Idaho Department of Fish and Game

Idaho compiled and delivered fish data to StreamNet as time and staffing allowed. All metric data used to derive HLIs for CAX were uploaded to the StreamNet database (e.g. redd counts, hatchery returns, weir counts). The Chinook, steelhead, and sockeye salmon redd counts, weir counts, and hatchery returns were all updated.

3. Montana Department of Fish, Wildlife & Parks

MFWP compiled traditional StreamNet data throughout the year and exchanged trend data consisting of 1,416 redd counts at 128 locations in the Columbia Basin. In addition, 15 references were added and fish population and genetic data were submitted to the StreamNet Data Store as independent data sets. Fish distribution was submitted as a spatial data set and included over 500 new or edited records in 2019.

4. Oregon Department of Fish and Wildlife

Oregon exchanged 29 new and 508 existing traditional data trends originating from the BPA Inventory effort, NPCC dashboards, opportunistic connection to CA data, priority populations within the Columbia Basin, and QC information from StreamNet staff (including 1,237 for escapement data only). A significant portion of the escapement data updates originated from conducting QA/QC and adding new records for John Day basin spring Chinook.

5. Washington Department of Fish and Wildlife

WDFW updated Columbia Basin trend data in 2019. Specifically, for the following categories of trends: 69 redd counts, 35 carcass counts, 36 escapement or spawning abundance, and 5 harvest.

D. GIS Layers Updated Content and Access

PSMFC's GIS Center continues to support an integrated Columbia Basin fish facilities GIS data set. This effort eliminates multiple data sets with varying degrees of accuracy for location information, and establishes a common layer which is now shared between programs. This integrated GIS data set approach continued to support StreamNet and CA during 2019.

PSMFC's GIS Center also provided links to barrier data sets that partner agencies publish publicly. These barriers data are not standardized and are not compiled regionally. The status of this information reflects that this data category has not been identified as a priority for standardized compilation and distribution at the regional level. However, if this was accomplished this would be beneficial for the fish distribution data set.

It is noteworthy to point out that although PSMFC's GIS Center receives new stream routes from partner agencies, StreamNet is no longer funded to maintain a coordinated regional hydrography layer.

1. The Confederated Tribes of the Colville Reservation

GIS related tasks are not included in the StreamNet scope of work for the Colville Tribes.

2. Idaho Department of Fish and Game

The generalized fish distribution layer was updated in 2019 via direct GIS Exchange.

3. Montana Department of Fish, Wildlife & Parks

MFWP StreamNet staff manage the agency's fisheries spatial data and post GIS layers to the MFWP Open Data site where they are available for viewing and download. Spatial data sets include fish distribution, fish survey locations, genetic sample locations and hatchery locations. StreamNet staff under the guidance of PSMFC have begun to submit some data sets as spatial data sets rather than tabular.

In addition to managing StreamNet data sets as GIS layers, MFWP staff outside of StreamNet also make further fisheries GIS layers and products available to the public and partners such as aquatic invasive species information, fish stocking data, disease information and interactive maps and Story Maps.

4. Oregon Department of Fish and Wildlife

Within Oregon, routine GIS coordination occurred during 2019, as well as maintaining hydrography data (whole stream routes) to support mapping trend data. Whole stream route data were synchronized with the April 2019 National Hydrography Dataset geometry. Efforts were initiated to complete an update to the whole stream route data set for the Columbia Basin, which supports trend data mapping. This is part of the larger statewide effort.

Staff coordinated with Regional StreamNet to update all fish habitat distribution data sets on the StreamNet website for the first time in approximately 5 years. Further development of fish habitat distribution data sets for anadromous and resident salmonids continued, along with other game, non-game and non-native fish species in the Columbia Basin. Fish distribution and barrier data continue to be submitted as stand-alone GIS data sets. This reduces the hydrography data maintenance burden and simplifies the data submission process for distribution and barriers.

ODFW staff added records to the Oregon Fish Passage Barrier database, and updated Oregon Fish Habitat Distribution Database records in the Columbia Basin as necessary.

5. Washington Department of Fish and Wildlife

WDFW StreamNet GIS staff continued updates of WA NHD hydro databases and continued to support GIS needs to ensure the flow of StreamNet trend, fish distribution and CA data. In 2019 the GIS work focused on fish distribution, population geometry reviews and supercode, linework and dataflow tools. With this work we synchronized StreamNet with WDFW's master Statewide Washington

Integrated Fish Distribution layer and submitted new trends for new supercode locations to coordinate better with CA data. The supercode, linework and dataflow tools will aid next year's effort to centralize the StreamNet data compiling via an online feature service.

E. High Level Indicators Updated Content and Access – Coordinated Assessments

Work Elements:	159: Support transfer of data into secure and accessible repositories 161: Data - dissemination

The CA effort is designed to build automated HLI sharing capability in all the data source agencies. StreamNet worked with the agencies to develop procedures for internal conversion of the data to regional standards defined in the Data Exchange Standard.

StreamNet contributed to the coordination and standardization of monitoring data throughout the basin in 2019. StreamNet staff continued to work with partners in IDFG, Colville Tribes, MFWP, ODFW, CRITFC, and WDFW to promote data standardization within agencies. StreamNet staff and members actively supported improving data sharing capabilities in the region through the CA, such as by using an exchange network approach and dynamic web services to share data. Contributing to this effort, in 2012 StreamNet staff developed an automated means of feeding indicators and metrics from the CA to the NOAA Salmon Population Summary (SPS) database, and continued to maintain this tool in 2019. In 2019, StreamNet staff also continued to support NOAA staff accessing data directly from the CAX online query.

During the calendar year 2019 the CA effort partners continued to maintain and publish new records to the CAX query system resulting in a total of 12,541 records by the end of calendar year 2019 (Tables 7 and 8). The CAX query system displays HLIs and related trends data stored in the StreamNet database.

Table 7: Number of records of data, by high level indicator and StreamNet partner, as of 12/31/2018 and 12/31/2019.

High Level Indicator	Partner*	12/31/2018	12/31/2019
Natural Origin Spawner Abundance (NOSA)	Colville Tribes	13	14
	YN	34	272
	IDFG	1,226	1,254
	ODFW	2,347	2,445
	USFWS	33	33
	WDFW	2,101	2,142
Presmolt Abundance	Colville Tribes	40	49
	ODFW	85	89
	PSMFC	1	1
	Terraqua Inc.	23	23
Juvenile Outmigrants	Biomark	0	31
	Colville Tribes	11	12
	IDFG	482	741
	ODFW	308	315
	WDFW	341	358
Smolt to Adult Return Rate (SAR)	Colville Tribes	9	10
	FPC**	759	759
	ODFW	235	246
	USFWS	16	16
	WDFW	42	44
Recruits per Spawner (R/S)	Colville Tribes	9	10
	IDFG	1,020	984
	ODFW	2,152	2,232
	USFWS	13	13
	WDFW	310	302
Proportionate Natural Influence (PNI)	WDFW	113	146
Total number of records	**All combined**	**11,723**	**12,541**

*Biomark = Biomark, Inc.; Colville Tribes = Confederated Tribes of the Colville Reservation; YN = Confederated Tribes and Bands of the Yakama Indian Nation; FPC = Fish Passage Center IDFG = Idaho Department of Fish and Game; ODFW = Oregon Department of Fish and Wildlife PSMFC = Pacific States Marine Fisheries Commission; USFWS = U.S. Fish and Wildlife Service; WDFW = Washington Department of Fish and Wildlife.

**The FPC was attacked by ransomware during 2019. Due to technical difficulties at FPC PSMFC staff were not able to enter the 2019 FPC SAR data in December as expected. Thus, the results in this table do not reflect the 2019 FPC data later added to the CAX in February 2020.

Table 8: Summary of populations represented in the data as of 12/31/2019, by population group and high-level indicator. Groups reported are the combination of the first two columns. First column is population grouping; second column is high level indicator; third column is number of populations represented in the group; fourth column is the number of populations that are represented only as part of one or more superpopulations rather than as data specific to only a single population; fifth column is the number of records of data in the group; sixth column is the year range of the group.
The third column minus the fourth column is the number of populations that were represented by data specific to only a single population (i.e., not represented only by superpopulations).

Population Group*	High Level Indicator	Pops	Superpops Only	Records	Year Range
BPA Priority	Natural Origin Spawner Abundance (NOSA)	60	12	2,356	1949 - 2019
	Presmolt Abundance	8	0	162	1993 - 2018
	Juvenile Outmigrants	37	0	905	1987 - 2019
	Smolt to Adult Return Rate (SAR)	56	40	261	1985 - 2016
	Recruits per Spawner (R/S)	39	0	2,083	1949 - 2017
	Proportionate Natural Influence (PNI)	3	0	118	1985 - 2018
Columbia River Basin	Natural Origin Spawner Abundance (NOSA)	158	14	5,595	1938 - 2019
	Presmolt Abundance	8	0	162	1993 - 2018
	Juvenile Outmigrants	62	4	1,325	1978 - 2019
	Smolt to Adult Return Rate (SAR)	97	74	951	1985 - 2017
	Recruits per Spawner (R/S)	66	0	2,847	1949 - 2017
	Proportionate Natural Influence (PNI)	4	0	146	1985 - 2018
Oregon Coast	Natural Origin Spawner Abundance (NOSA)	56	35	565	1994 - 2018
	Juvenile Outmigrants	7	0	132	1997 - 2017
	Smolt to Adult Return Rate (SAR)	7	0	124	1997 - 2016
	Recruits per Spawner (R/S)	21	0	694	1994 - 2015

*BPA Priority = The 69 BPA Tier 1 and Tier 2 priority ESA-listed populations.
Columbia River Basin = All population within the Columbia Basin, including the BPA priority populations.
Oregon Coast = Populations in Oregon coast river systems draining directly into the Pacific Ocean. These are outside the Columbia River basin and are compiled using alternative funding.
The database held no data for Puget Sound populations.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes' HLIs are housed in the OBMEP database, and a Python script syncs these data with the CAX database. In 2019, the Python script and HLI tables in the OBMEP database were updated to comply with new CAX validation rules.

2. Idaho Department of Fish and Game

The IDFG StreamNet subproject can currently accomplish nearly automated submittal of data consistent with the DES through their IFWIS database and APIs, which the Idaho StreamNet project helped to initiate and partially supports.

IDFG StreamNet expanded streamlined data flows for CAX HLI data to include new species, populations, and life stages.

3. Montana Department of Fish, Wildlife & Parks

CA indicators and DESs have not been developed for resident fish species. MFWP staff have been staying aware of work being done for the CA project and will be prepared as work begins to develop metrics and indicators for resident species.

4. Oregon Department of Fish and Wildlife

The ODFW StreamNet subproject enhanced their CA automated data exchange system to stay in sync with StreamNet CAX changes, increase robustness, and implement new pre-submission validation rules. ODFW's application that loads CA from an Access database into a SQL database and then on to StreamNet via the StreamNet API was also updated and enhanced. In 2019, ODFW staff made significant progress developing a web application that will allow Coordinated Assessments data to be entered directly into the ODFW Coordinated Assessment SQL server database and to automate the processes for validation and submission to the StreamNet API. A test application for the NOSA and RperS tables has been developed. The goal is to have a fully operational application for data stewards to use by the end of 2020.

Oregon StreamNet staff also coordinated internally and externally to ensure priority CA and recovery related efforts were addressed. ODFW regional coordination focused on NOAA TRT recovery population changes, regional information gathering requests, data exchange standards, traditional data category definitions, and StreamNet's Integrated Query system. Oregon spent significant time participating in the development, update and maintenance of the CA and StreamNet DESs throughout the year, including updating the application used to exchange four CA DES indicators. Some ODFW coordination occurred with other agencies, tribes, regional groups, non-profits, efforts outside the FWP, etc. beyond the CA process in CY2019.

ODFW StreamNet acquired new and maintained existing data sets for population estimates from various contributors in the Columbia Basin. This resulted in the submission in CA DES format of all BPA priority populations that ODFW committed to (see Tables 7 and 8).

5. Washington Department of Fish and Wildlife

WDFW is in the process of modifying their Salmonid Stock inventory (SaSI) to carry CA indicator data and deliver them to the CA StreamNet database using the StreamNet API.

WDFW StreamNet staff loaded the WDFW CA database with NOSA (2018-2019) and SAR (2003-2010) data to test exchanging data with PSMFC through the API. Although the test was successful, these data

were not published as at that time the PopFit and TRTmethod columns in the data tables needed to be documented further to accurately reflect the data. The Upper Columbia Data Steward conducted a regional WDFW review to identify CA metric data and associated time series for CA data in the upper Columbia Basin. These data were identified and compiled for future integration into the CA database. All StreamNet staff contributed and continue to contribute to the new design of the TWS (Traps, Weirs, Surveys) restructure and to ensure all measurements were being collected to support metrics needed to create focal indicators.

F. DES and Validation Process for Data and HLIs Submitted to the StreamNet Database

Work Elements:	159: Support transfer of data into secure and accessible repositories 159: CA Data – compile data 160: CA Data -automated data exchange 159 Compile high priority traditional StreamNet data 160 Infrastructure and base operations

StreamNet maintains a thorough data validation system as detailed in the approach/methodology section. During CY2019, StreamNet PSMFC staff have updated the DES and the related validation rules.

StreamNet Data Stewards are also engaged in development of the DES and validation process.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes staff participated in the DES development meetings during 2019.

2. Idaho Department of Fish and Game

IDFG StreamNet staff continued to support the development and maintenance of CA DES and database. They coordinated with development between the proposed DES, the prototype database and application, and the web service data exchange. IDFG StreamNet staff completed, corrected, and standardized data source workbooks for natural origin HLI data.

IDFG StreamNet staff collaborated with PSMFC staff to update validation rules and used web services to exchange data between IDFG, StreamNet, and the CAX HLI databases. They also helped regional staff test updates to DES and validation.

3. Montana Fish, Wildlife & Parks

MFWP staff are ready to engage when CA indicators and DES are developed for resident fish.

4. Oregon Department of Fish and Wildlife

ODFW staff contributed significant input to CA DES discussions, various forums and email correspondences throughout the year, including submitting a detailed Natural Origin Spawner Abundance (NOSA) table proposal to Regional StreamNet staff. The CA DES Development Team (DDT)

sought a way to distinguish NOSA estimates from escapement estimates used as surrogates. The proposal suggests adding new fields to describe whether estimates in the NOSA table are a true NOSA estimate or an escapement estimate. All StreamNet partners are hopeful that a final solution to distinguish NOSA from escapement will be identified and approved in 2020.

5. Washington Department of Fish and Wildlife

WDFW participated in CA DES development discussions and meetings with the CA DES Development Team (DDT). WDFW SN Staff continued to map the CA DES to ETL processes in our own internal corporate systems for the three primary CA indicators in 2019.

G. Metadata Documentation

Work Elements:	159: Support transfer of data into secure and accessible repositories 160 Infrastructure and base operations

During 2019, metadata continued to be captured for new data sets submitted to the Data Store. These metadata are provided by the entity that uploads the data set. The Data Store online upload process requires that descriptive information be completed before the data set is accepted. For data from projects funded under the Fish and Wildlife Program, the application pre-fills some project related metadata fields directly from the BPA Cbfish.org database. All metadata are included whenever users download data sets. The amount of detail regarding sampling methodology and other key aspects is dependent on the entity uploading the data. The Data Store metadata constitute an extension to the FGDC Biological Profile metadata standard.

During 2019, metadata also continued to be captured for data submitted to the StreamNet database. The metadata captured differed depending on whether the data were submitted to the StreamNet database for display on the CAX Query or StreamNet's Integrated Query, as described in Section IV.H. The documentation of metadata could be further improved.

1. The Confederated Tribes of the Colville Reservation.

The metadata related to the compilation of filed data used for the HLI are housed in MonitoringResources.org.

2. Idaho Department of Fish and Game

IDFG continued to create and update metadata for all data submitted to SN and CAX per the DES. During 2019 links to data sources were updated.

3. Montana Department of Fish, Wildlife & Parks

MFWP StreamNet staff created and updated metadata for all spatial data sets submitted to StreamNet or posted to the MFWP Open Data site. Metadata were completed for all data submissions to the StreamNet Data Store.

4. Oregon Department of Fish and Wildlife

Staff completed a full draft of the Snake River spring Chinook Viable Salmonid Population (VSP) Compendium that is currently under final review. The VSP Compendium is a detailed field and analysis methods document for CA indicators and metrics and should be available via ODFW's Data Clearinghouse in Spring of 2020. We also developed a Data Management Flow Diagram (DMFD) for ODFW CA data, from data collection to data dissemination.

5. Washington Department of Fish and Wildlife

WDFW StreamNet staff continued to work with contributing biologists to document methodologies and update them within our corporate reporting systems. The development of formal metadata for CA data and beyond will greatly aid efforts to document data origin, protocols used to collect the data, and uses of the data.

H. Data Backup Systems

Work Elements:	159: Support transfer of data into secure and accessible repositories 160 Infrastructure and base operations

The StreamNet staff continued to maintain and implement the data backup approach described in Section IV-I above. No changes in data backup systems were made in 2019.

I. Supported Reporting and Decision-Making Processes

Work Elements:	185 Produce PISCES Status Report 161: Data Dissemination 119: Manage project activities 132: Produce annual reports 141: Produce BiOp RPA Reports

StreamNet Staff manages all project activities and ensures that StreamNet project quarterly status reports, annual report and BiOp RPA report to BPA are submitted on time to BPA. All reports were submitted to BPA as requested during calendar year 2019.

During 2019, StreamNet continued to support BPA's mandate to have data sets collected using rate payer funding be publicly accessible in a web-based data repository by facilitating submittal of data sets to the StreamNet Data Store. The availability of population estimates through the CAX has facilitated BPA's "One Fish Two Fish" tool to pull information from the CAX database as well as other data sources to display these on an interactive web-tool that communicates the status of ESA-listed salmon and steelhead populations (http://www.onefishtwofish.net/sps/SPS3.html). BPA also manages a web-based project contracting tool, CBFish.org, which contains annual reports of BPA funded projects, several of

which submit their data to the StreamNet Data Store, to the CAX as derived estimates and HLIs, and/or as a trends data set to the StreamNet database.

NOAA staff involved in the data compilation to inform the 5-year status review of CRB salmon and steelhead populations continue to participate in the CA and StreamNet committees to inform the content of the CAX to support their data needs. NOAA Fisheries uses the natural origin CRB salmon and steelhead indicators currently reported through the CAX (e.g., adult spawner abundance and productivity,) to inform their status reviews and delisting decisions. The CA and the DES have greatly reduced the time and effort required by NOAA Fisheries staff to obtain and process data for their CRB ESA status assessments. StreamNet staff continued to assist NOAA staff and respond to their requests during 2019.

StreamNet Staff continued to provide support in 2019 to NPCC staff and their program tool contractors. NPCC staff continued throughout 2019 to use and rely on the Protected Areas mapper and associated database and documentation to inform their decisions related to whether proposed new hydroelectricity development is consistent with the NPCC FW Program policy. Furthermore, StreamNet databases and maps supports the NPCC FW Program reporting needs related to tracking the status of the basin's fish and wildlife resources (2014 FW Program Part Two, section V), reporting on the program's approved high-level indicators (2014 FW Program Appendix E), and tracking progress towards Program goals, objectives and indicators (2014 FW Program Appendix D and its draft 2020 Addendum Part 1A). NPCC also has several online reporting tools that relies on StreamNet's Integrated Query tool and the CAX population estimates including:

- NPCC high-level indicators and Program Tracker to track the status of species, progress of fish and wildlife efforts in the Columbia Basin, and with the adoption of the 2020 Program addendum, will assess progress towards NPCC FW Program objectives and performance Indicators. The CAX and StreamNet's Integrated Query traditional trends data feed information to these reporting tools.
- NPCC Fish Objectives Mapper and Query Tool displays in real time the CAX population estimates to provide context to the adult salmon and steelhead goals and objectives from CRB management and policy documents.
- NPCC subbasin plan "dashboards" show extracts of subbasin plans and related links. StreamNet data are widely used in support of dashboards. In particular StreamNet partners have made the underlying "Trend" data sets that support these dashboards an update priority through StreamNet.

StreamNet maintains a custom set of web services that allow NPCC to retrieve, in an automated way, specific sets of detailed "trend" data and Columbia Basin Fish & Wildlife Library reference documents (via URL) for use in NPCC online reporting tools.

During 2019, StreamNet co-authored with the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and NOAA Fisheries Service West Coast Region West Coast Region a white paper on citing aquatic monitoring data set (released August 15, 2019). This white paper provides guidance for proper crediting of data providers and metadata recommendation for multi-contributor data sets; a valuable resource for contributors and users of the Coordinated Assessments Exchange (CAX) web-based query. StreamNet staff assisted PNAMP with the planning and organization of the Smolt Estimation and Analytics Workshop which was held on November 6-7, 2019. StreamNet staff are also assisting PNAMP in the organization of the Emerging Technologies Workshop planned for early 2021.

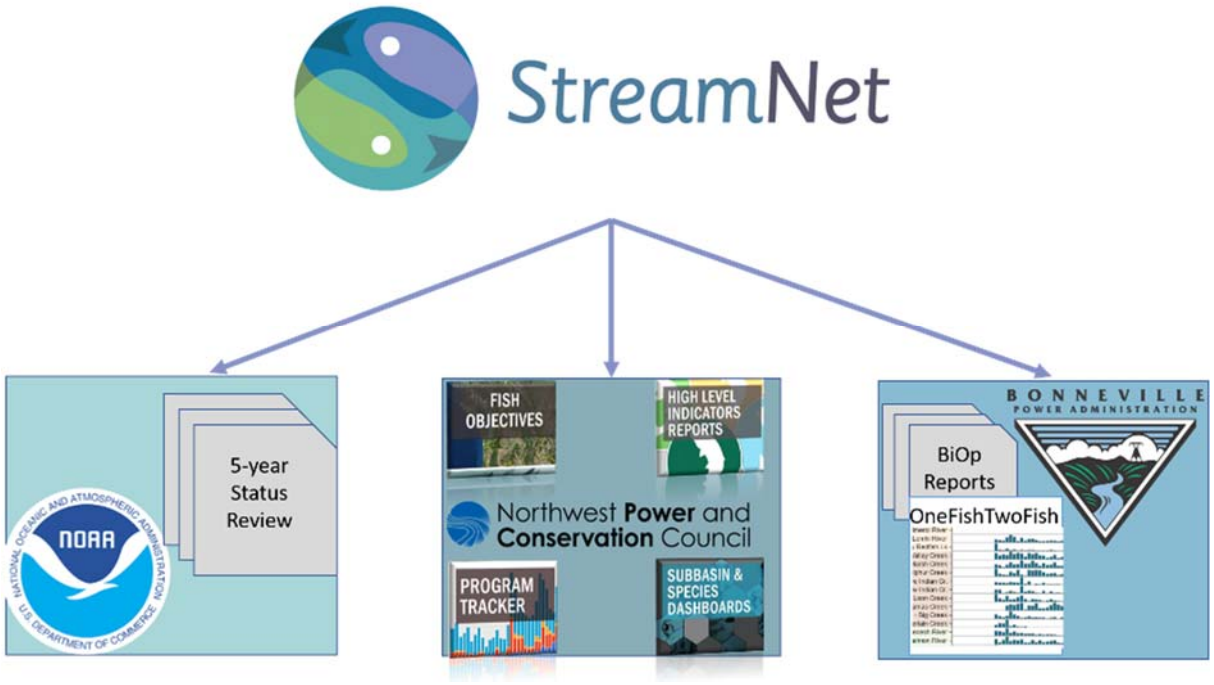


Figure 12: StreamNet provides information to several regional reporting tools and decision-making processes.

1. The Confederated Tribes of the Colville Reservation

Tribal data management advancements supported in part by StreamNet data stewards have also contributed data informing the Colville Tribes Okanogan Monitoring and Evaluation Program Report Card[xxvii] which informs decisions related to habitat action implementation.

2. Idaho Department of Fish and Game

IDFG's Follow Idaho Salmon Home (FISH)[xxviii] public website that provides access to Idaho's wild and hatchery sockeye, steelhead and Chinook salmon populations as well as distribution maps, juvenile abundance, and age data have benefited from the work supported by StreamNet Data Stewards. The entire data set for the salmon and steelhead was updated in collaboration with the FPC. During 2019 the FISH website hosted by the FPC was attached by ransomware and is currently being worked on to bring it back online.

3. Montana Department of Fish, Wildlife & Parks

MFWP data and information websites have advanced their capacity for providing access and sharing data for resident fish species important to the NPCC FW Program. These include

- Fish Inventory System (FIS) FIS is available through the agency internal website and holds survey data, individual fish information, distribution, tagging data and hatchery data to name a few. FIS also contains sophisticated analysis tools which incorporate the use of R statistical code. This application puts the data entry, analysis and reporting in the hands of biologists. Data are continually updated, and sources include FWP, US Forest Service (USFS), USFWS, Bureau of Land Management (BLM) and tribal fisheries biologists and supplemented with information provided in technical documents and reports

- FishMT is a public facing web application that provides users with access to vast amount of fish and fishing information. Through FishMT the public can get information related to fish stocking records, survey data, species distribution, reports, publications and more. In addition, users can find fishing opportunities, report catching tagged fish, link to the regulations and buy licenses http://fwp.mt.gov/fish/
- Crucial Areas Planning System is a Web-based mapping application aimed at future planning for a variety of development and conservation purposes so fish, wildlife, and recreational resources can be considered earlier. It leverages information developed as part of the Crucial Areas Assessment effort, part of a 2008 Western Governors' Association initiative, which evaluated the fish, wildlife, and recreational resources of Montana in order to identify crucial areas and fish and wildlife corridors. with MFWP staff providing updated data on an annual basis annual or as needed basis. This effort has since been transferred over to the Western Association of Fish and Wildlife Agencies. http://fwp.mt.gov/fishAndWildlife/conservationInAction/crucialAreas.html

4. Oregon Department of Fish and Wildlife

In 2017, ODFW initiated Phase 1 efforts to pilot a comprehensive information system which once fully implemented will greatly improve ODFW data management and sharing efficiency. Such a system was also called for in the ODFW 2018 Strategic Plan. With the establishment of an Enterprise Governance Committee in 2018, agency data management was deemed to be an enterprise level project under their purview. Discussions are ongoing to determine the best data management and sharing approach for the agency.

Currently, ODFW provides access to salmon and steelhead information and data through several websites:

- Data Clearinghouse stores natural resource information, including reports, data files, databases, GIS files, maps and pictures from natural resource projects. This includes agency projects that provide CA data for recovery populations, and Oregon Watershed Council projects funded by the Oregon Watershed Enhancement Board, and other partners implementing the Oregon Plan for Salmon and Watersheds.
- Oregon Salmon and Steelhead Recovery Tracker website (http://www.odfwrecoverytracker.org/) allows exploring and downloading information related to salmon conservation and recovery in Oregon.
- Centralized Oregon Mapping Products and Analysis Support System (Compass, http://www.dfw.state.or.us/maps/compass/), this online fish and wildlife habitat map provides coarse-scale, non-regulatory fish and wildlife information, and crucial habitat layers emphasizing areas documented as containing important natural resources. Compass is intended to support early planning for large-scale land-use, development, or conservation projects, helping users make informed decisions related to fish and wildlife habitats as energy, transportation, conservation and other large projects are planned.
- Fish Habitat Distribution and Barrier Data Viewer (https://nrimp.dfw.state.or.us/FHD_FPB_Viewer/index.html) facilitates access to ODFW stewarded data sets for fish habitat distribution and fish passage barriers.

5. United States Fisheries and Wildlife Service

USFWS Pacific Region Fishery Resources Program work with partners to protect the quality of aquatic habitats, and recover and restore fish and other aquatic resources. The HLIs and trends in the CAX database informs joint NOAA-USFWS status reports for salmon and steelhead (NOAA lead agency) and

complements the information in the USFWS ECOS Database[xxix]. The 5-year Coordinated Assessments Plan includes development of hatchery HLIs. As work is funded to develop hatchery indicators for data exchange with the CAX, this will leverage hatchery data that are stored in the Fish Inventory System[xxx] (FINS) database by USFWS staff.

6. Washington Department of Fish and Wildlife

Washington Department of Fish and Wildlife (WDFW) manages multiple data resources which provides up-to-date information on populations and provides context for the efforts WDFW and its partners are taking in the arenas of habitat, hatcheries, and harvest to protect and conserve salmon and steelhead in Washington. These databases have benefited from advances funded through StreamNet and includes:

- **SCoRe Interactive Map** [xxxi] allows the user to explore salmon and steelhead hatchery and population data and related information by salmon recovery region, county, lead entities, and by water resource inventory area (WRIA).
- **SalmonScape** [xxxii]delivers the science that helps recovery planners identify and prioritize the restoration and protection activities that offer the greatest benefit to fish. SalmonScape merges fish and habitat data collected by state, federal, tribal and local biologists and presents them in an integrated system that can be readily accessed by other agencies and citizens. SalmonScape is an interactive mapping application designed to display and report a wide range of data related to salmon distribution, status, and habitats.
- The **Spawning Ground Survey**[xxxiii] (SGS) database was designed as a repository for unexpanded data collected during spawning ground surveys and from adult traps. It is intended to provide a common framework for the collection, storage, retrieval, and dissemination of data collected by public and private entities. It includes status and trends of Coastal, Puget Sound, and Columbia Basin salmonid stocks.
- **CWT Recovery Database** live updates posted to Data.WA.Gov website.

J. Coordination with Partners and Responding to Data and Information Requests

Work Elements:	189: Coordination 161. Disseminate Raw/Summary Data and Results

PSMFC StreamNet continued to engaged in the CA Core Team which serves to coordinate among StreamNet, CRITFC-ITMD, NOAA, BPA and states. PSMFC StreamNet continued to organize and chair the StreamNet Steering Committee meetings and update the StreamNet Executive Committee. PSMFC staff continue to collaborate with and assist with partners submitting data to the StreamNet and CAX databases to improve data flow to the CAX and access to CAX HLI and related data. PSMFC staff continue to convene and chair DES team meetings to inform DES development/improvements. PSMFC StreamNet also regularly engages, on an individual basis, with USFWS, NOAA, BPA, CRITFC, PNAMP and NPCC staff to be informed about each entity's needs and how coordination can be enhanced.

Direct requests for information or help have become less frequent over the years, as the StreamNet web site has been more stable, our online services more robust, and our priority shift to population-scale data has meant that our traditional data are not updated as frequently. Only 5 non-trivial direct requests were received by PSMFC StreamNet staff in 2019. All were promptly and satisfactorily addressed.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes Data Steward participated in on the CA Core Team and the DES Development Team, and provided feedback on the DES.

The Colville Tribes' anadromous division coordinated with other separately funded Colville Tribes programs such as the Chief Joseph Hatchery and the Resident Fish Department to keep them informed of the efforts and data structure the Colville Tribes was using for the Coordinated Assessments project.

The Colville Tribes responded to 12 data requests this year which were either met by directing users to appropriate data sources, or by running specific queries in the OBMEP database to fulfill the request.

2. Idaho Department of Fish and Game

IDFG StreamNet staff participated in the Steering Committee and Technical Committee, and supported development of DES and streamlined data flows. They provided input prioritizing indicators, metrics, and metadata.

Staff coordinated data management and analyses with tribal collaborators. Staff also updated and improved the sockeye data source workbook in cooperation with research and hatchery staff.

IDFG StreamNet staff responded to data requests coming from internal and external partners, and the general public. The number of data requests continues to decrease as the number of IFWIS users increases, and people find data for themselves.

3. Montana Department of Fish, Wildlife & Parks

Staff participated in Western Association of Fish and Wildlife Agencies efforts which relate directly to the use of StreamNet data.

MFWP StreamNet staff responded to all data and map requests coming from internal staff, partners and the public. Many external data requesters are being referred to the FishMT web query system or the MFWP Open Data site to meet their needs. Internal requests consist of data queries and map requests that internal staff cannot complete themselves. MFWP GIS staff received 65 GIS or data requests during the calendar year and requests are tracked through an internal HelpDesk ticketing system.

4. Oregon Department of Fish and Wildlife

ODFW participated in CA Planning Group, DES Development Team, and StreamNet Technical and Steering Committee meetings, along with state and other regional discussions, workshops and planning efforts related to trend data development and CA data flow. Focused attention was given to developing a proposal to include new fields in the NOSA table to describe estimates more closely related to escapement and improvements to the design and functionality of the StreamNet and CAX websites. Staff continued contributions to BPA regarding priority population commitments and responding to requests from StreamNet partners.

ODFW contributed to Regional StreamNet's contributions and responses during the Independent Scientific Review Panel's F&W Program review process. Staff also participated in user testing of MonitoringResources.org with PNAMP staff to streamline navigation and functionality of the website.

Eastern Oregon StreamNet staff attended the Smolt Estimation and Analytics Workshop conducted by PNAMP and StreamNet. The Workshop was an effort to share and explore the standardization of juvenile collection and analytical methods across the Columbia Basin.

Staff conducted/participated in an ODFW-East Region steelhead meeting to discuss long term data needs, monitoring plans, and method changes for NOSA and other metrics. Discussion was focused on eastern Oregon but western Oregon biologists were present as well. Participants included staff from Fish Research, Fish Districts, Watershed Managers, East-side Conservation Implementation Coordinator, and the Oregon Plan Monitoring Coordinator.

Oregon StreamNet staff responded to data requests coming from internal and external partners, and the general public, with GIS, data, and tech support requests being the most frequent. Agency staff are also utilizing StreamNet funded staff as a resource for assistance with developing data standards and responding to data requests that come to them.

5. Washington Department of Fish and Wildlife

WDFW StreamNet continued this year to participate in the CA process. Attention was given to DES development efforts, working with other agencies on overlapping populations, and continued development of data flow. Staff developed the code and processes to update CA tables with final products.

In 2019 and 2020, WDFW collaborated with CA partners to develop and submit a hatchery CAX grant proposal and preliminary scoping.

WDFW StreamNet staff responded to data requests coming from internal and external partners, and the general public, with GIS, data, and tech support requests being the most frequent.

VI. Discussion – Lessons Learned and Recommendations

StreamNet serves as a regional coordination body to support data management and facilitate cooperation across organizational boundaries. StreamNet supports coordination through establishing and implementing basin-wide data reporting standards for a specific suite of fish related measures, including abundance, distribution, and productivity, with a long-term goal of extending coverage to additional metrics of regional importance. These data have traditionally been created and managed internally by the region's state, tribal and federal fish management agencies or programs, and have not been shared widely in a consistent format, except through StreamNet

StreamNet makes all compiled data available through multiple web-based data query tools as well as multiple data download formats and through specialized categories of downloadable data. All data are available to the public, either directly from the web tools or after requesting access through the StreamNet API as recommended by programming best practices. Some sensitive data, such as specific spawning locations, may be obscured by the submitting agency to protect the resource. In such cases, the agency will typically generalize locations to a larger map section (show a large stream section rather

than a point). Users accessing data through the CAX query system are also required to agree to the End User Agreement (EULA) at the request of data submitting agencies.

StreamNet staff are involved in standardization and coordination efforts on a wide variety of data management issues. StreamNet does not compile raw data in its database nor does it conduct analysis. Where derived data, such as estimates of spawning populations, are disseminated through the project, they are obtained from the source agencies for inclusion in the StreamNet data systems. Virtually all data sets collected by the collaborating agencies are submitted in slightly summarized format or as high-level indicators with associated metadata. Thus, StreamNet staff work closely with states, tribes, agencies, and with organizations such as the NPCC, Columbia River Intertribal Fish Commission (CRITFC), and the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) to ensure that data managers can communicate, share, and interpret data effectively across boundaries.

The primary focus of StreamNet staff in 2019 continued to be implementation of the CA. It is continually evident that automation of data flow is more difficult than originally anticipated. Partners are still regularly involved in obtaining data from field staff, and there is a high degree of analysis required in order to produce high-level population indicators. Varying environmental conditions, changes in analytical protocols, and staffing changes all contribute to a "hands-on" effort that is essential for production of the indicators. This has led to a slowdown in development of new indicators and has impacted the regular updates of more traditional trend data in StreamNet, as the anticipated de-obligation of resources resulting from automation of data flow has yet to be achieved.

As of the end of calendar year 2019, StreamNet query system continues to support access to data for NPCC FW Program focal species as well as other west coast species (Appendix B) and, based on a preliminary crosswalk, the CAX contains population level estimates for populations identified in the draft 2020 FW Program addendum. The CAX query system also continues to provide access to BPA priority populations. With the efforts of the Colville Tribes, CRITFC ITMD project, and CRITFC member tribes CAX has also seen an increase in tribal data submission. Challenges remain regarding having broad coverage of HLIs for many salmon and steelhead populations partially due to (1) lack of populations being monitored, (2) indicators not being calculated for all defined populations or calculated at the sub-population scale, and (3) various state and tribal agencies being at significantly different stages in developing the capabilities of their data management infrastructure.

StreamNet's "classic" query system was retired in 2016 and is no longer visible to the public. Some of the functionalities of the classic query were a better fit for some data consumers (e.g. NPCC Program Tracker contractor) and remained accessible to them. Work was initiated in CY 2019 to develop a filterable API that would better meet the custom data requests from the diversity of users accessing the StreamNet data. This improved API will also allow StreamNet staff to completely retire the classic query system.

StreamNet staff remained available for responding to specific requests for maps, data queries, and topic specific reports. In the past these have included reports on the geographic distribution of fish, fish marking and hatchery releases, and other topics for which StreamNet holds data, or where StreamNet can serve a facilitating role with other PSMFC projects and databases. As a BPA funded project, StreamNet regularly issues required reports through Pisces and Cbfish.org. In 2019 these included quarterly progress reports, cost-share reports, inventory reports, BPA annual project reports, and BPA BiOp reports.

A. Participation in Standing Committees

CRITFC member tribes have been invited to participate on both the Executive Committee and Steering Committee, and do sometimes attend. The tribes have made it clear that lack of funding restricts their ability to participate, thus expansion of the StreamNet Committees and engagement in the CA requires financial support.

B. Implement NPCC 2019 Budget Recommendation

BPA funding of the StreamNet project has remained static, and has even decreased as discussed above, since 2004 (Figure 5 in Section III.D). With this static, and reduced, budget it has become increasingly difficult to implement the project as recommended by the NPCC and as dictated in the Five-Year CA Plan, especially when considering the increasing costs associated with FTE and technology. This interaction of static budget and increasing costs have resulted in a lack of progress on expanding into other indicators and species, such as hatchery and resident fish data and increasing tribal participation, as originally planned in the StreamNet Strategic and CA 5 Year plans. To support broader participation of tribal agencies in StreamNet Committees and CA as well as to support development of data exchange standards for new data categories and species identified as priorities by BPA, NOAA, and NPCC, the annual StreamNet budget needs to be reinstated to $2,145,483 as recommended by the NPCC in 2019. StreamNet will also continue to explore grant opportunities to advance the development of data sharing such as the US EPA Exchange Network grant which was successfully secured in 2015 and used to initiate implementation of the CA.

C. Adequately Support State and Tribal Data Stewards

One of the lessons learned in this project has been that embedded data management staff paid for through StreamNet serve an important and often unrecognized role within the agencies. StreamNet Data Stewards are instrumental in assuring that relevant BPA-funded data are submitted on a regular basis to the StreamNet database in the agreed upon format. At the same time, integrating data stewards within agencies and tribes allows for implementation of more efficient data flow to decision makers, as there is a collaborative approach and common vision about how to make the desired information accessible. The existing committee and team structure of StreamNet further facilitates this shared effort as all levels are informed through the same flow of information, from the Executive and Steering Committees to the DES Development Team and Technical Team.

D. Establish StreamNet as System of Record for BPA/NPCC Program

BPA recognizes the PSMFC StreamNet GIS data layers for GIS locations related to fish populations and sites associated with data submitted to the StreamNet database as the system of record for fish facilities (e.g., hatchery, weirs) and for fish distribution. Establishing StreamNet as the system of record for these GIS data layers provides a comprehensive location for Columbia River basin information that is collaboratively informed by partners and facilitates consistency across users.

It would be beneficial if the NPCC would also recognize PSMFC StreamNet GIS and the StreamNet database as the system of record for the Program. Having both BPA and NPCC supportive of StreamNet in this manner would allow StreamNet to assist the NPCC in maintaining their GIS-based program tools, and ensure consistency of information across BPA and NPCC as well as other partners. This would also provide more specific guidance and resources to improve the PSFMC-StreamNet GIS system to address BPA's and NPCC's growing needs, such as having a comprehensive database of BPA funded and NPCC recommended fish facilities.

E. Expand CA Data Content to Support Regional Reporting

The CA originally, and continues, as documented in its Five-Year Plan, to intend to expand to additional data categories, fish species, and geographic scope. The recent focus of the CA obtaining standardized data and associated trends information for BPA priority populations and relatively static resources devoted to the project has resulted in a lack of progress on expanding into other indicators and species, such as hatchery and resident fish data.

Data disseminated through the project are primarily focused on the Columbia Basin, but other data are included when they are obtained through other contracts or are already consolidated in agency databases. StreamNet continues to explore expanding the data and HLIs contributed to the CAX to better address NOAA's 5-year status review and to respond to the NPCC FW Program 2020 Addendum Part 1 information needs. Additional funding from other partners and sources would greatly facilitate advancing the CA's ability to inform the reporting needs of NOAA and NPCC. Alternatively, additional funds from BPA would also be viable to better address BPA's information needs such as other VSP parameters and carrying capacity.

F. Document Metadata – Including Analysis

One lesson learned through this project is that the existing system of decision-making is reliant on a small, core network of biologists with a long history and significant institutional knowledge that is largely irreplaceable. As these professionals retire a more automated and documented system will be essential to assure continuity of population assessments. Projects such as StreamNet serve a key role in assuring that this documentation and the data needed to inform the assessment process are accessible and stable during any upcoming transition. Analytical method documentation for the CA continued to be a priority for StreamNet in 2019.

VII. Appendix A: User Statistics for PSMFC-StreamNet Project Information Tools

Table 9: Summary of the number of visitors to the StreamNet website including the number of page-views, average page viewed, and average time on the website. Last two columns on the far right summarizes the combined usage (hits) of the StreamNet Query (SNQ) and the Coordinated Assessments Exchange (CAX), as well as the usage of the API (hits).

Calendar Year:	Total Visits	Unique Visitors	Page Views	Ave. Page Views	Ave. Time on Site (min)	SNQ / CAX data (hits/usage)	Data API Usage (hits/usage)
2019	11,774	8,232	23,458	2	1	6,968	425,710
2018	13,371	9,197	34,551	3	2		2,399,444*
2017	22,630	14,228	54,677	2	1		508,123
2016	29,708	18,399	83,182	3	3		412,504
2015	32,590	20,014	63,880	3	3		144,698
2014	39,171	31,424	75,112	2	1		51,358
2013	44798	36683	89681	2	1.11		n/a
2012	27163	19291	66686	2.46	1.38		n/a
2011	25169	16586	63186	2.51	1.58		n/a
2010	23,029	13,924	49,725	2.16	2.06		n/a
2009	11,578	6,983	26,261	2.27	2.11		n/a

** New API feature allowing internal AGENCY/TRIBAL validation before data submission and new partners starting to use API resulted in the large increase of API usage in 2018 before returning to more stable amount in 2019.*

Table 10: Summary of the number of visits per year by entities/groups visiting the StreamNet website based on their IP addresses.

CALENDAR YEAR:	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
BPA	235	91	173	536	448	213	220	258	141	296	150
NOAA	216	115	251	540	574	349	309	385	144	572	306
USFWS	160	86	208	388	256	201	109	182	111	262	185
WDFW	154	64	111	220	194	165	89	156	36	584	261
IDAHO	142	52	134	270	158	118	120	132	63	166	128
OREGON	438	203	380	948	776	640	600	961	881	974	594
WA	35										
NPT	66	36	37	80	99						
US ACOE	98	72	120	198	394	360	462	342	96	515	277
USFS	90	172	218	308	347	241	393	443	0	593	339
USDA	74	50	78	129	126	122	148	130	58	244	201
US BLM	47	38	83	125	176	122	139	186	81	155	95
USGS	34										
PUBLIC	7,417	6,170	9,621	10,906	9,241	17,862	17,711	12,515	4,200	8,369	2,530
OSU	79	77	146	175	187	158	186	152	40	148	64
UNIV. OF WA	69	65	17	141	167	114	91	109	24	169	70
PORTLAND STATE UNIV.	47	81	40	103	146	70	73	88	0	55	39
TOTAL	9401	7372	11617	15067	13289	20735	20650	16039	5875	13102	5239

VIII. Appendix B: NPCC FW Program Focal Species and other Fish Species included in StreamNet Query System

NPCC Focal Species	SN Query Trend data
Chinook salmon	Yes
Chum salmon	Yes
Coho salmon	Yes
Green sturgeon	Yes
Pacific lamprey	Yes
Sockeye salmon	Yes
Steelhead	Yes
American shad	Yes
Black crappie	Yes
Bluegill	Yes
Brook trout	Yes
Brown trout	Yes
Bull trout	Yes
Burbot	Yes
Channel catfish	Yes
Coastal cutthroat trout	Yes
Cutthroat trout	Yes
Kokanee	Yes
Lahontan cutthroat trout	Yes
Lake trout	Yes
Largemouth bass	Yes
Mountain whitefish	Yes
Northern pike	Yes
Northern pikeminnow	Yes
Rainbow trout	Yes
Rainbow trout X Cutthroat trout hybrid	Yes
Redband trout	Yes
Sculpins	Yes
Smallmouth bass	Yes
Walleye	Yes
Western brook lamprey	Yes
Westslope cutthroat trout	Yes
White crappie	Yes
White sturgeon	Yes
Yellow perch	Yes
Yellowstone cutthroat trout	Yes
Oregon Chub	No

IX. Appendix C: NPCC FW Program Draft 2020 Addendum Salmon and Steelhead Groupings Cross-walked to StreamNet/CAX Query Systems

Below we provide a preliminary crosswalk between the populations with data within the CAX and the grouping of populations used by NPCC and MAFAC. For populations not linked to data in the CAX need to verify with managers if there is available data.

Table 11: Preliminary crosswalk between the NPCC/MAFAC salmon and steelhead groups with content of the CAX query system.

NPCC 2020 Addendum and MAFAC-CBPTF Group	pop with HLI and/or Trend	total pop in group	% covered
CBPTF Lower Columbia Chum group	4	17	24%
CBPTF Lower Columbia Coho group	23	25	92%
CBPTF Lower Columbia Fall Chinook (tules) group	20	21	95%
CBPTF Lower Columbia Late Fall Chinook (bright) group	2	2	100%
CBPTF Lower Columbia Spring Chinook group	6	9	67%
CBPTF Lower Columbia Steelhead group	22	30	73%
CBPTF Mid-Columbia (upriver) Coho group	0	14	0
CBPTF Mid-Columbia Sockeye group	0	1	0
CBPTF Mid-Columbia Spring Chinook Group	0	14	0
CBPTF Mid-Columbia Steelhead group	17	20	85%
CBPTF Mid-Columbia Summer/Fall Chinook group	0	1	0%
CBPTF Snake River Fall Chinook group	1	2	50%
CBPTF Snake River Sockeye group	1	6	17%
CBPTF Snake River Spring/Summer Chinook group	35	54	65%
CBPTF Snake River Summer Steelhead group	5	26	19%
CBPTF Upper Columbia Fall Chinook group	0	1	0%
CBPTF Upper Columbia Sockeye group	0	2	0%
CBPTF Upper Columbia Spring Chinook group	3	5	60%
CBPTF Upper Columbia Summer Chinook group	2	4	50%
CBPTF Upper Columbia Summer Steelhead group	4	5	80%
CBPTF Willamette River Spring Chinook group	6	7	86%
CBPTF Willamette River Winter Steelhead group	4	4	100%

X. Appendix D: Update Summary by Each Work Element

Work Element	Entity	Milestone Title	2019 Update
159. Transfer/Consolidate Regionally Standardized Data	Colville	C. CTCR StreamNet will assist tribal project sponsors transfer of data to secure and accessible repositories	CTCR continues to communicate with Project Sponsors, inventory data storage and offer assistance to secure accessible repositories.
	IDFG	D. IDFG Assist project sponsors transfer of data to secure and accessible repositories	IDFG StreamNet supported state and tribal project sponsors in the transfer of data to secure and accessible repositories.
	MFWP	E. MFWP Assist project sponsors transfer of data to secure and accessible repositories	MFWP StreamNet supported project sponsors in the transfer of data to secure and accessible repositories.
	ODFW	F. ODFW Assist project sponsors transfer of data to secure and accessible repositories	ODFW StreamNet staff continued to assist and encourage BPA funded, ODFW, and local project sponsors to manage or locate their data within secure and accessible data repositories.
	WDFW	G. WDFW Assist project sponsors transfer of data to secure and accessible repositories	WDFW continues to communicate with project sponsors, review data storage and offer assistance to secure accessible repositories. StreamNet's request to submit geometry instead of event data also prompted work to make basic location data more integral and available to CA and traditional StreamNet data compilers.
	PSMFC	A. PSMFC Assist project sponsors transfer of data to secure and accessible repositories	We received a request to transfer ISEMP fish data for 2003-2018 to StreamNet, and were told the data set is approximately 200GB in size. We attempted to work out a method to transfer and add these to the Data Store, but the effort fell through. We will again attempt to get this data set in 2020.
	PSMFC	B. PSMFC StreamNet will continue to manage and improve the StreamNet Data Store as a repository for unstructured data.	Submitted data sets were reviewed and data/metadata suggestions were made as appropriate. Data Store and it's Publishing Service were maintained. Several updates were made to connected web services (cbfish.org, monitoringresources.org).

Work Element	Entity	Milestone Title	2019 Update
189. Coordination-Columbia Basinwide	Colville	B. CTCR Coordinate and support the Coordinated Assessments project	CTCR Data Steward participated in CA Planning Group, Exchange Configuration Team, and Hatchery Indicators Teams for DES development, provided feedback on the DES.
	IDFG	C. IDFG Coordinate and support the Coordinated Assessments project	IDFG StreamNet staff participated in the CASC, CATC, and supported development of DES and streamlined data flows.
	ODFW	D. ODFW Coordinate and support the Coordinated Assessments project	ODFW participated in CA Planning Group, DES Development Team, and StreamNet Technical and Steering Committee meetings, along with state and other regional discussions, workshops and planning efforts related to trend data development and CA data flow. Focused attention was given to developing a proposal to include new fields in the NOSA table to describe estimates more closely related to escapement and improvements to the design and functionality of the StreamNet and CAX websites. Staff continued contributions to BPA regarding priority population commitments and responding to requests from StreamNet partners. Staff conducted/participated in an ODFW-East Region steelhead meeting to discuss long-term data needs, monitoring plans, and method changes for NOSA and other metrics. Discussion was focused on eastern Oregon but western Oregon biologists were present as well. Participants included staff from Fish Research, Fish Districts, Watershed Managers, East-side Conservation Implementation Coordinator, and the Oregon Plan Monitoring Coordinator.
	PSMFC	A. PSMFC Coordinate and support the Coordinated Assessments project	Regular activities during the year included CA Core Team, StreamNet Steering Committee meetings and update to the StreamNet Executive Committee. PSMFC staff continue to improve data flow to the CAX and access to CAX HLI and related data. PSMFC staff continue to convene DET meetings to inform DES development/improvements. Project goals and objectives were reviewed with the Executive Committee. Data flow was monitored and reported.
	WDFW	E. WDFW Coordinate and support the Coordinated Assessments project	WDFW StreamNet continued this year to participate in the CA process. Attention was given to DES development efforts, working with other agencies on overlapping populations, and continued development of data flow. Staff developed the code and process to update CA tables with final products.
160. Create/Manage/Maintain Database	Colville	C. CTCR Development and maintenance of CA data exchange standards and database	CTCR staff participated in the DES development meetings.
	IDFG	D. IDFG Development and maintenance of CA data	IDFG StreamNet staff continued to support the development and maintenance of CA DES and database. Helped regional staff test updates to DES and validation too.

Work Element	Entity	Milestone Title	2019 Update
		exchange standards and database	
	WDFW	F. WDFW Development and maintenance of CA data exchange standards and database	WDFW participated in CA DES development discussions and meetings with the SN DES Development Team (DDT) WDFW SN Staff continue to map the CA DES to ETL processes in our own internal corporate systems for the three primary CA indicators in 2019.
	PSMFC	A. PSMFC Lead development of database	C.A. data flow continued; validation rules improved; database backup systems expanded and improved. Smolt estimation workshop we participated in hosting produced ideas for improved DES. Additional proposed changes to the DES were identified and discussed for possible implementation.
	PSMFC	B. PSMFC Lead development of DES	Due to competing priorities associated with the reduction from 3 technical staff to 2, no DES changes were promulgated or implemented this year. However, additional validation rules were identified and implemented to match the existing DESs. Also, significant progress was made toward distinguishing NOSA from escapement.
	MFWP	G. MFWP Development and maintenance of CA data exchange standards and database	CA indicators and DES' have still not been developed for resident fish. MFWP staff have been staying aware of work being done for the CA project and will be prepared as work begins to develop metrics and indicators for resident species.
159. Transfer/Consolidate Regionally Standardized Data	Colville	B. CTCR compile data relevant to Coordinated Assessments indicators and metrics	Available CA indicators and metrics have been obtained and the process of converting to DES format and exchange has begun.
	IDFG	C. IDFG Compile data relevant to Coordinated Assessments	Links to data sources were updated, and the queries ran to extract, transform, and load for all indicators and species available into the IDFG HLI and regional CAX databases. All metric data used to derive HLI for CAX were uploaded to SN database (e.g. redd counts, hatchery returns, weir counts)

Work Element	Entity	Milestone Title	2019 Update
	ODFW	D. ODFW Compile data relevant to Coordinated Assessments	Staff compiled and submitted all Priority 1, 2, and 3 ODFW population commitments identified by BPA for the biological opinion (BiOp) via the CA API. The submission included updates to existing data sets and adding new records (years) for both adult and juvenile natural origin abundance and productivity indicators and metrics for the data exchange standard (DES). Also, Lower Columbia, Middle Columbia and Snake River DES data were processed and uploaded to the ODFW Recovery Tracker public website. ODFW staff have contributed the following to the Coordinated Assessments effort: 2,445 NOSA records (1949 – 2019 spawning years) 2,017 adult recruits per spawner records (1949 – 2015 brood years) 241 juvenile recruits per spawner records (1992 – 2017 brood years) 269 smolt to adult ratio records (1994 – 2017 outmigration years) 339 juvenile outmigrant records (1994 – 2019 outmigration years) 89 presmolt abundance records (1993 – 2017 survey years) Staff completed a full draft of the Snake River spring Chinook Viable Salmonid Population (VSP) Compendium that is currently under final review. The VSP Compendium is a detailed field and analysis methods document for CA indicators and metrics and should be available via ODFW's Data Clearinghouse in Spring of 2020.
	PSMFC	A. PSMFC will ensure that annual work plan includes measurable goals and objectives for data comp	Measurable goals developed thru the Executive Committee, reviewed with the StreamNet partners, and incorporated into the CA work plan. Revised and updated the 5 year plan for the CA project during 2019, which was adopted by the Executive Committee. Ongoing tracking of data flow with BPA priorities and attempted to maximize data flow for BPA priority populations.
	WDFW	E. WDFW: Compile data relevant to Coordinated Assessments	Staff compiled and submitted all Priority 1, 2, and 3 WDFW population where data are complete and finalized by biologists. The submission included updates to existing data sets and additional new data sets for both adult and juvenile natural origin abundance and productivity indicators and metrics for the data exchange standard (DES). Staff began the process of adding Priority 1, 2 natural origin abundance for the Washington's Puget Sound and Coastal population from WDFW's SaSI database.
160. Create/Manage/Maintain Database	Colville	C. CTCR Improve systems to manage data feeding CA indicators	CTCR initially used StreamNet's Access Database/API to transfer and update Natural Origin Spawner Abundance data. Beginning in late 2014, CTCR collaborated with Sitka Technology Group to replicate the data transfer so that it occurred from their servers, which is where the CTCR data system of record now resides.
	IDFG	B. IDFG : Improve systems to manage data feeding CA indicators	IDFG StreamNet staff collaborated with PSMFC staff to update validation rules and used web services to exchange data between IDFG, StreamNet, and the CAX HLI databases. The sockeye data source workbook was updated and improved in cooperation with research and hatchery staff.

Work Element	Entity	Milestone Title	2019 Update
	ODFW	F. ODFW Improve systems to manage data feeding CA indicators	Staff maintained and enhanced internal databases that maintain data for CA and Related Data efforts. The ODFW process to transmit Coordinated Assessment data to StreamNet via the StreamNet API continued. Also, database systems and procedures were developed to transmit traditional Trend data via the StreamNet API. Both processes were used successfully throughout the year. Needed repairs and enhancements to the ODFW Recovery Tracker website were identified and the process of hiring someone to do the work was initiated. Staff developed an 'issues' list as a guide to operational problems with the SQL online spawning ground survey database. This system will allow standardization of spawning ground survey data across ODFW. In addition, several local eastern Oregon databases have been revised to prepare them for eventual upload to the SQL online database.
	PSMFC	A. PSMFC Improve systems to manage data feeding CA indicators	Additional data validation rules and related error messages were embedded into extended properties of Coordinated Assessments tables' fields in order for the StreamNet API to validate field-level values on records submitted to StreamNet. Record-level data validation rules were added and updated to match the StreamNet and CA DESs. Reports were designed to summarize Coordinated Assessments data flow and incorporate related StreamNet Trends and NPCC Dashboard links and BPA priority tiers.
	WDFW	E. WDFW Improve systems to manage data feeding CA indicators	Work continued on automated data feeds to StreamNet CA using the StreamNet API. Internal Agency data systems are still in the process of being modified to contain CA indicator data. Internal databases (including WDFW SaSI) and applications that import, export, transform, and transfer data necessary to populate the CA focal tables were updated 2ith 2017, 2018, and 2019 data.
161. Disseminate Raw/Summary Data and Results	PSMFC	A. PSMFC disseminate the CA indicators and metrics	Automated data flow continued with multiple organizations. Current focus in on acquisition of NOSA indicators as prioritized by the Exec Comm. and related time series data sets.
159. Transfer/Consolidate Regionally Standardized Data	PSMFC	A. PSMFC Compile and deliver fish data to StreamNet databases.	PSMFC-StreamNet database continued to receive on an annual bases trends data set and maintains the Protected Areas. See Table 6 in the 2019 Annual Report Section to view summary of data as of 12/31/2019. The StreamNet database continued to receive annually CAX HLI data that are displayed on the CAX Query system. See Tables 7 and 8 in the 2019 Annual Report for a summary of the CAX HLI data as of 12/31/2019.

Work Element	Entity	Milestone Title	2019 Update
	Colville	B. CTCR Compile and deliver fish data to StreamNet databases.	CTCR's "traditional StreamNet data" included juvenile snorkel densities, redd counts, and video counts. However, the Coordinated Assessments project now captures adult steelhead spawner estimates which the redd counts were a part of. Redd count data and snorkel densities are still available on CTCR's website, and video counts are submitted to and available on the DART website.
	IDFG	C. IDFG Compile and deliver fish data to StreamNet databases.	Idaho compiled and delivered fish data to StreamNet as time and staffing allowed. The Chinook, steelhead, and sockeye salmon redd counts, weir counts, and hatchery returns were all updated. The generalized fish distribution layer was also updated.
	WDFW	D. WDFW Compile and deliver fish data to StreamNet databases.	All available and up to date population level CA data were submitted to StreamNet. Fish Distribution data were submitted at the outset of this fiscal year. Staff continued work to update the interior Columbia River traditional trend data (including new trend locations), and SWIFD fish distribution as time allows when not focusing on CA metrics. Staff focused on updating Puget Sound and Coastal trends to most current data available.
	ODFW	E. ODFW Compile and deliver fish data to StreamNet databases.	ODFW submitted 29 new and updated 508 existing (including 1,237 Trends for EscData only) traditional data records, including index redd, peak, carcass, spawner and juvenile counts, dam/weir trap counts, and juvenile and spawner abundance estimates for recovery populations from BPA projects in the Lower Columbia, Willamette, Mid-Columbia and Snake River ESU. A significant portion of the EscData updates originated from conducting QAQC and adding new records for John Day basin spring Chinook. These data contribute to Council websites and Biological Opinion (BiOp) assessments, and were submitted via the StreamNet API. Oregon StreamNet continued to develop fish habitat distribution data sets for anadromous and resident salmonids as well as other game, non-game and non-native fish in the Columbia Basin. Fish Passage Barrier data were also updated. Changes were derived from direct observations of juvenile and adult fish, redd location data, CHaMP snorkeling data, incidental species information from juvenile monitoring sites observations of habitat expansion and habitat use types, as well as many other sources. Staff coordinated throughout the year with Regional StreamNet staff to update all fish habitat distribution data sets on the StreamNet website for the first time in approximately 5 years. Whole stream route data were synchronized with April 2019 National Hydrography Dataset geometry. Efforts were initiated to complete an update to the whole stream route data set for the Columbia Basin, which supports trend data mapping. This is part of the larger statewide effort.
	MFWP	F. MFWP Compile and deliver fish data to StreamNet databases.	MFWP compiled traditional StreamNet data throughout the year and exchanged the following data: 15 references, 1,416 redd counts at 128 locations. Fish population and genetic data were submitted as independent data sets. Fish distribution was submitted as a spatial data set and included over 500 new or edited records in 2019.

Work Element	Entity	Milestone Title	2019 Update
132. Produce (Annual) Progress Report	PSMFC	A. Non-Technical: Prepare for non-technical Progress Report. Review most recent guidance and template.	Done on schedule.
	PSMFC	B. Non-Technical: Write Non-technical Progress Report	Done on schedule.
	PSMFC	C. Non-Technical: Upload Non-Technical Progress Report in Pisces	Done on schedule.
189. Coordination-Columbia Basinwide	PSMFC	A. Collaborate to display locations and types of monitoring data available	N/A
	PSMFC	B. Coordination with data source agencies inside and outside the Fish & Wildlife Program	Prioritized coordination efforts through the Executive Committee, CA project, website, presentations to NPCC, and other activities.
	Colville	C. CTCR StreamNet coordinate to support the Fish & Wildlife Program	CTCR anadromous division coordinated with other separately funded CTCR programs such as the Chief Joseph Hatchery and the Resident Fish Department to keep them informed of the efforts and data structure CTCR was using for the Coordinated Assessments project.
	IDFG	D. IDFG coordination with the Fish and Wildlife Program	IDFG StreamNet expanded streamlined data flows for CAX HLI data to include new species, populations, and life stages. We coordinated data management and analyses with tribal collaborators.

Work Element	Entity	Milestone Title	2019 Update
	ODFW	E. ODFW provide support to F&W Program development activities	ODFW contributed to Regional StreamNet's contributions and responses during the Independent Scientific Review Panel's F&W Program review process. Staff also participated in user testing of Monitoring Resources.org with PNAMP staff to streamline navigation and functionality of the website. Oregon StreamNet reviewed the StreamNet website with ODFW SN Data Analyst, to assess issues with data visualization and display of CA and Related Data. Detailed suggestions were submitted to Regional staff, which led to some changes to the website. Eastern Oregon StreamNet staff attended the Smolt Estimation and Analytics Workshop conducted by PNAMP. The Workshop was an effort to share and explore the standardization of juvenile collection and analytical methods across the Columbia Basin. Oregon sent John Day steelhead survey reach and redd location spatial files to a GIS analyst from the US Forest Service to be incorporated into the Fish Data Analysis Tool (FDAT), a web-based statistical tool for modeling salmonid density and habitat relationships using spatial stream-network (SSN) models. The FDAT tool will help inform management, including BiOp work strategies, tributary habitat prioritization for BPA and regional partners, and processes such as BPA's Atlas restoration prioritization (https://erin-peterson.com/projects/prototype-ssn-fish-data-analysis-tool/) .
	MFWP	F. MFWP provide support to F&W Program development activities	Staff participated in Western Association of Fish and Wildlife Agencies efforts which relate directly to the use of StreamNet data. No other support was identified or requested.
	MFWP	G. MFWP coordinates multi-state Yellowstone cutthroat assessment	MFWP StreamNet staff updated the central Yellowstone Cutthroat Trout Assessment database in 2019. Staff submitted the Yellowstone Cutthroat Trout Range-Wide database and associated geodatabase to the StreamNet Data Store. Staff continue to be involved in the effort and conversations were had in 2019 related to incorporating the Yellowstone Cutthroat Trout assessment data into the Intercontinental Cutthroat Trout Protocol (ICP) Data System. This effort was put on hold in 2019 due to the inability for the contractor to complete the work in the necessary time-frame as well as the retirement of the Native Species Coordinator at MFWP.

Work Element	Entity	Milestone Title	2019 Update
	WDFW	H. WDFW provide support to Fish and Wildlife Program development activities	WDFW provided support to the program, including continued leadership of the CA project through the CA project steering committee. in 2020, WDFW collaborated with CA partners to submit Hatchery CAX grant proposal and preliminary scoping. WDFW continued to support GIS needs to ensure the flow of StreamNet trend, fish distribution and CA data. In 2019 the GIS work focused on fish distribution, population geometry reviews and supercode, linework and dataflow tools. With this work we synchronized StreamNet with WDFW's master Statewide Washington Integrated Fish Distribution layer and submitted new trends for new supercode locations to coordinate better with CA data. The supercode, linework and dataflow tools will aid next year's effort to centralize the StreamNet data compiling via an online feature service.
189. Coordination-Columbia Basinwide	All	I. StreamNet partners promote the project through technical and professional organizations	StreamNet partners presented information on the project at multiple forums, including the NPCC, AFS, internal meetings, and related organizations. Oregon responded to a data request from ODFW Corvallis Research Lab staff, in need of spatial information on long term monitoring of adult Chinook and steelhead in northeast-central Oregon. The information was used in an AFS presentation. Staff submitted an article to the ODFW Fish and Wildlife Commission, highlighting the flow of fish research data from collection to dissemination (via the ODFW Recovery Tracker, StreamNet CA, and NOAA Salmonid Population Summary websites).
189. Coordination-Columbia Basinwide	PSMFC	J. Support and maintain regionally significant datasets and processes	Maintained a common facilities GIS data set to improve quality and function in StreamNet, RMIS, and PTAGIS. Incorporated sharing of data from the Fish Passage Center in the CA database.
	PSMFC	K. Support documentation of monitoring protocols	Continued working with PNAMP to foster documentation and encourage improvement and participation in monitoringresources.org. Worked with data providers and CRITFC to ensure that documentation of trends via links to Columbia Basin Fish & Wildlife library were maintained and updated.
	PSMFC	L. PSMFC supports implementation of BPA data management strategy	Regular engagement with BPA fish policy group to discuss BPA data needs and how StreamNet can further improve their support of BPA needs. BPA general data priorities are included in the StreamNet project. Reviewed CA data flow with BPA regarding BPA priority populations.
161. Disseminate Raw/Summary Data and Results	PSMFC	D. PSMFC assures CA Website and Database Maintenance	Made significant improvements to the website and the Data Store. The StreamNet web site was updated as needed and new project and data pages added. Maintained website and regularly fixed errors. Updated design of CA data display and query system. Reviewed with Steering and Executive Committees. Continued integration work with NPCC dashboards and indicators.

Work Element	Entity	Milestone Title	2019 Update
	PSMFC	E. PSMFC responds to and tracks data/information requests	Direct requests for information or help have become less frequent over the years, as our web site has been more stable, our online services more robust, and our priority shift to population-scale data has meant that our traditional data are not updated as frequently. Only 5 non-trivial direct requests were received in 2019. All were promptly and satisfactorily addressed.
	Colville	F. CTCR responds to and tracks data/information requests	CTCR responded to 12 data requests this year which were either met by directing users to appropriate data sources, or by running specific queries in the OBMEP database to fulfill the request.
	IDFG	G. IDFG responds to and tracks data/information requests	IDFG StreamNet staff responded to data requests coming from internal and external partners, and the general public. The number of data requests continues to decrease as the number of IFWIS users increases, and people find data for themselves.
	MFWP	H. MFWP responds to and tracks data/information requests	MFWP StreamNet staff responded to all data and map requests coming from internal staff, partners and the public. Many external data requestors are being referred to the FishMT web query system or the MFWP Open Data site to meet their needs. Internal requests consist of data queries and map requests that internal staff cannot complete themselves. MFWP GIS staff received 65 GIS or data requests during the calendar year and requests are tracked through an internal HelpDesk ticketing system.
	ODFW	I. ODFW responds to and tracks data/information requests	Oregon StreamNet staff responded to data requests coming from internal and external partners, and the general public, with GIS, data, and tech support requests being the most frequent. Agency staff are also viewing and utilizing StreamNet funded staff as a resource for assistance with developing data standards and responding to data requests that come to them.
	WDFW	J. WDFW responds to and tracks data/information requests	WDFW StreamNet staff responded to data requests coming from internal and external partners, and the general public, with GIS, data, and tech support requests being the most frequent.
160. Create/Manage/Maintain Database	PSMFC	A. PSMFC Develop automated data flow to central StreamNet database	Automated data flow has been achieved for most partners via the StreamNet API. Continued development of the automated data validation techniques and reviewed with partners.
	PSMFC	B. PSMFC Assist agencies with development of internal database systems	Continued to support partners' database development and maintenance. This was largely assistance in partners' efforts to develop system for interacting with the central database via the StreamNet API.
	Colville	C. CTCR Develop automated data flow to central StreamNet database	Beginning in late 2014, CTCR collaborated with Sitka Technology Group to establish direct connections between StreamNet's and Sitka's servers, which is where the CTCR data system of record now resides.

Work Element	Entity	Milestone Title	2019 Update
	IDFG	D. IDFG Develop automated data flow to central StreamNet database	IDFG StreamNet staff completed, corrected, and standardized data source workbooks for natural origin HLI data. Validated and exchanged data with PSMFC using automated web services.
	MFWP	E. MFWP Develop automated data flow to central StreamNet database	StreamNet staff have implemented internal scripting to allow for a more streamlined process for submitting data to StreamNet. Staff worked to improve MFWP automatic data extraction and processing workflow to better integrate with the StreamNet API.
	ODFW	F. ODFW Develop automated data flow to central StreamNet database	Staff initiated and made significant progress on an effort to develop a web application that would allow Coordinated Assessments data to be entered directly into the ODFW Coordinated Assessment SQL server database and to automate the processes for validation and submission to the StreamNet API. The project is currently in the testing phase; full deployment is expected in 2020. New Data Clearinghouse records were added, and existing records were updated, increasing overall data availability and our ability to flow data using automated approaches. The new submission procedures for trend location geometries were finalized and have been implemented. The solution calls for the manual submission of a geodatabase of feature classes (point, lines, waterbodies, and supercodes) for new related data trends to the StreamNet GIS Coordinator when trends are submitted to the API. Staff updated an inventory of eastern Oregon CA and Related Data indicators and metrics, and the Projects associated with them. This inventory assists with tracking and prioritizing data submission efforts to CAX and StreamNet Related Data.
	WDFW	G. WDFW Develop automated data flow to central StreamNet	Staff continued work to improve WDFW database for a more automated data flow to StreamNet. Additionally, WDFW continue efforts to add mobile data collection and integration of corporate data sets.
	PSMFC	H. Share information on field trials of data capture devices	Shared data with partners and BPA through final report on project.
	PSMFC	A. PSMFC Infrastructure maintenance and base operations	Maintained DES through periodic review and discussion with partners. Worked with Library staff to resolve issues related to database coordination and updating links to documents. Implemented improvements to the facilities mapper across multiple PSMFC databases and programs.
160. Create/Manage/Maintain Database	Colville	B. CTCR infrastructure maintenance and base operations	CTCR collaborated with Sitka Technology Group to host and manage CTCR's OBMEP database. Sitka maintains database infrastructure and runs routine and redundant backups of CTCR data. They also maintain existing custom applications and are developing new tools for collecting, editing, finalizing, and distributing fisheries data.

Work Element	Entity	Milestone Title	2019 Update
	IDFG	C. IDFG infrastructure maintenance and base operations	IDFG StreamNet staff did regular system and database administration, backup and recovery. We also updated applications and web services for StreamNet data and Coordinated Assessments. The IDFG spatial fishery databases were updated with new data. Existing applications and databases were enhanced per user feedback, and new applications and databases were supported by technical staff.
	MFWP	D. MFWP infrastructure maintenance and base operations	MFWP StreamNet maintained computer infrastructure and operations to assure efficient and effective management and flow of data internally and from MFWP to the StreamNet database. MFWP is actively maintaining the database and infrastructure of the internal Fisheries Information System. This work is being done by MFWP Application Development staff. MFWP staff, both funded and not funded by StreamNet, continue to develop or enhance tools to update hydrography layers. MFWP StreamNet staff continues to support and update relevant GIS mapping services and data sets for the FWPMapper, the internal web mapping application, and for dissemination to the public through the agency Open Data website
160. Create/Manage/Maintain Database	ODFW	E. ODFW infrastructure maintenance and base operations	Routine and required system management, maintenance, and QAQC was performed throughout the year. Data management protocols, indicator and metric data files, analysis flow diagrams, databases and website user interfaces were updated and managed to accommodate the ODFW Recovery Tracker, traditional StreamNet and Coordinated Assessments DES, ODFW Data Clearinghouse and internal website modifications, as needed. Oregon StreamNet's server infrastructure and application development systems were updated to .NET 4.6, Visual Studio 2019, Windows 10 v1903, Windows Server 2016 and SQL Server 2017, modern Microsoft technologies with long-term support. ODFW continued an effort to improve the accuracy of over 39,000 old ODFW Library electronic bibliography records that now reside in the Data Clearinghouse (DC) in order to preserve the historic record of ODFW documents, with the goal of providing access to digital copies of these documents. 756 existing records were updated, and 431 new DC records were reviewed, edited and approved, using alternate funding for non-Columbia Basin records. Staff made significant progress during the year to locate and upload electronic versions of ODFW Fisheries Information Reports, Progress Reports, Oregon Plan Reports, fish management reports, status reports, and BPA funded reports published in the 1940's through the 2000's. ODFW updated 24 and added 64 new reference records and memos and submitted to the StreamNet Library. Staff filed and stored electronic documents for dam counts at hydropower facilities, joint staff reports, other online resources, data sets and reports. Information was obtained through email list serves, the Internet, or as a data request, and are stored in an ODFW server directory. Continued to document, enter database records, and create memos obtained through electronic transmittals and data requests to the program, as needed.

Work Element	Entity	Milestone Title	2019 Update
			ODFW upgraded ArcGIS Enterprise server software on both internally and externally facing installations. The GIS license server was upgraded to version 2019. The Fish Habitat Distribution and Barrier Data Editor application was maintained. Updates were made to data management plans that direct the timely collection and submission of StreamNet Related Data for populations of the Snake River spring Chinook ESU and the Snake River and Middle Columbia steelhead DPSs. Staff spent time on QA/QC and crosswalking data from previous John Day spring Chinook Salmon annual reports to a current database to correct and update the data for future analysis and reporting. Staff also reconciled site-specific information between previous and current database for the John Day Chinook Salmon populations. This effort will assist with the incorporation of older data into CA and Related Data. Staff conducted QA/QC and fixed missing and incorrect data in the Middle Fork John Day steelhead database. Staff uploaded John Day Chinook Salmon and steelhead annual reports to the Middle Fork John Day Intensively Monitored Watershed (MFIMW) website to enhance discoverability. Developed a Data Management Flow Diagram (DMFD) for ODFW CA data, from data collection to data dissemination.
160. Create/Manage/Maintain Database	WDFW	F. WDFW infrastructure maintenance and base operations	WDFW StreamNet staff did routine and required system and database maintenance and backup. Reviewed the new validation rules for related Trends DES to understand the new StreamNet API process of uploading these data effectively.
119. Manage and Administer Projects	PSMFC	A. WE Budget Tab: Error-check and update actual spending (reflect contract close-out value)	Held regular meetings with the Executive Committee, the Steering Committee, BPA, NPCC, and others to ensure program alignment with regional fish and wildlife managers. Continued to apply the simplified and streamlined SOW and reduced PSMFC staff dependence on BPA budget and made funds available to other partners.
	PSMFC	B. Begin drafting contract renewal documents and conduct internal review as needed	Done on schedule. New 2 year contract implemented in 2019.
	PSMFC	C. Submit contract renewal package (SOW, Excel budget, property inventory) to BPA COTR	Done on schedule. New 2 year contract implemented in 2019.

Work Element	Entity	Milestone Title	2019 Update
	PSMFC	D. Address comments and revise SOW, LIB, and PI as needed to get BPA manager approval	Done on schedule. New 2 year contract implemented in 2019.
	PSMFC	E. Return signed contract to BPA's Contracting Officer within 30 days	Done on schedule. New 2 year contract implemented in 2019.
	PSMFC	F. Submit final invoice for prior contract within 90 days to facilitate contract closeout	Done on schedule. New 2 year contract implemented in 2019.
	PSMFC	G. Accrual - Submit September estimate to BPA	Done on schedule. New 2 year contract implemented in 2019.
	PSMFC	H. Facilitate inputting Cost Share information into Pisces at the Project level	Continued cost share data input into Pisces.
	PSMFC	I. Comply with all applicable federal, state, tribal and local safety requirements, including reporting	Done on schedule. New 2 year contract implemented in 2019.
119. Manage and Administer Projects	WDFW	J. WDFW Effective program management will be maintained	WDFW StreamNet staff participated in project management, StreamNet Technical and Steering Committee meetings. Staff were supervised, budgets were tracked and managed throughout the year. Staff provided input to the SOW and budget.
	ODFW	K. ODFW Effective program management will be maintained	ODFW StreamNet staff participated in project management, StreamNet Technical/DES, Steering Committee, and Executive Committee meetings. Staff were effectively supervised, and budgets were tracked and managed throughout the year. ODFW StreamNet staff provided input to Statement of Work and budget discussions, and submitted updated inventory reports to Regional StreamNet.
	MFWP	L. MFWP Effective program management will be maintained	MFWP StreamNet staff participated in project management, StreamNet Technical and Steering committee meetings. Budgets were effectively tracked and managed. Staff participated in all relevant budget and Statement of Work discussions and provided input to SOW and budget.
	IDFG	M. IDFG Effective program management will be maintained	IDFG StreamNet staff, budgets, and resources were effectively managed to meet all program objectives.
	Colville	O. CTCR Effective program management will be maintained	

Work Element	Entity	Milestone Title	2019 Update
	PSMFC	P. PSMFC Project oversight and guidance: Project management Executive and Steering Committees	Regular meetings were held with both groups in 2019. Agendas were formulated, issues discussed and resolved where possible, and priorities were set. Reporting and posting of notes and decisions was facilitated via the StreamNet website.
132. Produce (Annual) Progress Report	Colville	H. CTCR Produce Annual Report	CTCR provided input for the Annual Report
132. Produce (Annual) Progress Report	IDFG	G. IDFG Produce Annual Report	IDFG StreamNet staff provided input for the Annual Report.
132. Produce (Annual) Progress Report	MFWP	F. MFWP Produce Annual Report	MFWP StreamNet staff provided input to the Annual Report.
132. Produce (Annual) Progress Report	ODFW	E. ODFW Produce Annual Report	Staff summarized activities in preparation for completing the 2019 Annual Progress Report. ODFW StreamNet staff provided input for the Annual Report on schedule, and participated in editing efforts.
132. Produce (Annual) Progress Report	PSMFC	I. PSMFC Produce Annual Report	Completed as required for CY 2019.
132. Produce (Annual) Progress Report	WDFW	D. WDFW Produce Annual Report	WDFW StreamNet staff provided input for the Annual Report. BC-2020
185. Produce Pisces Status Report	All	A. Oct-Dec 2017 (10/1/2017 - 12/31/2017)	Completed as required in CY 2019.
	All	B. Jan-Mar 2018 (1/1/2018 - 3/31/2018)	Completed as required in CY 2019.
986. Catch-all for SOW items or anything else in the calendar year	Colville	CTCR Add additional Milestone(s) in editable text box	CTCR did not conduct any work beyond the SOW.
	IDFG	IDFG Add additional Milestone(s) in editable text box	IDFG StreamNet staff did not use BPA funding to do any work outside of the SOW.
	MFWP	MFWP Add additional Milestone(s) in editable text box	MFWP StreamNet staff did not use BPA funding to do any work outside of the SOW.

Work Element	Entity	Milestone Title	2019 Update
	ODFW	ODFW Add additional Milestone(s) in editable text box	ODFW StreamNet staff did not use BPA funding to do any work outside of the SOW. Utilizing other funding, staff updated and submitted Coastal coho natural origin spawner abundance and adult recruits per spawner estimates to StreamNet. The Coastal coho DES data were processed and uploaded to the ODFW Recovery Tracker public website, also using alternative funding. ODFW continued an effort to improve the accuracy of over 39,000 old ODFW Library electronic bibliography records that now reside in the Data Clearinghouse (DC) in order to preserve the historic record of ODFW documents, with the goal of providing access to digital copies of these documents. Non-Columbia Basin records were improved using alternate funding. Staff made significant progress during the year to locate and upload electronic versions of ODFW Fisheries Information Reports, Progress Reports, Oregon Plan Reports, fish management reports, and status reports.
	PSMFC	PSMFC Add additional Milestone(s) in editable text box	No work performed beyond the SOW
	WDFW	WDFW Add additional Milestone(s) in editable text box	WDFW StreamNet staff did not use BPA funding to do any work outside of the SOW.
202. Produce BiOp RPA Report	PSMFC	A. Lead project proponent will download RPA questions from cbfish.org	Completed as required in CY 2019.
	PSMFC	B. Lead project proponent will finalize calendar year report in cbfish.org	Completed as required for CY 2019.
161. Disseminate Raw/Summary Data and Results	PSMFC	C. PSMFC implements Data Sharing Agreements	No new work on this item in 2019.

Work Element	Entity	Milestone Title	2019 Update
	PSMFC	B. PSMFC assures that metadata exchange standards are established and maintained	Maintained and reviewed CA DES standards regularly. Further developed and refined validation routines for time series data traditionally compiled by StreamNet project.
160. Create/Manage/Maintain Database	ODFW	E. ODFW Development and maintenance of CA data exchange standards and database	ODFW staff contributed significant input to CA DES discussions, various forums and email correspondences throughout the year, including submitting a detailed Natural Origin Spawner Abundance (NOSA) table proposal to Regional StreamNet staff. The StreamNet DES Development Team (DDT) sought a way to distinguish NOSA estimates from escapement estimates used as surrogates. The proposal suggests adding new fields to describe whether estimates in the NOSA table are a true NOSA estimate or an escapement estimate. StreamNet partners are hopeful a final solution to distinguish NOSA from escapement will be identified and approved in 2020
	MFWP	D. MFWP Improve systems to manage data feeding CA indicators	CA indicators and DES' still have not been developed for resident fish. MFWP staff have been staying aware of work being done for the CA project and will be prepared to assist with resident species indicator development and associated data management.

XI. References / Endnotes

[i] NPCC 2012/2013 Decision Memorandum: Council recommendations on Resident Fish, Data Management and Regional Coordination Category Reviews – projects and associated programmatic issues https://www.nwcouncil.org/sites/default/files/CouncilDecision_0.pdf

[ii] NPCC 2012 Program Evaluation and Reporting Committee https://www.nwcouncil.org/fw/program/perc and the November 2012 Council recommendations based on the PERC https://www.nwcouncil.org/sites/default/files/2012_1106_1.pdf

[iii] NPCC 2019, Committee Recommendations on mainstem and Program Support Project Review: Project Implementation and Programmatic Issues https://www.nwcouncil.org/sites/default/files/2019_0716_f1.pdf; Council recommendations from August 2019 are similar https://www.nwcouncil.org/fish-and-wildlife/fish-and-wildlife-program/project-reviews-and-recommendations/mainstem-review

[iv] 2019 version of the Five-Year Plan for Coordinated Assessments, discussed in June 2019, adopted August 1, 2019 and posted online on August 6 2019 https://www.streamnet.org/data/coordinated-assessments/

[v] StreamNet Strategic Plan, March 2015, http://www.streamnet.org/wp-content/uploads/2019/08/20150309-StreamNet-Vision-Strategic-Plan-2015Update.doc

[vi] Tier 1 and Tier 2 populations as identified by BPA at the end of 2015 https://www.streamnet.org/ca-priority-data/

[vii] NOAA Fisheries Biological Opinion for operation and maintenance of the Columbia River System Operations and related documents https://www.salmonrecovery.gov/BiologicalOpinions/FCRPSBiOp/2008FCRPSBiOp.aspx

[viii] June 14, 2018 StreamNet Executive Committee meeting notes https://www.streamnet.org/wp-content/uploads/2018/07/StreamNet-Excomm-Meeting-Notes-20180614.docx

[ix] NPCC July 2019 Committee Recommendations on mainstem and Program Support Project Review: Project Implementation and Programmatic Issues https://www.nwcouncil.org/sites/default/files/2019_0716_f1.pdf; Council recommendations from August 2019 are similar https://www.nwcouncil.org/fish-and-wildlife/fish-and-wildlife-program/project-reviews-and-recommendations/mainstem-review

[x] For more details see the Project Summary: https://www.cbfish.org/Project.mvc/Display/1988-108-04 and past and current Contract Summary: https://www.cbfish.org/Contract.mvc/Summary/66435

[xi] StreamNet Data Store https://app.streamnet.org/datastore_search_classic.cfm

[xii] Columbia Basin Fish & Wildlife Library hosted by CRITFC https://www.streamnetlibrary.org/

[xiii] StreamNet subbasin plans and achieved datasets used during the NPCC2001-2004 subbasin planning effort https://www.streamnet.org/services/technical-assistance-to-agencies-and-tribes/subbasin-plans-archived-datasets/

[xiv] NPCC FW Program Protected Areas documentation, river reach, and online Protected Areas database and interactive map https://www.streamnet.org/data/protected-areas/

[xv] Habitat Evaluation Procedures (HEP) https://www.streamnet.org/hep

[xvixvi] Hatchery Reform Project http://hatcheryreform.us/

[xvii] NPCC FW Program Strategy for *Fish Propagation including hatchery programs* https://www.nwcouncil.org/reports/2014-columbia-river-basin-fish-and-wildlife-program/b-fish-propagation-including-hatchery-programs

[xviii] Hatchery scientific review group's products resulting from the hatchery reform project http://hatcheryreform.us/
[xix] StreamNet Query – Abundance Estimates and Indexes at Local Scales https://snq.streamnet.org/
[xx] GIS Data & Mapping Applications https://www.streamnet.org/data/interactive-maps-and-gis-data/
[xxi] StreamNet Coordinated Assessments Query (High Level Indicators) https://cax.streamnet.org
[xxii] PNAMP 2009 annual report https://www.cbfish.org/Document.mvc/Viewer/P115609
[xxiii] PNAMP 2010 annual report https://www.cbfish.org/Document.mvc/Viewer/P120754
[xxiv] PNAMP 2018 annual report https://www.cbfish.org/Document.mvc/Viewer/P167990
[xxv] HEP archived data and documents http://www.streamnet.org/hep.
[xxvi]NOAA and USFWS engagement in the hatchery reform project and the hatchery scientific review group https://www.nwfsc.noaa.gov/research/divisions/efs/hatchery/review.cfm ; products produced by the hatchery scientific review group for the hatchery reform project http://hatcheryreform.us/
[xxvii] The Okanogan Subbasin Report Card online tool https://ecosystems.azurewebsites.net/reportcards/okanogan/
[xxviii] Follow Idaho Salmon Home http://216.206.157.62/idaho/web/apps/index_main.php
[xxix] USFWS ECOS Environmental Conservation Online System https://ecos.fws.gov/ecp/report/table/species-listed-as-distinct-population-segments.html
[xxx]Fish Inventory System (FINS) database https://idfg.idaho.gov/data/fisheries/fins
[xxxi] SCoRE https://fortress.wa.gov/dfw/score/score/
[xxxii] SalmonScape http://apps.wdfw.wa.gov/salmonscape/
[xxxiii] Spawning Ground Survey (SGS) https://wdfw.wa.gov/fishing/management/sgs-data